Is an Image Worth a Thousand Votes? Evidence from a Natural Experiment in Political Advertising

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Abstract

This paper studies the effect of political advertising on electoral behavior, leveraging a natural experiment in Barcelona (Spain) where street-level ad locations are randomly assigned. Using a novel dataset on ad location, I find a positive impact on vote shares, varying across socio-demographic and ideological characteristics of voters. On average, a one standard deviation increase in ads (around 100 additional ads) boosts a party's vote share by 0.34 percentage points. Ad effectiveness is higher in lower-income and younger-population areas. Effects are heterogeneous across party types and candidate characteristics. For instance, new candidate ads are more effective whereas ads featuring women candidates are relatively less effective. Ads are more effective in disputed or ideologically aligned areas. Additionally, there is evidence of spillover effects from ads of other parties; its effectiveness depending on ideological similarity.

Keywords: Advertising; Electoral campaigns; Political parties; Voting.
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Introduction

Political campaigns represent a core element of the democratic process on which a substantial amount of time, effort, and money is spent. Parties strategically decide where, when, and how to advertise to maximize their vote share, which requires careful planning and execution. Moreover, modern tools have allowed parties to target small groups of voters and tailor their messages to them. This has been accompanied by a rise in campaign costs worldwide. For example, new records of campaign spending have been set in Brazil, the United Kingdom, and the United States in recent elections.[1]

The abundance of resources that parties devote to political campaigns pose a significant methodological challenge in quantifying their impact on electoral outcomes. While changes in the laws regulating the spending and financing of electoral campaigns may help in understanding how it affects electoral performance (e.g. Avis et al. 2022; Bekkouche et al. 2022; Cagé 2020; Fouirnaies 2021), finding other sources of exogenous variation in political advertising are rare. This is particularly the case when examining how the effects of ads vary in response to strategic choices made by political parties, such the number of ads shown in a medium or which subsets of the population to target. Additionally, parties running for election craft their advertising campaign taking into account their competitor's strategies, rendering it inherently difficult to isolate the impact of a party's own ads on voter behavior.

This paper studies the effects of exposure to political advertising on voting behavior by leveraging a large-scale natural experiment where the ads of all major political parties are randomly assigned to different locations within a major Spanish city. The paper's main result shows that own ads have a positive effect on the party's vote share. Ads of other parties also have an effect on a parties' vote share, which depends on the ideological similarity between the parties. The effect of ads is heterogeneous across socio-demographic and ideological characteristics of the voters. For instance, ads are less effective in higher-income and older-population areas, with mild positive effect in more densely-populated areas.

[1]Sources: Brazil (Folha de São Paulo, 2018), United Kingdom (Electoral Commission, 2019), and United States (OpenSecrets.org, 2021).

Street-level ads constitute an important part of the electoral campaign period, both socially[2] and in terms of parties' expenditure, amounting to several millions of euros.[3] Moreover, these ads are displayed during the two weeks prior to election day and are likely to be the last ads that voters are exposed to before going to the polls. More broadly, street-level ads – be it on city streets or highways – are ubiquitously used around the world during electoral campaigns.

The research design is based on exploiting the random allocation of street-level ad locations in the city of Barcelona, the second most populated city in Spain. While the use of any media by parties is regulated by Spanish law, this paper's identification strategy relies on legal and administrative constraints of street-level ads that are particular to the city of Barcelona. The assignment of ad locations to parties is randomized, being determined by the outcome of a lottery, and is enforced by the Electoral Commission. This unique setting combined with granular-level data not only allows the causal estimation of the direct effects of advertising free of any strategic considerations, but also to uncover heterogeneous effects across parties and voters.

To assess the effect of these ads, I create a novel dataset with the location of street-level ads for the national elections held in June 2016 and April 2019. It contains information on the location of over six thousand ads in each election. Notably, the political parties featured in this dataset are the universe of parties that opted to have official advertising in a given election: all parties with parliamentary representation, several parties without parliamentary representation, and even parties running for the first time. Overall, these parties garnered between 1% to 27% of the votes individually and represent over 90% of the votes countrywide. Street-level ad data is then combined with voting results and socio-demographic data at the census section level, the smallest administrative unit in Spain. A section is determined by the decennial census and simultaneously identifies a group of contiguous city blocks, typically one or two blocks, as well as a few voting booths (typically just one). There are 1068 census sections in Barcelona, which remain unchanged in the two elections used in this paper. On average, a census section has a little over a thousand voters, ranging between approximately 400 to 2400 voters in a given election.

The main specification measures the effect of exposure to a party's own ads on that party's vote share within a given census section. Ad exposure is measured by the number of ads per $100m^2$ (1,076 sqft) near the voters' residence. This measures not only captures the number of ads in

[2]For instance, candidates typically attend the putting up of the first poster at the beginning of the campaign, sometimes even doing it themselves. This is then often used by television news broadcasts as a starting segment on the first day of the electoral campaign.

[3]Campaign expenditures are audited and then made publicly available (Tribunal de Cuentas 2017, 2020).

a given section, but also the density of ads in that area. Since census sections tend to be quite small in size, counting only the ads located within the census section would not fully capture the range of ads that voters would be exposed to on a regular basis in the vicinity of their residence. Hence, I consider the 500m perimeter around the section as the area where voters are likely to be exposed to the ads regularly within a two-week campaign period. Section and party-election fixed effects are included. [4] Standard errors are estimated by either clustering them at the section level or following Conley (1999) to account for spatial autocorrelation.

On average, a party's own ads have a positive effect on that party's vote share in a given year. In particular, I find that a one-standard-deviation increase in a party's number of ads – equivalent to around 100 extra ads or being assigned an additional lottery number – would increase that party's vote share by around 0.34 percentage points. These results are mostly concentrated in areas where a party had at least two-thirds of the ads. Furthermore, due to the random allocation of ads, this means that some parties will be the only parties with ads in a given section. I find that a section being exposed to ads of single party increases that party's votes share by 3.5 percentage points compared to sections that only saw ads of another party. The results are robust to different measures of ad exposure, area buffers, and vote shares, as well as when using changes in the variables across the two elections in the regression – i.e. changes in ad density against changes in vote shares. The overall positive effect of ads is consistent with the results found in the literature (e.g. Larreguy et al. 2018; Sides et al. 2022; Spenkuch and Toniatti 2018).

After showing that own-party ads have a significant effect on vote share, the paper explores potential cross-party effects, that is, whether a party's ads can have an effect on another party's vote share. Spain, like many other countries, has a multi-party electoral system. The multiplicity of parties not only weakens the zero-sum logic often found in studies of advertising in two-party systems or two-round elections (Spenkuch and Toniatti 2018; Silveira and Mello 2011), but also gives the opportunity to explore cross-party effects by ideological (dis)similarity.

I consider the effects of the presence of ads of other parties that do not target opponents – differently from Galasso et al. (2023). Ads of other parties have a statistically significant effect on a party's vote share, but the sign and magnitude of the effect depend on the degree of ideological similarity between the different parties. I use voters' perception of the location of parties on two

[4] Note that, although the data covers at least six parties running in a given election, there are also at least two other parties running for the same election. Moreover, vote shares are computed by including party votes and blank votes.

different policy dimensions — the traditional left-right scale and the party's stance on regional autonomy — in order to categorize parties as being either "close" or "distant".

Ads of parties that are ideologically distant are found to always have a negative (but not always significant) effect on a party's vote share. The effects of the ads of ideologically similar parties vary between left- and right-wing parties. For the former, ads of close parties have a strongly negative effect – even larger than that of distant parties. In contrast, right-wings parties seem to benefit from ads of other close parties. This may suggest that the effects of ads could be mediated by how voters perceive future government formation. I provide contextual evidence suggesting that parties had very different strategies — more adversarial or coalitional — with respect to their stance towards ideologically-akin parties in these elections. This, in turn, may have influenced whether the ads of other parties act as substitutes or complements.

The last set of results focuses on the heterogeneous effects of ads across parties, voter characteristics, and area characteristics – all of them being variables that parties consider when organizing an electoral advertising campaign. Ads' effectiveness could depend on their location and the socio-demographic characteristics of the local electorate, both of which have been shown to matter for voter behavior at a larger scale (Cantoni and Pons 2022). The voters' previous voting record is also likely to be an important factor in determining the effectiveness of ads. For example, ads of a left-wing party could be more effective in areas where voters have voted for progressive parties in the past. Finally, I examine whether ads are more effective in urban rather than suburban areas. This is plausible since, in the former, residents often walk for their daily errands and therefore have greater exposure to ads.

First, I find that the ads of left-wing parties are more effective than those of right-wing parties. The large disparity in the effects of ads across party types suggests that the content displayed in the ads may matter. Since ad characteristics are quite homogeneous across parties, I focus on the characteristics of candidates who are portrayed in the ads. I find that ads featuring relatively young and new candidates get a boost, but only in the first election they run for. On the other hand, ads featuring women candidates are relatively less effective than those featuring men.

Second, ads are less effective in increasing a party's vote share in sections with higher income and in those with a relatively older population. As income tends to be strongly correlated with education, it is possible that the diminished effect of partisan ads on higher income voters is due to a lower cost of obtaining information by voters with higher educational attainment and, consequently, a lower sensitivity to ads. Lower sensitivity to ads by older voters can be similarly due

to the fact that such voters are better acquainted with the existing political parties or potentially more entrenched in their political positions. Additionally, there is limited evidence suggesting that ads may be more effective in densely populated areas, as indicated by the density of shops and air quality.

Finally, I find that ads are relatively more effective in areas where the electorate has historically favored the party or in areas where it has been split. This implies that parties can benefit from advertising not only in areas with a favorable electorate, but also in areas where voters are split. An area's ideological leaning is measured with previous electoral data.

Overall, I find strong evidence that ads are an effective campaigning tool and that key aspects of a political campaign strategy such as the characteristics of the candidates featured in the ads, local electoral characteristics, the ad locations, and the ads of other parties all matter. On average, political parties benefit from higher own ad density, especially if they have a high share of all ads in a given area. The ads' effectiveness vary considerably. Hence, ads influence voter behavior not only through a salience effect — where more ads draw attention to a party — but also through the candidates featured in the ads and the ad locations. Additionally, ads placed by other parties also have an impact on a party's vote share, an effect that hinges on ideological similarity.

These insights open up new avenues for both empirical and theoretical research on the strategic use of advertising by parties and its impact on voters. In particular, the findings support models where voters value a party's policies as well as candidate characteristics beyond affiliation (e.g. Gul and Pesendorfer 2009; Bernhardt et al. 2011; Polborn and Snyder 2017), where voters respond differently to campaigns or information signals by parties depending on their level of information and partisanship (e.g. Baron 1994; Levy et al. 2021). Models of voting behavior in proportional systems should also incorporate the possibility of non-trivial substitution and complementarity effects between parties based on future government coalitions (e.g. Baron and Diermeier 2001; Buisseret and Prato 2020). Hence, a welfare analysis of different electoral campaign regulations should then take into account the potential heterogeneous effects of ads across diverse socio-demographic groups as well as ad spillover effects.

Literature Review

Effects of ads on electoral performance

This paper contributes to the literature examining the effects of political advertising by leveraging a natural experiment involving all major political parties. This literature studies the success of ads and campaign strategies across different types of media, including radio, TV, and door-to-door canvassing.[5] The most closely related papers have relied on randomly varying elements of a given party's electoral campaign and exploiting different regulations or overlaps of media coverage across different geographical areas that generate exogenous variation in exposure to advertising.

On the former, Green et al. (2016) conducted a field experiment randomizing the planting of candidates' lawn signs across precincts in the United States. In close congressional races, lawn ads with ideological cues increased the vote share of the candidate by almost two percentage points, although the results are not robust to randomization inference. In an earlier work, Gerber et al. (2011) experimentally varied campaign start dates and ad quantities during the 2006 Texas gubernatorial race, finding a positive impact on party vote intention from ad exposure. Using survey data, they find that this effect disappears within one to two weeks.

This study focuses on ads that are continuously shown to voters for two weeks, reducing the likelihood of their effects diminishing over time. The randomization occurs across all major parties, which allows me to look at heterogeneities and spillovers across parties.

On the other hand, Spenkuch and Toniatti (2018) and Larreguy et al. (2018) use changes in ad exposure caused by different TV and radio channel coverage, respectively. Both find that increasing ad shares have a positive effect on vote shares, but in Larreguy et al. (2018) the effect is only present for non-dominant parties. They also find that ads were more effective at increasing the number of votes for a given party among voters in poorer areas.

I also find that ads are more effective for new parties – but only in their first election – and in areas with household income below the city's average. Moreover, I further explore the heterogeneities in the effects of ads for other types of parties, area characteristics, and past voting behavior. I focus on a multi-party system with very competitive elections, where no party has more than

[5] Dewan and Squintani (2016); Durante and Guitierrez (2014); Kalla and Broockman (2018); Kendall et al. (2015); Le Pennec and Pons (2023); Silveira and Mello (2011); Pons (2018)

27% of the vote and most parties have between 10 and 20% of the vote shares. In this context, parties could benefit significantly from even a small increase in ad exposure. Overall, instead of relying on plausibly exogenous variation in ad exposure across neighboring areas, I leverage the randomly allocated ads of all major political parties and account for potential spatial correlation across observations.

Spillover effects of electoral ads

Most of the literature in electoral advertising that considers the effects of other parties' ads focuses on negative advertising – ads attacking another party – and, in particular, whether it depresses turnout. Results are inconclusive as to whether negative ads depress turnout or bolster it.[6]

More recently, Galasso et al. (2023) conducted a field experiment during the campaign for mayoral election in an Italian city. The authors collaborated with the incumbent and experimentally varied whether the incumbent's ads targeted the main opponent or focused on a positive message. They found that negative ads benefited the candidate who neither used nor was the target of such ads.

In this paper ads do not feature attacks towards other parties. However, the competitive nature of the elections makes it plausible that spillover effects would occur. The results go beyond a zero-sum logic of advertising, revealing more complex patterns of substitution and complementary, and suggest that other parties' ads do matter, and their effect broadly depends on the ideological distance between parties. Also, I observe over one thousand voting booths, which allows me to have more precise estimates.

Effects of candidate characteristics on electoral performance

Finally, the most prominent feature of ads considered in this paper are pictures of the candidates themselves and I explore how their characteristics interact with ad effectiveness. Indeed, Casey (2022) finds that voters are able to form accurate judgments on politicians' competence from photographs alone. More broadly, the salience of candidate characteristics such as valence and competence has been amply studied in the literature. In terms of voting behavior, certain characteristics such as gender may have an effect on voters.[7]

[6] Ansolabehere and Iyengar (1995); Barton et al. (2016); Lau and Rovner (2009)

[7] Ashworth and de Mesquita (2009); Barbanchon and Sauvagnat (2022); Bernhardt et al. (2011); Casas-Arce and Saiz (2015); Dal Bó et al. (2017); Kartik et al. (2007)

In a related paper Kendall et al. (2015) design two different campaign ads for one of the candidates running for an incumbent mayor from an Italian city emphasizing either valence or ideology. They randomize the electoral precincts that receive electoral mail or phone calls with either one of those two messages, both, or none. An increase in ad exposure increases the incumbent's vote share by four percentage points, but only in precincts where voters were contacted by phone and ads emphasized the candidate's valence.

I focus on candidate characteristics such as age and gender that voters would be able to identify from just looking at a picture of the candidates. This is also because, in this context, ads do not contain hard information about the candidates or the party's platform. I find that ads featuring young and new candidates are more effective in years in which new parties are running for the first time and that ads featuring women candidates are overall less effective.

The remainder of the paper is organized as follows: Section 1 summarizes the key elements the regulation of electoral campaigns in Barcelona. Then, Section 2 describes the datasets used, while Section 3 details the main aspects of measuring ad exposure and the identification strategy used. Finally, Section 4 presents the results, and Section 5 concludes.

1. Background

1.1. Elections and Campaign Regulations

The main features of the Spanish electoral system are proportional representation, closed lists, and multiple electoral districts. Parties can choose to run in any given district with a list of candidates. In order to be considered for the allocation of Members of Parliament (MPs) in a given district, parties must obtain at least 3% of the votes in that district. Seats are subsequently allocated following the D'Hondt method. Spain's legislature is constituted of two separate chambers: the parliament and the senate. Elections are held every four years for the lower and upper chambers, but parties' campaigning efforts focus on candidates running for parliament.

Spanish electoral advertising regulations impose strict restrictions on timing and content. The campaign period is limited to 15 days, ending at midnight the day before the election. All campaign activities, including advertising, are banned on election day and the day prior. However, street-level ads remain on display during these two days. Political parties face specific constraints on ad placement, timing, and quantity across most media formats. Outside the campaign period,

parties are prohibited from displaying posters, broadcasting TV ads, or mailing voter solicitation materials. All advertising expenditures are subsidized by the central government, with the amount determined by the party's election performance. For a more detailed description, refer to Online Appendix A.

Street-level advertising for political parties must adhere to two legal principles: (i) All parties or coalitions requesting ad space must be accommodated, and (ii) the proportion of ad space awarded to each party should correspond to their vote share in the most recent comparable election within the relevant district. For instance, the distribution of ad space for the 2019 national elections was based on the performance of each party in the 2016 national elections. Municipalities can determine their ad allocation method as long as it adheres to these two principles. However, these specific allocation schemes are not widely known among the public.[8]

The process of allocating street-level advertising spaces involves both the municipal administration and the Junta Electoral de Zona (JEZ), an independent entity representing the electoral commission. In the lead-up to the election, the municipal administration compiles a list of available spaces for political parties to display their ads, which is shared with the JEZ and all participating parties.[9] Parties interested in securing ad space must notify the JEZ by a specified deadline. The allocation of ad space is held ten days to two weeks before the start of the campaign. Representatives from all participating parties, the municipal administration, the JEZ, and a notary are present at this meeting.

In Barcelona, two separate lotteries are held for each type of advertising – posters and ad banners –, matching the parties' "lottery tickets" to ad locations.[10]. Posters are allocated individually while banners are allocated in street segments – e.g. a party would be given Street A, starting at its intersection with Avenue X up until its intersection with Avenue Y, which contains β banners. Once the allocation is done there cannot be any ex-post trading of locations, parties cannot put up ads in locations attributed to another party, nor in any other space that may have remained

[8]Based on discussions with campaign organizers and townhall officials countrywide, municipalities decided on their allocation method when the 1985 law regulating elections was enacted and have not changed it since.

[9]For a discussion and evidence that the mayor's party is unlikely to have manipulated the overall location of the ads see the Appendix A.

[10]Banners are placed on street lighting. Out of the electoral period, banners in street lighting are used to advertise municipal policies or regulations, as well as cultural activities. They can also be left empty. Posters are larger than banners and are also placed by the street where ads for firms are placed.

empty.[11] An example of how these ads are displayed can be found in Figure OA.6. Note that the population is not widely aware of how street-level ads are allocated.

Electoral campaigns begin two weeks before election day, with overnight placement of street-level ads. A significant share of voters often decide their vote during this period (e.g Le Pennec and Pons 2023), around 25% in the elections in our sample.[12] These ads remain in place throughout the campaign, providing sustained exposure. The brief campaign duration and repeated exposure to nearby ads suggest a lasting impact on voters (Gerber et al. 2011). Additionally, no advertising or campaign events, including on social media, are permitted on the day of the election or the preceding day. Street-level ads, exempt from this rule, remain on display until the days following the election, likely making them the last ads voters encounter in the crucial 48-hour period before the election.

1.2. Electoral Competition in Barcelona

There are four parties that compete in all of Spain's electoral districts: Ciudadanos (Citizens, Cs, liberal), En Comú Podem (Together We Can, ECP, left), Partido Popular (People's Party, PP, center-right), and Partit dels Socialistes de Catalunya (Party of the Socialists of Catalonia, PSC, center-left). A new party, VOX (extreme right), created in 2013, also ran in the 2019 elections in the province of Barcelona for the first time.

Two regional parties with significant influence in local politics participated in both elections: Convergència Democràtica de Catalunya (Democratic Convergence of Catalonia, CDC, center-right) and Esquerra Republicana de Catalunya (Republican Left of Catalonia, ERC, left). While regional parties may not match the main national parties in votes, they still garner enough district support to secure MPs. This means that when the leading party falls short of a majority, it often leans on the support of regional parties to form a government.

Lastly, two other parties in Barcelona had ad space in at least one of the two elections but did not obtain representation in the national parliament.[13] Five more parties competed in the Barcelona

[11] It is customary to leave one to two ad locations empty in case a party decides to protest the allocation and it is given more space. This did not happen in any of the elections considered in this paper.

[12] Source: Centro de Investiaciones Sociológicas (2016). *Postelectoral Elecciones Generales 2016*, No. 3145; Centro de Investiaciones Sociológicas (2019). *Postelectoral Elecciones Generales 2019*, No. 3248.

[13] Front Republicà (Republican Front, FRONT) and Partit Contra el Maltractament Animal (Animalist Party Against Mistreatment of Animals, PACMA).

district in at least one of the two elections.[14] These parties have received limited support from the electorate, and their vote count frequently falls short of the number of blank votes. It is likely the latter did not request ad space because, despite not having to pay to place the ads, they still must bear the costs associated with ad printing, installation, and removal.

Overall, the parties included in my sample include all parties represented in parliament[15], three parties that ran for the first time in 2016 or 2019, and two parties that did not obtain representation in the national parliament. More details regarding the Spanish party system can be found in Online Appendix A.

2. Data

In this section, I outline the data used, which includes electoral results, information about the location and distribution of political advertising at the street level, as well as demographic and economic indicators.

Advertising data. The main dataset used in this paper includes the location of electoral ads in the city of Barcelona for the 2016 and 2019 national elections. The data was provided by the Barcelona townhall and by ERC[16]. In order to map the information on the location of ads, I also use the outline of the city of Barcelona and its census sections provided by the Instituto Nacional de Estadística (INE). The census section, the unit of analysis, is the smallest administrative division in Spain and its geometry is determined by the population registered in the most recent Decennial Census, which, in this case, took place in 2011. Since I only focus on the effect of ads in the 2016 and 2019 national elections, there are no changes in the census sections to consider.[17]

Election data. I also use the voting data of the April 2016 and 2019 general elections at the voting booth level. The dataset contains information on the overall population, the number of people

[14] These parties also have no representation in the regional parliament or in the city councils in the district of Barcelona.

[15] Excluding regional parties that *do not* run in Barcelona, such as the Basque Nationalist Party (PNV).

[16] Although the data provided by these two different sources do not cover the exact same elections, there is some overlap, which allowed me to verify that the reported assignment on both documents was the same.

[17] There are four sections that had minor border adjustments between 2016 and 2019. Two do not include any changes in terms of residential areas, one includes some scattered houses and the last one includes a full (newly built) apartment complex. All in all these changes should not affect much the population within those sections.

registered to vote, voter turnout, and the distribution of votes, whether they were blank, null, or in favor of a specific party.[18] In most cases, each section is assigned to a single voting booth.[19]

Other data. I also use socio-demographic information from the Atlas de la Renta, a project within INE that uses data from tax returns of the years 2015 to 2019. In particular, it contains indicators relating to income and its distribution within the census section, as well as different income sources. Moreover, it also has demographic indicators at the census section level related to the age distribution and size of households. I also use data provided by the municipality of Barcelona on air quality across the streets of Barcelona in 2016 and the census of all street-level shops in 2016 and 2019.

As explained in Section 1, parties are assigned a number of ad locations in proportion to their results in the previous comparable elections. Tables 1 and A.5Table show the allocation of both types of ads – banners and posters – across parties for the 2019 elections and 2016 elections, respectively.[20] The two tables show that, indeed, for both types of ads, the percentage of ads allocated is very close to the results in the 2015 elections in the case of the 2016 allocation, and the 2016 elections for the 2019 allocation. Note that due to the random allocation of segments, it so happens that a party with more segments has fewer banners than a party with fewer segments.

Figure 1 shows the distribution of ads across the city of Barcelona for the 2019 elections – the map for 2016 can be found in Figure A.5. Although ads are spread across the city, there are some areas with a higher concentration of ads than others. In particular, areas in the outskirts of the city as well as the dockyards have a lower concentration of ads. Areas with narrow streets, such as the Gothic Quarter, also have fewer ads due to logistical constraints. For the same reason, long and wide streets, such as Avinguda Diagonal or the Ronda de Dalt feature several ad segments. Overall, the distribution of ads is similar across the two elections.

3. Empirical Strategy

This section explains how I measure voters' ad exposure and the random ad allocation to identify the effects of ads on votes shares.

[18] All Spanish citizens are automatically registered as voters when they turn 18 or when obtaining the nationality.
[19] When the section is deemed to have too large a population, it is assigned to two or more voting booths. Voters within that section are allocated to the different booths by alphabetical order of their surnames and first names.
[20] Because 2016 was a repeat election, one of the parties decided to not have any street-level ads at all. This affected all municipalities in the country. These are excluded from the analysis, which means that there are fewer observations in 2016 than in 2019. More details can be found in Appendix A and Online Appendix B.

Table 1. **Distribution of Street-Level Ads in Barcelona (2019)**

	ECP	PSC	ERC	PP	CDC	Cs	PACMA	FRONT	VOX	Total
Banners (N)	1604	954	1070	660	531	742	98	78	90	5827
Banners (%)	27.53	16.37	18.36	11.33	9.11	12.73	1.68	1.34	1.54	
Segments (N)	18	12	11	9	8	8	1	1	1	69
Segments (%)	26.09	17.39	15.94	13.04	11.59	11.59	1.44	1.45	1.45	
Posters (N)	23	15	15	12	11	10	2	1	1	90
Posters (%)	25.56	16.67	16.67	13.33	12.22	11.11	2.22	1.11	1.11	
2016 Votes (%)	25.68	16.84	16.56	13.54	12.26	11.53	1.80	—	—	
2019 Votes (%)	16.31	24.66	22.97	5.00	10.15	11.98	1.62	2.72	3.59	

Notes: The distribution of the electoral campaign space is for the 2019 general election, held in April. The electoral results refer to the previous comparable election, which was held in April 2019. ECP stands for "En Comú Podem" (Together We Can), PSC stands for "Partit dels Socialistes de Catalunya" (Party of the Socialists of Catalonia), ERC stands for "Esquerra Republicana de Catalunya" (Republican Left of Catalonia), Cs stands for "Ciutadans" (Citizens), CDC stands for "Convergència Democràtica de Catalunya" (Democratic Convergence of Catalonia), PP stands for "Partido Popular" (People's Party), PACMA stands for "Partit Animalista Contra el Maltractament Animal" (Animalist Party Against Mistreatment of Animals), FRONT stands for "Front Anticapitalista" (Anticapitalist Front), and VOX is the actual name of the party.

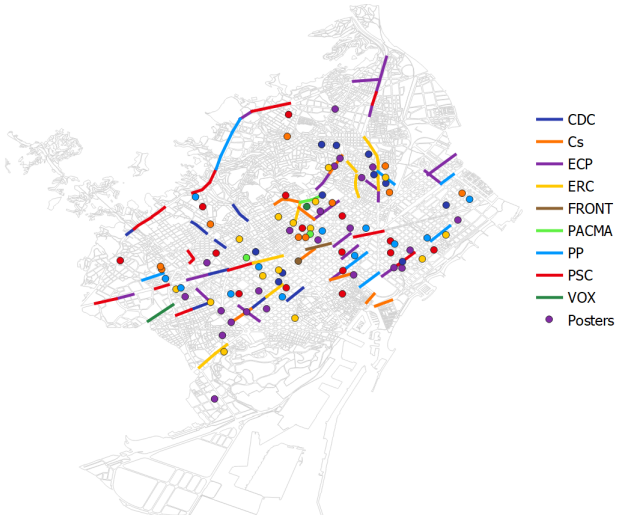


Figure 1. **Location of Electoral Advertising in the 2019 National Elections in Barcelona**
Notes: The lines denote the segments of streets allocated to different parties, where each party has a different color. Dots denote the posters by each party.

3.1. Measuring Ad Exposure

To measure ad exposure, ads are given a precise location by converting the original address information into precise geographic coordinates for both banners and posters in the city during both elections.

Once the ads are located, the next step is determining which local ads voters living in a section will be most likely to be exposed to. Census sections are typically quite small, covering approximately 1% of the city's area on average. Therefore, it's reasonable to assume that voters are exposed to ads within walking distance of their section. To account for this, I create a 500-meter buffer around each section to define its area of influence. As a robustness check, I will also use buffers from 300m to 450m for the main results of the paper. Two maps with examples of how the buffers are drawn can be seen in the Appendix in Figure OA.8 .

Next, I focus on one measure of exposure to electoral ads, ad density. I define ad density as the number of ads within a given section and buffer area divided by its total area – which includes the buffer area too. I transform this variable so that it can be interpreted as the number of ads per $100m^2$ (around 1076 sqft). This is an absolute measure of the amount of advertising in a given area that also takes into account that the concentration of ads may differ as the size of the areas is not homogeneous.

3.2. Identification

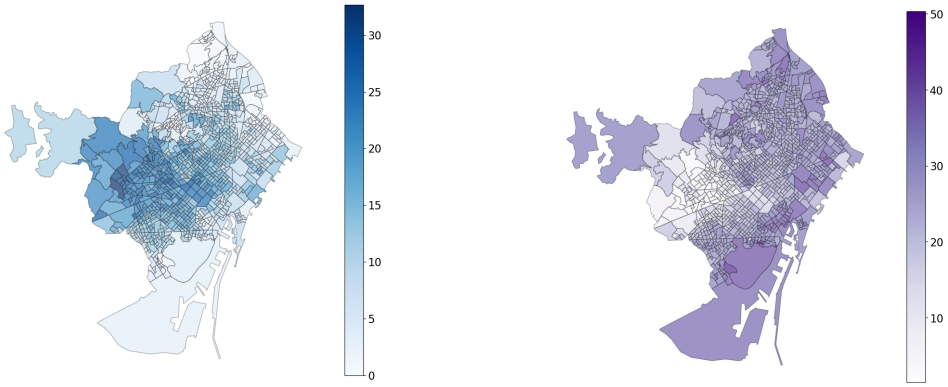
The identification strategy relies on the randomization of ad locations across parties ahead of each election. Hence, an important consideration is that, although ads are randomly assigned to locations, those locations are predetermined by the municipality in each election. The locations of ads induce a variation in which sections are exposed to ads, but that variation is not random. However, within a section with at least one poster or one banner segment, which party gets assigned that particular spot is random.

Once the ads are allocated to the parties, which occurs within two weeks to ten days before the start of the campaign, these face no specific restrictions with respect to the content of the ads. The campaign's overall design and slogan are set at the national level up to the use of regional languages in the ads, such as Catalan, instead of Spanish. Moreover, all parties have very similar ads in terms of structure and content – see Figures OA.6 and OA.7 for examples of banners. Parties usually have a set of 2 to 6 different banner designs, which often feature the party's candidate for prime minister as well as the party's top candidate in that electoral district. All parties place the different designs sequentially on the street segments, with one design being allocated to one streetlamp, although this is out of habit rather than due to a rule. This ensures that all voters in an area exposed to ads from a particular party see all of its ad designs. With respect to posters,

parties also have a limited number of designs. Since the size of posters is larger than that of banners, some but not all the posters will contain an additional slogan.

Overall, there is little cause for concern that parties might be targeting the content of the ads, or any other campaign activities, to the areas they are assigned to. The reasons for why this is likely the case include time constraints, how campaigns are organized, and conversations with campaign organizers – for more details, see Appendix A. Furthermore, parties may choose not to use the spots that they were assigned to and do so strategically. It is extremely unusual for parties that have requested to have street-level slots just to relinquish them after the allocation.[21]

For this analysis, I use the sub-sample of the sections that were exposed to at least one ad.[22] Moreover, I include section fixed effects to control for section-specific characteristics such as the area of the section and the number of ads it is exposed to.[23] I also include party fixed effects in all estimations combining the voting outcomes for more than one party and year fixed effects when considering the data for the two elections. When it is not possible to include section fixed effects, I include the socio-demographic variables in the regressions as control as well as the total number of ads.



(a) **CDC (2016)** (b) **ECP (2016)**

Figure 2. **Vote Shares of CDC and ECP (2016)**

[21] Sometimes small parties choose not to fill in *any* of the spots allocated to them because the production and distribution costs are too high, this, to my knowledge does not happen in either the 2016 or 2019 elections.

[22] That is, sections where no ads were allocated to any party are excluded from the analysis. I cannot observe whether parties chose to leave some of their spots empty, only the spots that they were allocated to. To the best of my knowledge given my conversations with party organizers, no party left any of their spots empty in the 2016 and 2019 elections. For more details, please see Appendix A.

[23] There are several other parties that ran in these elections but are not included because they did not have ads. Vote shares also include blank votes. Nevertheless, the results hold when section fixed effects are replaced by socio-economic control variables and the total number of ads.

In order to account for spatial correlation, I estimate Conley standard errors (Conley 1999) as well as standard errors clustered at the section level in all regressions.[24] As can be seen in Figure 2, there is a large variance in the vote shares of a given party across sections. However, it is also apparent that if two sections are nearby, it is more likely that there is a smaller difference in a party's vote share between those sections. Moreover, as mentioned before a majority of the ads, banners, are divided into segments. The segments' length can be as short as 250m (820 ft) to over 1km (0.630 miles). This means that sections that are nearby are likely to, at least partially, be exposed to the same ads.

Randomization-inference p-values are computed for the main results as a robustness check. I use the randomization device used in the allocation to simulate 10000 potential assignments of the ad locations across parties. Using the new random assignments, I compute, for each permutation, the number of ads of a given party that each section would be exposed to in this hypothetical scenario. Then, I run the same regression on the permutation dataset and derive randomization-inference p-values based on the share of permutations with t-statistics larger the actual t-statistic.

Finally, I check on the randomization of ad location across parties with balance tables – see Tables OA.17 to OA.20 in Online Appendix D. I compare (i) the first and second most voted parties and (ii) left-wing and right-wing parties. Variables include income distribution, income sources, age, population, household size, shop density, and turnout in the 2015 national election. Whenever possible, I use values from the year preceding either of the two elections (2015) or the election year (2016 and 2019). I conduct t-tests for group differences and calculate randomization-inference p-values (p^{RI}). In 2019, some income-related variables differ significantly, but the differences are minor compared to group averages and standard deviations. Only the variable indicating the average share of household income from unemployment benefits has a $p^{RI} < 0.10$, with a small difference of approximately 0.1 percentage points between the groups.

[24] I estimate these standard errors by using the econtools package for Python, a bandwidth of approximately 280m with a triangular kernel

4. Results

4.1. Effects of Ads on Vote Shares

This section focuses on estimating the effects that a party's own ads have on its vote share. The main specification is as follows:

$$\text{VoteShare}_{i,p,e} = \beta \, \text{AdDensity}_{i,p,e} + \pi_p + \psi_i + \tau_e + \pi_p \times \tau_e + \varepsilon_{i,p} \tag{1}$$

Where $\text{VoteShare}_{i,p,e}$ refers to the vote share of party p in section i in election e, $\text{AdDensity}_{i,p,e}$ refers to the number of ads per 100m^2 of party p within the perimeter of influence of section i for election e, π_p denotes party fixed effects, ψ_i denotes section fixed-effects, τ_e election fixed effects. I also add party-election fixed effects, for those parties that had ads in both elections. Furthermore, I also estimate this regression using each election separately.[25]

Table 2 displays the results of estimating Equation 1 in sections that had at least one ad, for the two elections under consideration, separate and combined. The effect of ads on vote share is consistently positive and statistically significant, remaining robust across different area buffers. Moreover, $p^{RI} < 0.10$ for both 2019 and both years combined. Also, ads were less effective in 2016 than in 2019, likely due to a preceding general election just seven months earlier, which may have diluted the impact of the new campaign.

The findings remain consistent when using the number of ads instead of ad density, and controlling for the total number of ads within the area – see Table OA.24. Additionally, they are also robust to using a different specification and regressing the change in vote share across the two elections against the change in ad density. The effect is always positive, but only statistically significant for the 400m, 450m, and 500m buffers – see Table A.6. All the above is also robust to using raw vote shares – number of votes for a party divided by the electorate, see Table OA.25 and Table OA.26.[26] This suggests that increasing the ad density of parties' ads not only increases its relative vote share but also the number of voters that voted for that party.

The results presented show that campaign ads matter and have a positive effect on party's electoral performance. To have an idea of the overall effect across the city, I do a back-of-the-envelope

[25] I also estimated this model with a quadratic term for ad density, but that term was not statistically significant in any specification. In Section 4.3, I will explore other potential non-linear effects of ads.

[26] This setting is not ideal to study voter turnout. Nevertheless, Section B in the Appendix describes the results of an exploratory analysis on the effects of ads on turnout by looking at sections that were only exposed to ads in one of the two elections.

Table 2. **Effects of Own Ad Density on Vote Shares**

	Vote Shares		
	2016	2019	2016–2019
	(1)	(2)	(3)
Ad Density	0.843***	1.158***	0.952***
	(0.305)	(0.161)	(0.150)
	[0.360]	[0.193]	[0.187]
	{0.386}	{0.035}	{0.085}
R^2	0.63	0.79	0.73
Observations	5670	8802	14472
Mean of Outcome	14.09	10.96	12.19
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes
Year FEs	No	No	Yes
Party×Year FEs	No	No	Yes

Notes: Ad density refers to the number of ads in $100m^2$. There are section and party fixed effects, and column (3) has year and party-year fixed effects. Results shown using the 500m perimeter of influence. Standard errors are clustered at the section level and are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

calculation using the results from the regression using the number of ads. The estimated coefficient in the first column can be interpreted as one additional ad in a given section increasing by 0.008 the vote share of that party. An additional slot – combining both banners and posters – contains between 23 and 213 additional adds, with a standard deviation of around 43 ads. Therefore, if a party were given an additional slot in each lottery, their vote share would increase between 0.16 and 1.92 percentage points. A one standard deviation increase in the number of ads would increase a party's vote share by around 0.34 percentage points. This is a large effect, especially considering that the average vote share of the parties with ads is around 13%.

4.2. Cross-Party Effects of Ads

Voters are often exposed to ads from multiple parties, not only in this context but also across TV, radio, and social media. It is thus important to assess the potential impact of these competing ads on a party's vote share, which may depend on the ideological proximity between them.

I measure the parties' position within the traditional left to right spectrum with survey data. I rely on data from the 2016 and 2019 Pre-electoral and Post-electoral surveys conducted by the Centro de Investigaciones Sociológicas (CIS). These in-person surveys were carried out in the two weeks prior to the start of the campaign and in the weeks following the elections, respectively. Respondents were selected through stratified random sampling to be representative of all the electoral districts in Spain. Since the perception of a party's ideology may vary across the country, I only use the sub-sample of respondents that live in the district of Barcelona, which has over 600 respondents in each year. In the 2016 and 2019 surveys respondents are asked to place themselves in the left-right wing spectrum, where 1 means the most left-wing and 10 the most right-wing. They are also asked to use this same scale to place a group of political parties.[27]

While the left-right spectrum is a useful and meaningful means to characterize a party's platform, there are often multiple policy dimensions that are relevant for describing a party's ideology. Hence, I also use the parties' location in their perceived stance on the territorial organization of Spain, which has been a topic of notable relevance in the recent past. [28] This 'regionalism' scale takes a value of 1 if the party has a negative stance on regional identities and favors centralization and 10 if it has a strong regional identity and is in favor of the independence of a given region.

Figure 3 shows the average location of the seven main parties in both 2016 and 2019. According to the respondents' assessment, parties seem to be spread out throughout both dimensions. For instance, there are both left-wing and right-wing parties with a low regionalist score.

Using the survey data I categorize parties as being close or far from one another. In particular, party q is close to party p if party q's average ideological position is no more than 3 points away from party p's.[29] Otherwise, party q is far from party p. This definition, rather than a more traditional left-wing group versus right-wing, allows for parties to have a different set of close or distant parties depending on their own position.

[27] Usually, only parties represented in parliament are considered. Exceptions are made when the political party is expected to gain representation in the upcoming elections. In this case, the surveys covers 6 out of the 9 parties in the sample.

[28] This question was only asked in the 2016 post-electoral survey. This means that I have no estimate for where VOX, which was not represented in the Spanish parliament in 2016, is located on this particular scale. For 2019, I assume that VOX is more extreme in its views than the party with the most extreme position I do have data for the regionalism scale, PP, and impute the minimum value in that scale, 1. PP's average perceived position was 1.36 in 2019. For the 2019 elections, VOX's electoral program proposed a centralized organization of Spain where there is a single national parliament and regions have no sector-specific competencies. This is a stance that is not shared by any other party represented in the Spanish parliament.

[29] When grouping the parties using both dimensions, I classify them as close if they are not more than 4 points away.

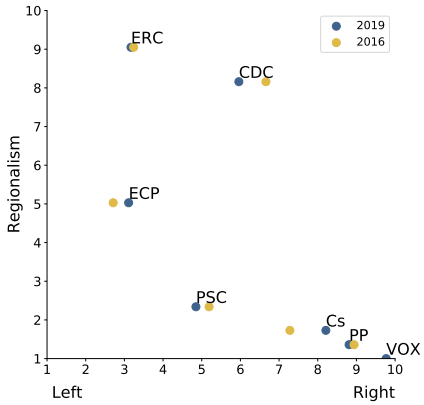


Figure 3. **Location of parties in the Regionalist and the Left-Right dimensions**

Hence, I can use these indicators to create two variables relating to the ad density of close and distant parties.

$$\text{VoteShare}_{i,p} = \beta\,\text{AdDensGroup}_{i,p} + \pi_p + \psi_i + \tau_e + \pi_p \times \tau_e + \varepsilon_{i,p} \tag{2}$$

where $\text{AdDensityGroup}_{i,p}$ refers to the number of ads per 100m^2 of party p's close parties or distant parties, π_p denotes party fixed effects, ψ_i denotes section fixed-effects, τ_e election fixed effects.

The results in Table A.7 suggest that ads from any competing party will have a negative effect, that is they always act as substitutes. The coefficients are negative and statistically significant when estimating the effect of close and distant parties in separate regressions or when both are added as regressors. These results also hold when looking at each election separately and when using only the left-right dimension to categorize parties. However, the effects in Table A.7 are not statistically significant when looking at p^{RI}, which is always above .10.

The role of other parties' ads changes when considering left- and right-wing parties separately. In Table 3. In particular, whereas the effect of distant parties' ads is also negative (but not always significant), the effect of close parties' ads depends on whether a party is left- or right-wing. For left-wing parties, the ads of close parties still have a negative and significant effect, whereas for right-wing parties they have a *positive effect*.[30][31]

[30]When estimating a model using instead changes in ad density against changes in vote share, the sign of the coefficients stays the same – see Table OA.29. Only the negative effect of close parties for the left wing and of distant parties for the right wing remain statistically significant.

[31]Note that $p^{RI} > 0.1$ for all columns of Table 3, this changes when looking at the effects per year as detailed below.

Table 3. **Effects of Own and Other Party's Ad Density on Vote Shares (2016–2019)**

	Vote Share					
	Left-Wing Parties			Right-Wing Parties		
	(1)	(2)	(3)	(4)	(5)	(6)
Ad Density Close Parties	-1.054***	–	-1.356***	0.333**	–	0.149
	(0.161)		(0.177)	(0.138)		(0.113)
	[0.184]		[0.199]	[0.167]		[0.149]
	{0.910}		{0.933}	{0.229}		{0.269}
Ad Density Distant Parties	–	-0.142	-0.629***	–	-0.345**	-0.284*
		(0.167)	(0.182)		(0.154)	(0.154)
		[0.200]	[0.215]		[0.188]	[0.187]
		{0.240}	{0.441}		{0.669}	{0.605}
Observations	4824	4824	4824	6747	6747	6747
R^2	0.53	0.53	0.53	0.67	0.67	0.67
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party×Year	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. Ad density Close Parties refers to the number of ads of parties that are no more than 4 points away from party p using both scales. Left-wing parties are ECP, ERC, and PSC. Right-wing parties are CDC, Cs, PP, and VOX. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

The negative effect for all other parties' ads in left-wing parties is present in both elections – see Table A.8 and Table A.9. The positive effect of close ads for the right-wing parties is concentrated in 2016, where a 1 ad increase per 100m^2 increases vote share by 2.17 percentage points – with a $p^{RI} < 0.10$. These effects disappear in the 2019 elections and their size reduces significantly for both ads of close and of distant parties. This suggests that in the 2016 election, voters may have been engaged in coalition-type thinking for right-wing parties, where close parties are not seen as close competitors but as likely to form alliances in the coming term. An increase of ads from parties that are similar to a voter's preferred party might encourage the feeling that this is a group of parties that could do well in the elections and hence have a shot at leading policy initiatives and passing laws once they are elected. In 2019, the ads of other parties had overall no effect on the vote share of right-wing parties, which is not the case for left-wing parties.

There are two possible reasons why the effect of other parties' ads changes across the years and across different party types. First, the content of the ads has changed. There are new slogans and different candidates, potentially changing the interaction across parties – the effect of candidate characteristics will be discussed in the following subsection. The second is that the political context, which influences the overall campaign strategy and message of political parties, has changed.

The 2015 election results led to a parliamentary composition where any party seeking to form a government would require the support from at least one other party. Despite efforts by both the incumbent and the runner-up (a center-left party) to establish a government, they were unsuccessful, which triggered the 2016 election in the sample. As the 2016 campaign started, it became clear that the incumbent, Spain's major center-right party, would again win the election but still need support from other parties.[32]

During that campaign, some parties emphasized the need to form a stable government, which would inevitably have to rely on multiple parties. This was particularly the case for right and center-right parties, but not so much for left-wing parties. In fact, polls were suggesting that a new left-wing party, would increase its vote share considerably and could even overtake the main center-left party in the country. This led the new left-wing party to adopt a more belligerent stance against the center-left party.[33] The fact that the party that was most likely to win the elections — and indeed, won the elections — and the most likely party to form a coalition to elect a government mutually benefit from each other's ads gives support to the coalition effect hypothesis.[34]

In 2019, the center-left party was set to win the elections, but it would need the support of other parties in order to form a government. Whereas the center-left party was relatively open to form a coalition government or to get support from other left-wing parties, the other left-wing parties adopted a more combative stance. In particular, the new left-wing party chose to distance itself from the center-left in order to in an attempt to minimize the vote transfer between them. [35] The other regional left wing party based in Catalonia was also quite critical of the center-left

[32]El Mundo, 09/06/2016, elDiario.es, 07/06/2016

[33]El País (06/06/2016), El Mundo (06/09/2016), El Periódico (06/13/2016), El Español (06/20/2016).

[34]For instance, the incumbent (PP, center-right) seemed to support the idea of getting support from the new liberal party and forward the idea of a "great coalition" between them and the center-left party. Similarly, the liberal made it clear that they were ready to negotiate with any party except the new left-wing party (El Confidencial, 06/14/2016; Libertad Digital, 06/15/2016).

[35]El Mundo (04/26/2019), ABC (04/23/2019)

since it stood to win the elections in that region. Moreover, the center-left was very critical of the Catalan pro-independence parties. This division among left-wing parties trigger a repeat election just some months later, as they were unable to form a government.[36]

All in all, it is not always the case that ads of other parties always reduce the vote share for a given party. There is evidence of a substitution effect, it being particularly strong for left-wing parties. However, the right-wing incumbent benefited from the ads of other close parties. This suggesting that being open to the formation of coalitions to form a stable government could significantly benefit parties, and especially the incumbent and the parties that are ideologically close to it. The results should not be interpreted as universal, or that similar effects should be expected in a different setting. Rather, the main takeaways are that (i) other ads matter and need not always act as substitutes, (ii) whether they have a positive or negative effect may depend on their ideological distance, and (iii) the broader electoral context.

4.3. Heterogeneous Effects of Ads

Heterogeneities across ads and ad concentration

The advertising data contains information on two types of street-level ads – banners and posters –, and one type could be more effective than the other. Banners are smaller, but each segment carries at least 20 of them, whereas posters are larger in size but only one can be placed in the assigned spot. Hence, it could be that one of the two is more salient than the other for voters, and explains most of the effect seen in Table 2. The results of estimating the model in Equation 1 while separating between the two types of ads reveal that banners account for most of the effect of ad density on vote shares – see Table A.10. This suggests that banners, while smaller, may be more salient to voters.

In light of these results and that ad density has been shown to have a significant effect on vote shares, it follows to ask if a party benefits more from higher ad concentration in a specific area. For instance, the allocation could result in certain areas only seeing ads of one party. In this setup, the 'treatment' is defined as being exposed to ads of a given party versus being exposed to ads of any other party – but only that party. Furthermore, I also take out observations that were only

[36] ABC, 04/23/2019; RTVE, 04/25/2019; El Mundo, 04/15/2019; eldiario.es, 16/04/2019

exposed to one single ad. In particular, I estimate the following specification:

$$\text{VoteShare}_{i,p,t} = \beta\, \text{AdShare}_{i,p,t} + \pi_p + \psi_i + \tau_e + \pi_p \times \tau_e + \varepsilon_{i,p} \tag{3}$$

Where $\text{AdShare}_{i,p,t}$ is the share of ads of party p in section i at time t, π_p denotes party fixed effects, ψ_i denotes section fixed-effects, τ_e election fixed effects. Since we are only considering sections that were exposed to ads by a single party, $\text{AdShare}_{i,p,t}$ is either equal to 0 or to 1. Finally, I also only consider parties for which there was at least one section that was exposed to ads of that party alone.

The results of the specification in Equation 3, where I only consider sections that were exposed to ads of a single party can be found in Table A.11. In particular, the effect of a section being exposed to ads of a single party increases that party's vote share, although there is substantial variance across elections, and it is stronger for sections that saw ads of one party in both years ($p^{RI} < 0.05$).

To maximize sample use, I consider terciles in the distribution of ad shares within a section. In particular, I create binary variables indicating whether a party had less than a third, between one to two thirds, or over two thirds of the ads within a section. I estimate a model similar to Equation 1 but using the last two indicators as regressors. The results in Table A.12 suggest that having at least two-thirds of the ads results in a significant increase in the vote share compared to having less than one third of the ads. In fact, having between one- and two-thirds of the ads has no significant advantage compared to having less than one-third of the ads.

Heterogeneities across parties

The discussion in the previous section on the effects of other parties' ads highlights the relevance of party characteristics. Hence, I now explore whether the ads of a given type of party was more effective than another. In particular, I consider the three main ways of grouping parties: left and right, national and regional, old and new parties.

Across both elections, left-wing and new parties benefit more from their own ads than right-wing parties, whereas new parties ads are less effective than those of old parties. Left-wing party ads are more effective than right-wing ads in both elections. New parties' ads are only more effective than right-wing ads in 2016, the second election the two new parties had participated in. On the other hand, the ads of regional ads becomes relatively more effective than national parties in 2019

– perhaps because regional issues became more prominent from 2017 onward, which particularly affected the parties in the regional group.

A possible explanation to why ads are ineffective could lie in their ad design. As discussed in Section 1, ads across parties exhibit nearly identical features in terms of information content. The campaign slogan and candidate's face are the most prominent features. An extensive literature explores the influence of candidates' physical appearance on voting behavior, with studies suggesting that attributes like attractiveness, smile, gender, and skin color affect perceptions of competence and voting likelihood (Alexander and Andersen 1993; Schubert et al. 2011; Horiuchi et al. 2012). These effects persist after controlling for non-visual candidate characteristics (Berggren et al. 2010). Quick judgments based on appearance reliably predict election outcomes (Ballew and Todorov 2007), and distinct neural activity patterns are associated with different physical attributes (Spezio et al. 2008). Parties are aware of these effects, with challenger parties often presenting candidates with favorable facial attributes (Todorov et al. 2005; Atkinson et al. 2009; Olivola and Todorov 2010).

I have collected information about both the content and on the candidates featured in the ads for the two elections in this sample. In terms of slogans, they are rather short, containing on average 3.4 words. The slogans do not discuss policy or ideology beyond, for instance, a willingness for change.[37] Hence, I will focus instead on visible candidate characteristics.

Visible candidate characteristics are those that would be apparent when looking at a picture of the candidate, like the one featured in ads. With that in mind, I consider sex, whether the candidate was 45 or older, and whether the candidate had been in politics for less than 4 years. The last characteristic is meant to capture whether the voter will be able to recognize the candidate. The results in Table A.14 suggest that candidate characteristics have a significant effect on vote share. Young and new candidates got a boost in 2016, the election where new parties ran with candidates that were relatively new to politics to signal their differences from "establishment" parties. This disappears in the 2019 election – much like the new party advantage –, when ads for young candidates become less effective than those for older candidates. Finally, on average ads featuring women candidates are relatively less effective than those featuring men candidates. However, ads with older more established women candidates are relatively more effective than that of their male counterparts.

[37] Some examples are: "A lot to defend" (regional center-right, 2016), "Let's win the change" (left, 2016), "The only possible change" (regional left, 2016), "Make it happen" (center-left, 2019), "Safe Bet" (center-right, 2019).

Heterogeneities within the city

The ads considered in this paper are placed on the street – as opposed to other types of ads that are broadcast through a device – and so the characteristics of the area where ads are displayed could explain whether they are more or less effective in affecting voters.

First, let's consider the socio-demographic characteristics of voters living in the areas where ads are displayed. Using the socio-demographic variables available from INE's *Atlas de la Renta*, I construct two binary indicators with respect to income and household age. The first indicates whether a section's average household income is above or below the city's median income for treated sections. The second indicates whether a section's average household age is above or below the city's median household age for treated sections. They are then added as an interaction term with ad density.

As shown in Table 4, ad density is relatively less effective in increasing a party's vote share in areas with a higher income – which is consistent with the findings in Larreguy et al. (2018) – and in areas with a relatively older population. The former result could be tied to the fact that wealth is often strongly correlated with education, and more educated voters tend to also be more informed about parties and their platforms, or face lower costs to obtain said information. Hence, they would be less likely to be influenced by campaign ads. The result on the lower effectiveness of ads in areas with an older population could be due to older voters having a habit of voting for a given party or more entrenched in their views. It could also be the case that older voters could be less likely to leave their homes as often as younger voters, and hence would be less exposed to street-level ads.

Indeed, another key component tied to the ads' effectiveness is whether voters do walk around the area often enough to be sufficiently exposed to the street-level ads. Since no low-level foot-tracking is available for the city of Barcelona, I use two different proxies: environmental pollution and shop density.

First, I consider pollution data from 2018 which is available by small street segments collected by the Barcelona townhall. Higher levels of pollution are more likely to occur in areas with more car traffic, which are the more densely populated areas in the city, where locals are more likely to walk around their neighborhood. Instead, areas with low pollution levels are more likely to be residential neighborhoods in the outskirts of the city. I include this measure in the estimated

Table 4. **Ad Density and Socio-Demographic Characteristics (2016–2019)**

	Vote Share					
Ad Density	2.322***	1.716***	1.611***	0.751***	0.871***	0.8710***
	(0.292)	(0.262)	(0.194)	(0.160)	(0.164)	(0.147)
	[0.313]	[0.280]	[0.232]	[0.200]	[0.208]	[0.183]
	{0.040}	{0.040}	{0.081}	{0.138}	{0.095}	{0.132}
Ad Density × Above Median Income	-1.539***	–	-1.572***			
	(0.262)		(0.264)			
	[0.288]		[0.294]			
	{0.717}		{0.728}			
Ad Density × Above Median Age	-1.041***	-1.097***	–			
	(0.284)	(0.286)				
	[0.285]	[0.286]				
	{0.900}	{0.904}				
Ad Density × Low Density	–	–	–	0.288	0.364	–
				(0.344)	(0.345)	
				[0.376]	[0.364]	
				{0.462}	{0.411}	
Ad Density × High Pollution	–	–	–	0.872*	–	0.905*
				(0.453)		(0.451)
				[0.530]		[0.513]
				{0.264}		{0.260}
R^2	0.73	0.73	0.73	0.73	0.73	0.73
Observations	14472	14472	14472	14472	14472	14472
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads per $100m^2$ of party p in section i. Ad density × Above Median Income refers to the interaction between Ad Density and a binary variable indicating whether the section is above or below the median income of treated section. Ad density × Above Median Age refers to the interaction between Ad Density and a binary variable indicating whether the section is above or below the median average household age of treated section. Heteroskedasticity-robust standard errors are shown in parentheses and Conley standard errors are reported in brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. Results shown using the 500m perimeter of influence. ***: $p < 0.01$, **: $p < 0.05$,*: $p < 0.10$.

model through a binary variable equal to 1 if that particular area have a maximum emission of nitrogen dioxide (NO_2) above 65 $\mu g/m^3$. [38]

Second, I use geocoded data on the location of all ground level shops in Barcelona for 2016 and 2019, also available in the townhall's open data portal. Indeed, the effect of electoral advertising might vary depending on whether neighbors of a given area do have amenities nearby and can walk to most of them or whether they need to take the car or public transportation. I use the

[38] One of the main sources of emission of nitrogen dioxide are combustion engines. The World Health Organization recommends an average annual exposure of not above 10 μg/m^3.

number of ground level shop per 100 square meters as a measure of density of amenities. I also create an additional measure with only shops that neighbors would find useful – e.g. it excluded wholesale shops or souvenir shops. As a regressor, I use a binary variable equal to 1 if that particular area and its buffer have a density below the 20th percentile of the city's distribution, which amounts to around 4 shops per $100m^2$ and interact it with ad density.

Overall, I find that ads are not less effective in areas with low shop density, but they are weakly more effective in areas with high air pollution. On the latter, the coefficient is similar in size to the effect of ad density alone – i.e. in areas with high levels of pollution an additional unit increase in ad density increases vote shared by around 0.9 percentage points.

Finally, another possible explanation for why we see such different effect across parties is their luck in the lottery draw. Some parties may have been places in areas where the voters were already favorable to them or instead where they would be very unresponsive to their ads. I consider the section's previous voting history by looking at the results of the 2011 general election[39]. I then group sections into three groups: if the combined vote share of left-wing parties differed to that of right-wing parties by 10 percentage points, the area is considered to be left-leaning, if the difference in vote shares is within a 10 percentage point range, the area is considered to be disputed, and otherwise it is considered to be right-leaning.These three groups represent 20.5%, 47% and 32.5% of the sections, respectively.

Having ads in disputed areas, where the electorate is evenly split between right-wing and left-wing parties, has a positive effect on a party's vote share. A one-unit increase in ad density increases that party's vote share by 0.61 to 0.78 percentage points. This results still holds when I use the change in vote share against the change in ad density across the two elections. Conversely, having ads in an area where voters are more aligned to your broader ideological group is beneficial for both left-wing and right-wing parties. The size of the effect of a one-unit increase in ads at least doubles compared to an increase in disputed areas. I find no effect when considering the change in the variables of interest, suggesting that this effect has been stable across the two elections.

[39]The 2011 election is the earliest general election that can be used without a significant loss of observations due to border changes after the decennial census. I only focus in general elections to ensure that voting patterns are comparable.

5. Conclusion

In this paper I analyze the effects of electoral advertising on voting behavior by studying the randomized allocation of the street-level ads of political parties in the city of Barcelona in the general elections of 2016 and 2019. This distinctive set-up not only provides a neat identification but also allows to further our understanding on how advertising affects voters.

First, ads have on average a positive effect on vote shares, which underscores the significance of strategic ad placement. Moreover, the findings in this paper suggest that ads are relatively less effective in areas that have an old and richer population that has not historically voted for ideologically similar parties. Furthermore, candidate characteristics, such as age and gender, play a notable role in the effect of ads.

Second, I find that ads have spillover effects, they affect not only their own vote share but also that of other parties. It is worth emphasizing that these are not ads that in any way target other parties explicitly or implicitly. It would be natural to expect that the ads of any other party would have a negative effect on a party's vote share, as they are all competing for the same voters. I find that this is the case for ads of parties that are ideologically distant, which is measured using the voter's perspective on a two-dimensional policy space. For ideologically similar parties, ads of other parties can instead be beneficial. This could be the case for incumbent parties that have emphasized the need to form a stable government with like-minded political parties. These findings suggest that advertising is permeated by the broader electoral context and how parties frame future government alliances.

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Appendix

A. Empirical Strategy

Selection of Location of Ads

There is little reason to believe that the townhall would strategically choose the spaces available for ads. First, by just looking at the streets chosen to display the ads, it seems that the logic followed was to pick streets that were long, wide enough to host banners, and that are crowded or busy streets. In fact, on of the main reasons why there are some changes in ad locations across

teh two years is due to there being some works planned during the electoral period. Second, the street segments and posters are spread widely across the city. Third, even if the townhall would try to choose some of the streets thinking about the governing party's electoral benefit there is no guarantee they would get their preferred locations, since the placement of the ads is randomly allocated. Finally, most of the changes in the street segments observed between 2016 and 2019 correspond to selecting different street segments within the same street. Moreover, I plot the vote share of ECP, the party that governed the townhall from May 2015 onward,– which would be the only party with the ability to select which areas were available for political ads in Figure OA.9.[40] In particular, I group census sections by whether they were exposed to ads only in the 2016 elections, only in the 2019 elections, in both elections, or in none of them. I also include standard error bandwidths for the first two groups, which are the two groups that changed status in either election. From the graph, it is clear that there is no difference in the voting patterns for ECP and that those differences are not statistically significant.

Do parties modify their campaign strategy based on their allocated lottery spots?

Above all, it should be clear that any evidence that I may provide here is based on reading interviews with campaign organizers and my own conversations with local party organizers in Barcelona. Generally speaking, local party organizers told me they did not change their strategy based on where their ads were located.

First, the allocation of ad space is done within two weeks to ten days of the start of the campaign, which severely limit the party's ability to change their strategies. As explained in the main body of the paper, ad content itself is fairly generic and not strategically placed in a given location.

Second, the types of campaigning that could be more easily adjusted would be door-to-door campaigning and phone banks, which are a fairly uncommon practice in campaigns in Spain, although they do exist. On the latter, this is mostly limited to having stands on the street where party officials and, very occasionally, candidates, will provide with information and leaflets to passersby. To the best of my knowledge, the decision on the location is based on (i) availability as time and location are also determined by the local authorities and the JEZ, and (ii) areas that are likely to see the most foot traffic. Unfortunately, I was not able to obtain a list of the sparty-level allocation of campaigning venues from the Barcelona townhall. On phone banks, political parties often target areas with a high unemployment rate or a relatively older population. This is because they

[40] Only three elections are available for this party, their first run being in December 2015.

are most likely to be at home at any given time of the day and because parties have very specific and tailored policies aimed at these two groups of voters.

Finally, voters are not aware of how street-level ads are allocated (or any other types of ads). I have had several conversations with people who live in Barcelona (including academics and people who have always lived there) and I have not met one that knew about this particular allocation method. My conversations with campaign organizers suggests that they also know that the electorate is, in general, unaware of this.

B. Turnout

In this section I consider the effects of ads on turnout. As explained in the main body of the paper, this is a less than ideal context to for this particular question since since the number and location of ads is not randomized. That is, which locations will have ads are pre-selected by the townhall but then which parties are assigned to each location is random. Instead, I use the cross-year variation in areas that were exposed to add to further explore the relationship between ads and turnout.

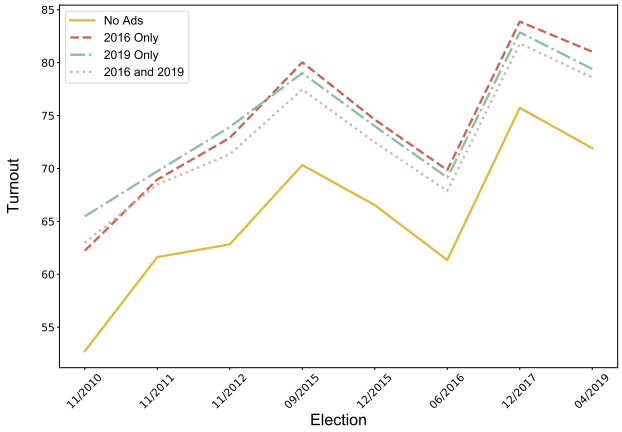


Figure A.4. **Turnout in General and Regional Elections in Barcelona (2010–2019)**

In Figure A.4, I plot the turnout throughout the eight general and regional elections in Barcelona between 2010 and April 2019.[41]. I compare four groups of sections: (1) sections that had ads only in 2016, (2) sections that had ads only in 2019, (3) sections that had ads in both years, and (4) the sections that had no ads in either election.

[41] In particular, I use the 2011, 2015, 2016, and 2019 general elections as well as the 2010, 2012, 2015, and 2017 elections to the Catalan parliament.

It is clear from the graph that the four groups follow the same trend. It must also be noted that the group of sections without any ads in both years consistently reports a turnout 10 points below the other three groups. To further check any possible differences in the voting trends across groups, I also plot the evolution of the vote shares of the four groups for the four parties that have ran in every election from 2010 to 2019.[42] In Figures OA.10 , it is also quite apparent that there is a common trend for all four groups for each of the parties' vote shares.

The estimation strategy follows a difference-in-differences approach by comparing group (1) and group (2) to group (3), separately, That is, I esimate the following two equations:

$$\text{Turnout}_{s,t} = \alpha + \gamma \text{Group1}_s + \lambda \text{Year}_{2016} + \delta \text{Group1}_s \times \text{Year}_{2016} + \boldsymbol{\beta X}_{s,t} + \varepsilon_{s,t} \quad (4)$$

$$\text{Turnout}_{s,t} = \alpha + \gamma \text{Group2}_s + \lambda \text{Year}_{2019} + \delta \text{Group2}_s \times \text{Year}_{2019} + \boldsymbol{\beta X}_{s,t} + \varepsilon_{s,t} \quad (5)$$

where $\text{Turnout}_{s,t}$ is the turnout in section s at election t, Group1_s is a binary variable indicating whether section s saw ads only in the 2016 election, Group2_s is a binary variable indicating whether section s saw ads only in the 2016 election, and $\boldsymbol{X}_{s,t}$ is a vector of control variables including percentage of the population aged 65 or older, average share of household income coming from wages, share of households with an income below 40% of the nationwide median, and the 80:20 ratio. In both equations Group 3, that is the sections that had ads in both years, acts as a control group. Table OA.38 displays the results.

I find that the sign of the coefficients goes in the expected direction – γ from Equation 4 is negative and γ from Equation 5 is positive. This means that turnout decreased in 2019 in areas that were only exposed to ads in 2016 compared to areas that were exposed to ads in both years. Conversely, turnout increased in 2019 in areas that were only exposed to ads in 2019 alone compared to areas that were exposed to ads in both years. However, due to the small number of observations in group 1 and group 2 – 2% and 5%, respectively – the standard errors are very large.

Finally, I consider whether candidate characteristics may affect turnout. Focusing on only sections that saw at least one ad, whether they saw ads of a new candidate or a woman candidate is still subject to randomization – given that parties do not choose their candidates or ads based on location. I find that candidate characteristics also has very small and insignficant effects on turnout – see Table OA.39. These results are consistent with the literature, that also finds little

[42] CDC was in a coalition with Unió Democràtica de Catalunya until 2015. In the 09/2015 Catalan elections, CDC and ERC formed an electoral coalition and so, for the sake of comparability, I omit this particular year.

evidence of the effects of political advertising on turnout (e.g. Krasno and Green (2008); Kendall et al. (2015); Freedman et al. (2004); Huber and Arceneaux (2007); Green and Gerber (2015)).

C. Additional Tables and Figures

Table A.5. **Distribution of Street-Level Ads in Barcelona (2016)**

	ECP	PSC	ERC	Cs	CDC	PP	PACMA	Total
Banners (N)	1632	886	850	800	746	734	58	5706
Banners (%)	28.60	15.53	14.90	14.02	13.07	12.90	1.02	
Segments (N)	17	11	9	9	9	7	1	63
Segments (%)	26.99	17.46	14.29	14.29	14.29	11.11	1.59	
Posters (N)	25	15	13	13	12	10	1	89
Posters (%)	28.08	16.85	14.61	14.61	13.48	11.24	1.12	
2015 Votes (%)	27.08	16.37	14.57	13.64	13.33	11.34	1.09	
2016 Votes (%)	25.68	16.25	16.56	11.53	12.26	13.54	1.80	

Notes: The distribution of the electoral campaign space is for the 2016 general election, held in June. The electoral results refer to the previous comparable election, which was held in December 2015. ECP stands for "En Comú Podem" (In Common, We Can), PSC stands for "Partit dels Socialistes de Catalunya" (Party of the Catalan Socialists), ERC stands for "Esquerra Republicana de Catalunya" (Republican Left of Catalonia), Cs stands for "Ciutadans" (Citizens), CDC stands for "Democràcia i Llibertat" (Democracy and Freedom), PP stands for "Partit Popular de Catalunya" (People's Party of Catalonia), and PACMA stands for "Partit Animalista Contra el Maltractament Animal" (Animalist Party Against Mistreatment of Animals). Note that, for this particular election PSC chose not to use the spaces assigned.

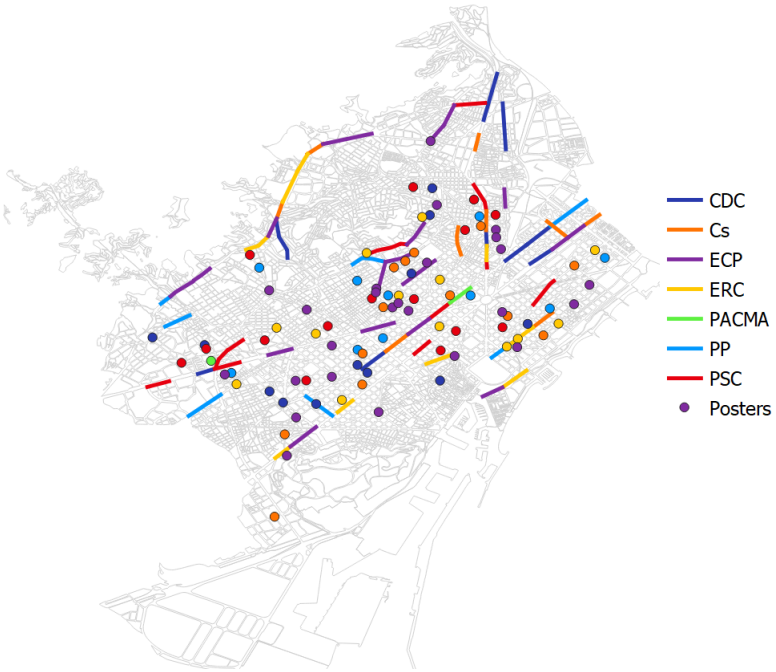


Figure A.5. **Location of Electoral Advertising in the 2016 General Elections in Barcelona**
Notes: The lines denote the segments of streets allocated to different parties, where each party has a different color. Dots denote the posters by each party. PSC chose to not use their spots in this election.

D. Regression Tables

Table A.6. **Effects of the Change in Ad Density on the Change in Vote Shares (2016-2019)**

	Δ Vote Shares				
	300m	350m	400m	450m	500m
Δ Ad Density	0.248	0.353	0.478**	0.543**	0.621**
	(0.155)	(0.168)	(0.179)	(0.192)	(0.207)
	[0.206]	[0.226]	[0.241]	[0.260]	[0.280]
Observations	4560	4872	5136	5406	5556
R^2	0.12	0.12	0.12	0.12	0.12
Controls	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Δ Vote Share refers to the change in vote share for a given party between the 2016 and 2019 elections. Δ Ad density refers to the change in the number of ads in $100m^2$ between the 2016 and 2019 elections. All parties that had ads in both elections are included. All sections that had ads in both elections are included. Controls include the change between the two elections of the following variables: average age within the household, percentage of the population aged 18 or younger, percentage of the population aged 65 or older, average share of household income coming from wages, average share of household income coming from retirement pensions, percentage of Spanish nationals, average household size, share of households with an income below 40% of the nationwide median, share of households with an income above 160% of the nationwide median, 80:20 ratio. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.7. **Effects of Other Parties' Ad Density on Vote Shares (2016–2019)**

	Vote Shares		
	(1)	(2)	(3)
Ad Density Close Parties	-0.386***	–	-0.914***
	(0.092)		(0.078)
	[0.114]		[0.088]
	{0.817}		{0.995}
Ad Density Distant Parties	–	-0.477***	-0.847***
		(0.128)	(0.137)
		[0.164]	[0.174]
		{0.640}	{0.791}
Observations	11571	11571	11571
R^2	0.60	0.60	0.61
Section FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Ad density Distant parties refers to the number of ads of parties that are over 4 points away from party p using both scales. Only parties with an observed ideology are included – namely, only PACMA and FRONT are exlcuded. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.8. **Effect of Other Party's Ad Density on Vote Shares (2016) – Both Dimensions**

	Vote Share					
	Left-Wing Parties			Right-Wing Parties		
	(1)	(2)	(3)	(4)	(5)	(6)
Ad Density Close Parties	-5.327***	–	-6.617***	1.538***	–	2.174***
	(0.928)		(1.203)	(0.439)		(0.472)
	[0.781]		[1.044]	[0.463]		[0.455]
	{0.00}		{0.00}	{0.18}		{0.080}
Ad Density Distant Parties	–	0.699	-1.089*	–	-0.357	0.811
		(0.469)	(0.622)		(0.558)	(0.636)
		[0.432]	[0.591]		[0.602]	[0.662]
		{0.00}	{0.00}		{0.552}	{0.399}
Observations	1890	1890	1890	2835	2835	2835
R^2	0.68	0.67	0.68	0.56	0.56	0.56
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Ad density Close Parties refers to the number of ads of parties that are no more than 4 points away from party p using both scales. Left-wing parties are ECP and ERC. Right-wing parties are CDC, Cs, and PP. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.9. **Effect of Other Party's Ad Density on Vote Shares (2019)**

	Vote Share					
	Left-Wing Parties			Right-Wing Parties		
	(1)	(2)	(3)	(4)	(5)	(6)
Ad Density Close Parties	-0.870***	–	-1.246***	0.016	–	-0.033
	(0.189)		(0.248)	(0.161)		(0.260)
	[0.198]		[0.260]	[0.184]		[0.298]
	{0.917}		{0.906}	{0.429}		{0.405}
Ad Density Distant Parties	–	-0.170	-0.947**	–	-0.038	-0.066
		(0.329)	(0.401)		(0.222)	(0.361)
		[0.353]	[0.428]		[0.255]	[0.414]
		{0.329}	{0.538}		{0.455}	{0.481}
Observations	2934	2934	2934	3912	3912	3912
R^2	0.47	0.47	0.48	0.70	0.70	0.70
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Ad density Close Parties refers to the number of ads of parties that are no more than 4 points away from party p using both scales. Left-wing parties are ECP, ERC, and PSC. Right-wing parties are CDC, Cs, PP, and VOX. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.10. **Effect of Banner and Poster Density on Vote Shares**

	Vote Share								
	2016			2019			2016-2019		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Banner Density	0.769**	–	0.861**	1.196***	–	1.152***	0.963***	–	0.953***
	(0.305)		(0.305)	(0.165)		(0.160)	(0.152)		(0.150)
	[0.359]		[0.361]	[0.200]		[0.192]	[0.189]		[0.187]
	{0.338}		{0.334}	{0.061}		{0.046}	{0.093}		{0.081}
Poster Density	–	-8.704	-37.787*	–	29.693*	20.955	–	16.279	-0.321
		(20.045)	(20.105)		(14.688)	(14.056)		(12.133)	(11.817)
		[21.140]	[21.603]		[16.849]	[16.047]		[13.572]	[13.291]
		{0.524}	{0.582}		{0.225}	{0.192}		{0.324}	
R^2	0.65	0.62	0.63	0.79	0.80	0.79	0.74	0.73	0.73
Observations	4824	4290	5670	7938	6975	8802	12762	11265	14472
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	No	No	Yes	No	No	Yes	No	No	Yes
Party×Year FEs	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Banner (poster) density refers to the number of banners (posters) in $100m^2$. The sample is restricted to sections that had at least one ad, one poster, or either. Results shown using the 500m perimeter of influence. Standard errors are clustered at the section level and are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.11. **Ad Concentration and Vote Shares (2016–2019)**

	Vote Share		
	2016-2019	2016	2019
Ad Share	3.593***	0.870	1.329**
	(0.770)	(0.969)	(0.667)
	[0.811]	[0.946]	[0.693]
	{0.011}	{0.315}	{0.182}
R^2	0.76	0.66	0.78
Observations	885	852	1053
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes
Year FEs	No	No	Yes
Party×Year FEs	No	No	Yes

Notes: Ad Share refers to the share of ads of a party in a given section. The sample for this regression includes sections that saw ads of only one party. Results shown using the 500m perimeter of influence. Standard errors are clustered at the section level and are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.12. **Ad Concentration and Vote Shares (2016–2019)**

	Vote Share		
	2016-2019	2016	2019
[1/3, 2/3) Ads	0.025	0.100	0.072
	(0.187)	(0.378)	(0.220)
	[0.201]	[0.392]	[0.225]
	{0.431}	{0.501}	{0.355}
≥ 2/3 Ads	0.978***	0.048	1.820***
	(0.228)	(0.415)	(0.262)
	[0.255]	[0.438]	[0.290]
	{0.124}	{0.436}	{0.016}
R^2	0.71	0.63	0.77
Observations	13494	5670	7824
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes
Year FEs	No	No	Yes
Party×Year FEs	No	No	Yes

Notes: [1/3, 2/3) Ads is a binary variable equal to 1 if the party has between one third and less than two-thirds of the ads in the area and 0 otherwise. ≥ 2/3 Ads is a binary variable equal to 1 if the party has at least two-thirds of the ads in a given area. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table A.13. **Ad Density and Area Characteristics (2016-2019)**

	Vote Share		
	(1)	(2)	(3)
Ad Density	0.751^{***}	0.871^{***}	0.810^{***}
	(0.160)	(0.164)	(0.147)
	[0.200]	[0.208]	[0.183]
	{0.138}	{0.096}	{0.132}
Ad Density × Low Density	0.288	0.364	–
	(0.344)	(0.345)	
	[0.288]	[0.376]	
	{0.462}	{0.411}	
Ad Density × High Pollution	0.872^{*}	–	0.904^{*}
	(0.453)		(0.451)
	[0.520]		[0.514]
	{0.264}		{0.260}
R^2	0.73	0.73	0.73
Observations	14472	14472	14472
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes

Notes: Ad density refers to the number of ads per $100m^2$ of party p in section i. Ad Density × Low Density refers to the interaction between Ad Density and a binary variable indicating whether the area has a shop density below the 20th percentile of the city's distribution. Ad Density × High Pollution refers to the interaction between Ad Density and a binary variable indicating whether the area has an annual average emission of nitrogen dioxide above 65 $\mu g/m^3$. Heteroskedasticity-robust standard errors are shown in parentheses and Conley standard errors are reported in brackets.Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. Results shown using the 500m perimeter of influence. ***: $p < 0.01$, **: $p < 0.05$,*: $p < 0.10$.

Table A.14. **Ad Density and Candidate Characteristics (2016-2019)**

	Vote Share			
	(1)	(2)	(3)	(4)
Ad Density	1.112***	0.370	1.332***	0.643**
	(0.170)	(0.217)	(0.180)	(0.223)
	[0.204]	[0.257]	[0.217]	[0.267]
	{0.035}	{0.240}	{0.000}	{0.412}
Ad Density × Young Candidate	-0.306	–	–	-1.054***
	(0.220)			(0.298)
	[0.267]			[0.351]
	{0.848}			{0.708}
Ad Density × New Candidate	–	1.092***	–	1.893***
		(0.285)		(0.355)
		[0.348]		[0.425]
		{0.378}		{0.000}
Ad Density × Woman Candidate	–	–	-1.811***	-1.760***
			(0.306)	(0.337)
			[0.355]	[0.384]
			{0.000}	{0.000}
R-Squared	0.61	0.61	0.61	0.61
Observations	11571	11571	11571	11571
Section FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. I include the main parties with ads for which I have data on candidate characteristics: CDC, Cs, ECP, ERC, PP, PSC, and VOX. Young Candidate refers to candidates that are less than 45 years old. New Candidate refers to candidates that have been in politics for four years or less. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Online Appendix

A. Electoral System and Advertising in Spain

Electoral System

Legislative elections in Spain follow a proportional representation system across multiple electoral circuits, provinces, where MPs are assigned at the province level and following the D'Hondt method. In national elections, each of the 52 provinces of Spain constitutes an electoral district. Each of these districts elects a number of Members of Parliament (MPs), which depend on the population of said district. A party can choose to run in each of these districts, presenting a list of candidates for each of them. All elections are overseen by the Junta Electoral, the electoral commission. Any possible transgressions of electoral laws are dealt with by this commission, which usually delegates its power to the regional or local electoral commissions. The local commissions are formed by three judges and two independents that have a degree in Law, Political Science, or Sociology that live in that judicial district.[43] The members of the local commission remain anonymous. The local commissions are formed a couple of months before election day and dismissed one hundred days afterward.[44]

Electoral Advertising and its Regulation

Spanish electoral law regulates all form of electoral advertising. On television and radio, state-owned channels offer a set amount of free airtime, with the duration and timing allocated based on each party's performance in the previous election. The total amount of time allocated ranges between 10 to 45 minutes. parties are only eligible to get those spaces if they run in at least 75% of the electoral districts covered by that particular TV channel[45] Privately-owned media may give parties more freedom in terms of the timing of the ads, although the allocation of airtime is still contingent upon their past electoral performance. These advertising slots are provided at no cost to the parties and it is not possible to acquire additional slots. When it comes to mail, parties are able to secure a substantial discount if they choose to send a letter to an entire province (i.e.

[43]Judicial districts most often correspond to one municipality. Usually, a Junta Electoral de Zona encompasses a territory that is larger than a municipality but smaller than a province

[44]Ley Orgánica 5/1985, de 19 de junio, del Régimen Electoral General. Tít. I, Cap III.

[45]That is, if that TV channel is only available in one region then parties need only to run in at least 75% if the districts within that region to be eligible to place ads in that channel. Some other conditions apply and they can be found in the Ley Orgánica 5/1985, de 19 de Junio, del régimen electoral general, Capítulo VI, Art. 64.4.

electoral district), instead of smaller areas. Moreover, parties can only send one letter per voter. Finally, no polls can be published in the week leading to election day.

The banners and posters in the data encompass most, though not the entirety, of street-level advertising. First, the townhall also puts up some panels across the city where any party — irrespective of whether it requested space for banners and posters — is allowed to display ads. These are often put on the ground, reclining on a wall, where parties can put ads one on top of the others, ads can be torn, painted over, etc. Second, parties may also put electoral ads in designated areas where anyone is free to put up whatever poster or piece of paper they which. Hence, not only can other parties put up their posters on top of another party's but so can private firms and individuals and also be subject to being torn, taken down, hidden, etc. Finally, ad space can be purchased to be displayed in subway – but not bus – stations. These do not follow any proportionality rules and can be acquired by any party in any location available. After contacting local campaign organizers in Barcelona, it seems that the purchase or location of these ads, or other campaign-related activities, is not contingent on the lottery allocation.

Campaign Spending

The amount a party can spend for a given general election is capped at €0.37 per voter within a given electoral district[46]. Only very small parties, which run in few or small electoral districts, go over the spending limit; major parties tend to spend a substantially lower amount[47].

All parties that obtain at least one MP or senator on that particular election are entitled to a government subsidy of their campaign. The precise subsidy amount is contingent upon several factors, including the total number of MPs elected, the quantity of votes garnered for their parliamentary lists, and the count of votes cast for their Senate candidates. To cover the remaining expenses, parties typically depend on party funds, private donations, and bank credits. Lastly, the maximum donation limit for any individual or legal entity to a party, federation, or coalition is set at €10,000 per election.

In Spain, the actions of the incumbent party are subject to strict regulations. Once elections are announced, the government cannot conduct any events or institutional campaigns that highlight the achievements of the government or use imagery and language reminiscent of their campaign

[46]Ley Orgánica 5/1985, de 19 de junio, del Régimen Electoral General. Tít. I, Cap VI

[47]This was indeed the case in the 2016 general elections, as seen in the reports submitted to the Tribunal de Cuentas (Court of Auditors) available in the "Informe de Fiscalización de las Contabilidades de las Elecciones a Cortes Generales de 26 de Junio de 2016."

slogans. Additionally, government officials are barred from taking part in the inauguration of public works or the commencement of public projects during this period.

Census Sections and Elections

Census sections are determined by the population registered in the Decennial Census. When individuals relocate, whether within the same city or to a different location, they typically inform the local townhall of their change of residence or officially register as residents in the new area. The primary concern for our analysis arises when individuals are registered as residents in a specific census section but, in reality, live elsewhere within the city. This is unlikely to be the case for a significant proportion of the population since crucial elements of public services are determined by the area of residence of a person. For instance, for medical appointments a person will be directed to the closest hospital or healthcare center as given by their registered residence.

The votes recorded within a census section correspond to voters who either voted in person or that requested an absentee ballot. They do not include the votes of voters who are registered as living abroad. If a person living abroad decided not to register at the consulate, she would only able to vote in person in Spain, in her designated voting booth. Hence, the share of the population that might not have been present during the electoral campaign and whose vote is recorded in the data should be quite small.

B. Data

Location of Banners and Posters

In the case of the posters, their location is given by the the intersection of two streets or a square, which facilitates imputing a set of coordinates. In the case of banners, I use information with respect to the location of the segments, that is the street where they are placed as well as the intersection with the streets that determine the beginning and end of the segment. Furthermore, I also have the total number of banners for each segment, but not the particular location of each banner. In order to place the banners, I assume that, within a given segment, banners are set such that they are equidistant to each other. This means that since segments vary in length and number of banners they contain, the space between the banners is not the same throughout the city. In the allocation data, streets are divided by segments that are assigned to different parties.

Each segment is bounded by the intersections with two other streets or squares. Each segment also has the number of ads in it.

Second, in 2016 one of the parties, PSC, chose not to use the spaces it was assigned. This was a last-minute decision made at the national level in an effort to reduce campaign costs since this was the second general election in less than a year. Consequently, PSC's 2016 ads are excluded from all analyses and tests that focus on parties with electoral advertising. I found no evidence that any of the other major parties made a similar decision in either election. The party's choices to use the spaces assigned to them will be further discussed in the upcoming sections.

Other Datasets

The INE Atlas de la Renta includes several income-related variables. In particular, yearly average household and per capita income as well as indicators of the sources of income (average share of income coming from wages, pensions, unemployment subsidies, other subsidies, and other income sources). It also has absolute and relative indicators of the income distribution of the households within a given census section, as the 80:20 ratio. In terms of demographic indicators, there are demographic indicators such as population, share of Spanish citizens, average age, percentage of the population below 18 and above 65, average size of the household, and the percentage of uni-personal households.

The geocoded data on the location of ground-level shops and air quality in Barcelona was obtained directly from the townhall's open data portal. For the former, the data is available for the years 2016 and 2019 among others. The dataset includes variables indicating whether the shops are active or not and several categorical variables indicating the type of shop. I exclude any shops that are not listed as active in the year of the election. I include shops from the following activity groups: clothes shops, food and drink shops, shoe shops, perfume and makeup shops, jewelry and watches, bookshops, bakeries, hairdressers, pharmacies, household goods, hospitals and primary health centers, education centers, among others. The air quality data starts in 2018, which is the year that I use in my analysis.

I used the Digital Archives at the Universitat Autonoma de Barcelona, which collects the posters and banners used by the main political parties in Catalonia. Out of the sample of 26 designs, 54% feature the name of the candidate at the national or district level, 61.5% featured a picture of the candidate. 65% of them featured the party's official election slogan together with "vote [party name]". On average, slogans have 3.5 words, with a minimum of 1 and a maximum of 6.

Figure OA.6. **Two Examples of Street-Level Banner Ads in Spain**

Source:*Diario16+* (October 3rd, 2019) and *El Mundo* (May 5th, 2016)

(a) **Convergència Democràtica de Catalunya (CDC)**

(b) **Ciutadans (Cs)**

(c) **En Comú Podem (ECP)**

(d) **Partit dels Socialistes de Catalunya (PSC)**

(e) **Esquerra Republicana de Catalunya (ERC)**

(f) **Partido Popular (PP)**

Figure OA.7. **Examples of Banners for the 2019 General Elections**

Source: Dipòsit Digital de Documents de l'Universitat Autònoma de Barcelona.

C. Additional Figures

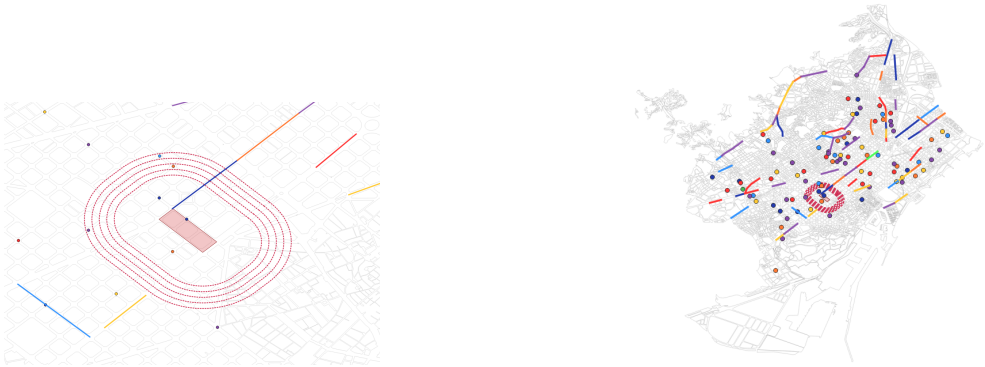


Figure OA.8. **Example of perimeters of influence in Barcelona**

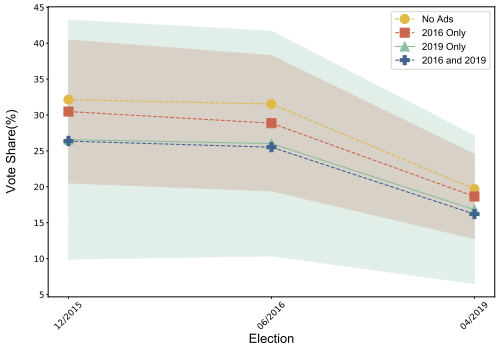
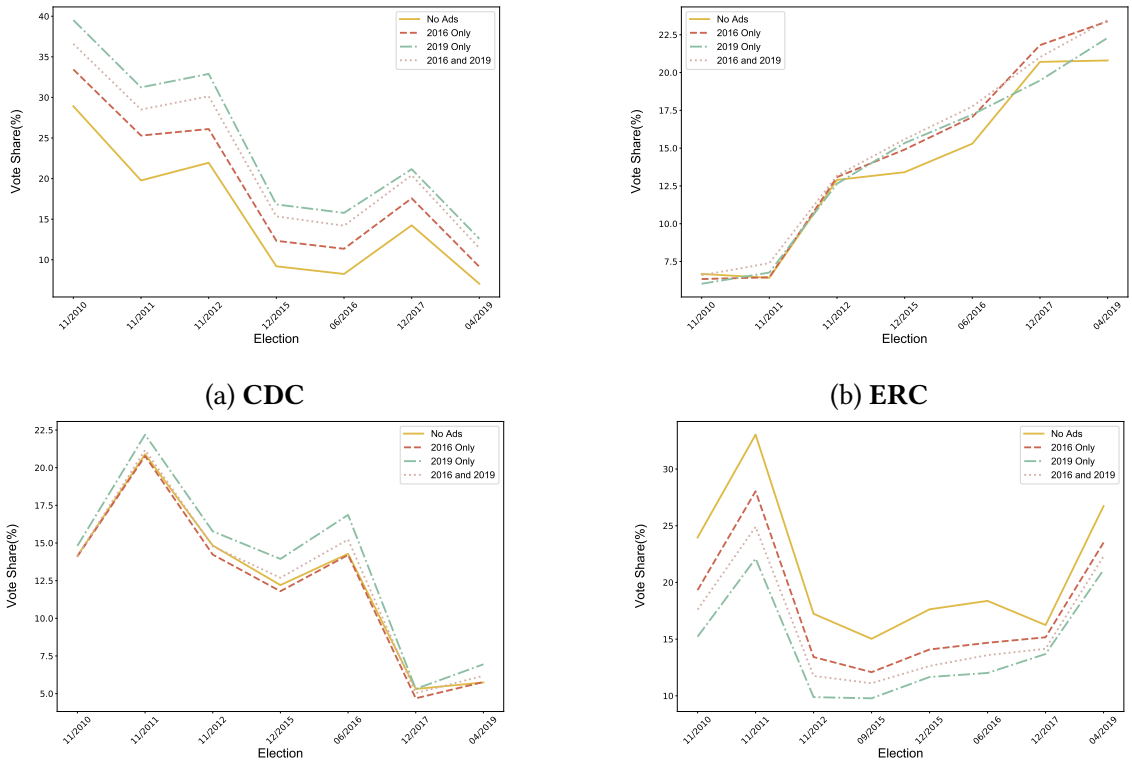


Figure OA.9. **Vote Share of ECP (2015–2019)**



(a) **CDC** (b) **ERC**

(c) **PP** (d) **PSC**

Figure OA.10. **Vote Shares in National and Regional Elections (2010–2019)**

D. Additional Tables

Table OA.15. **Population and Size of Census Sections in Barcelona**

		Mean	Stand. Dev.	Min.	Max.	Total
Barcelona	Population (2016)	1475.14	326.91	594	3173	1575453
	Area km^2	0.096	0.545	0.001	14.627	101.4

Table OA.16. **Parties Categorized as Close**

	2019			2016		
	Left-Right	Nat-Reg	Both	Left-Right	Nat-Reg	Both
CDC	Cs, ECP, ERC, PP, PSC	ERC	ERC	Cs, PP	ERC	ERC
Cs	CDC, PP, VOX	PP, PSC, VOX	PP, PSC, VOX	CDC, PP	PP	PP
ECP	CDC, ERC, PSC	PSC	ERC, PSC	ERC	-	ERC
ERC	CDC, ECP, PSC	CDC	CDC, ECP	ECP	CDC	CDC, ECP
PP	CDC, Cs, VOX	Cs, PSC, VOX	Cs, VOX	CDC, Cs	Cs	Cs
PSC	CDC, ECP, ERC	Cs, ECP, PP, VOX	Cs, ECP			
VOX	Cs, PP	Cs, PP	Cs, PP			

Table OA.17. **Balance Table – Two Most Voted Parties (2016), 500m Buffer**

	Most Voted Party	2nd Most Voted Party	Difference	t-statistic
Avg. % Income – Wage (2015)	58.84	59.14	-0.30	-0.92
	(5.70)	(5.34)		{0.72}
Avg. % Income – Wage (2016)	59.42	59.64	-0.22	-0.69
	(5.57)	(5.46)		{0.65}
Avg. % Income – Unemployment Benefits (2015)	1.70	1.61	0.09**	2.19
	(0.78)	(0.69)		{0.26}
Avg. % Income – Unemployment Benefits (2016)	1.43	1.35	0.08**	2.18
	(0.68)	(0.60)		{0.27}
Avg. Household Income (2015)	37415.43	38189.42	-773.99	-1.19
	(11421.64)	(10802.27)		{0.65}
Avg. Household Income (2016)	38176.31	38936.61	-760.30	-1.13
	(11806.77)	(11084.45)		{0.65}
% Households Income<40% Median (2015)	8.24	8.06	0.18	0.80
	(4.00)	(3.53)		{0.45}
% Households Income<40% Median (2016)	8.06	7.92	0.14	0.68
	(3.82)	(3.33)		{0.45}
% Households Income>160% Median (2015)	41.23	43.17	-1.95**	-2.38
	(14.86)	(13.15)		{0.76}
% Households Income>160% Median (2016)	42.47	44.41	-1.94**	-2.35
	(15.02)	(13.24)		{0.74}
80:20 Ratio (2015)	3.03	3.07	-0.04	-1.65
	(0.48)	(0.41)		{0.78}
80:20 Ratio (2016)	3.03	3.08	-0.05*	-1.81
	(0.51)	(0.45)		{0.80}
% Pop > 64 (2015)	22.22	21.97	0.26	0.90
	(4.88)	(4.34)		{0.26}
% Pop > 64 (2016)	22.27	22.09	0.18	0.65
	(4.88)	(4.47)		{0.32}
% Pop < 18 (2015)	14.65	14.34	0.31*	1.90
	(2.83)	(2.68)		{0.21}
% Pop < 18 (2016)	14.83	14.47	0.35**	2.18
	(2.84)	(2.70)		{0.19}
Average Age (2015)	44.41	44.44	-0.03	-0.21
	(2.51)	(2.22)		{0.46}
Average Age (2016)	44.46	44.52	-0.06	-0.41
	(2.51)	(2.24)		{0.53}
Average Household Size (2015)	2.39	2.38	0.01	1.52
	(0.18)	(0.16)		{0.26}
Average Household Size (2016)	2.37	2.36	0.01*	1.81
	(0.18)	(0.17)		{0.20}
Population (2015)	1487.23	1493.96	-6.72	-0.35
	(327.84)	(324.10)		{0.60}
Population (2016)	1481.80	1487.12	-5.32	-0.28
	(324.60)	(324.39)		{0.60}
% Spanish Population (2015)	84.15	83.90	0.25	0.55
	(8.48)	(7.25)		{0.38}
% Spanish Population (2016)	83.12	82.79	0.33	0.68
	(8.85)	(7.63)		{0.37}
% Sections with low shop Density (2016)	24.25	25.58	-1.33	-0.52
	(42.89)	(43.68)		{0.68}
Turnout (2015)	72.52	72.77	-0.25	-0.78
	(5.79)	(5.22)		{0.54}

Notes: In 2016, the most voted party was ECP (En Comú Podem), followed by PSC (Partit dels Socialistes de Catalunya), which chose not to use the slots assigned. Therefore, I use the third most-voted party this year, ERC (Esquerra Republicana de Catalunya). All variables are from 2015, before any of the two elections, except for the shop density variable, for which data is only available from 2016 onward. Average % Income from Wage refers to the combined household income that comes from work wages and not other sources of income – e.g. unemployment subsidies. % Households Income<40% Median refers to the share of households whose annual combined income is below 40% on the national median income. Average Age is the average age of the household. Average household size is the average number of residents (children included) in a household in that section. Low shop density is a binary variable equal to 1 if the number of shops per squared meter is below the 20th percentile of the city's distribution. Randomization-inference p-values are in curly brackets. Standard errors are in parentheses.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.18. **Balance Table – Two Most Voted Parties (2019), 500m Buffer**

	Most Voted Party	2nd Most Voted Party	Difference	t-statistic
Avg. Household % Income – Wage (2015)	59.21	59.54	-0.33	-0.99
	(5.42)	(5.54)		{0.75}
Avg. Household % Income – Wage (2019)	60.72	60.72	-0.00	-0.01
	(5.56)	(4.77)		{0.55}
Avg. Household % Income – Unemployment Benefits (2015)	1.74	1.61	0.13***	2.97
	(0.74)	(0.63)		{0.19}
Avg. Household % Income – Unemployment Benefits (2019)	1.20	1.12	0.08***	2.74
	(0.53)	(0.48)		{0.22}
Avg. Household Income (2015)	36517.76	37413.00	-895.24	-1.53
	(10628.88)	(8885.06)		{0.70}
Avg. Household Income (2019)	40857.50	41999.15	-1141.65	-1.75*
	(11813.41)	(9965.23)		{0.73}
% Households Income<40% Median (2015)	8.07	7.86	0.21	1.03
	(3.55)	(3.41)		{0.40}
% Households Income<40% Median (2019)	7.22	7.02	0.20	1.11
	(3.03)	(3.04)		{0.39}
% Households Income>160% Median (2015)	40.48	43.04	-2.56***	-3.24
	(13.89)	(12.39)		{0.83}
% Households Income>160% Median (2019)	38.51	41.46	-2.95***	-3.66
	(14.31)	(12.58)		{0.86}
80:20 Ratio (2015)	2.98	3.03	-0.05*	-1.88
	(0.44)	(0.40)		{0.78}
80:20 Ratio (2019)	2.83	2.86	-0.03	-1.41
	(0.41)	(0.33)		{0.70}
% Pop > 64 (2015)	22.56	21.94	0.62**	2.26
	(4.83)	(4.29)		{0.08}
% Pop > 64 (2019)	22.53	21.96	0.56**	1.97
	(4.85)	(4.63)		{0.11}
% Pop < 18 (2015)	14.42	14.27	0.15	1.00
	(2.71)	(2.40)		{0.39}
% Pop < 18 (2019)	14.22	14.10	0.12	0.77
	(2.72)	(2.39)		{0.44}
Average Age (2015)	44.67	44.44	0.23	1.64
	(2.44)	(2.26)		{0.14}
Average Age (2019)	44.78	44.50	0.28*	1.94
	(2.43)	(2.31)		{0.11}
Average Household Size (2015)	2.38	2.36	0.02**	2.07
	(0.16)	(0.16)		{0.18}
Average Household Size (2019)	2.38	2.35	0.03**	2.57
	(0.16)	(0.15)		{0.14}
Population (2015)	1475.30	1503.11	-27.81	-1.40
	(312.13)	(338.06)		{0.87}
Population (2019)	1498.23	1524.66	-23.43	-1.28
	(327.20)	(350.86)		{0.86}
% Spanish Population (2015)	84.81	84.24	0.57	1.30
	(6.33)	(7.78)		{0.29}
% Spanish Population (2019)	80.26	79.90	0.36	0.69
	(8.00)	(8.82)		{0.38}
% Sections with low shop Density (2016)	20.12	12.87	7.25***	3.29
	(40.12)	(33.52)		{0.12}
Turnout (2015)	72.86	72.94	-0.08	-0.27
	(5.17)	(5.20)		{0.44}

Notes: In 2019, the most-voted party was ECP (En Comú Podem), followed by PSC (Partit dels Socialistes de Catalunya). All variables are from 2015, before the two elections, except for the shop density variable, for which data is only available from 2016 onward. Average % Income from Wage refers to the combined household income that comes from work wages and not other sources of income – e.g. unemployment subsidies. % Households Income<40% Median refers to the share of households whose annual combined income is below 40% on the national median income. Average Age is the average age of the household. Average household size is the average number of residents (children included) in a household in that section. Low shop density is a binary variable equal to 1 if the number of shops per squared meter is below the 20th percentile of the city's distribution. Standard errors are in parentheses. Randomization-inference p-values are in curly brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.19. **Balance Table – Left and Right-Wing Parties (2016), 500m Buffer**

	Left	Right	Difference	t-statistic
Avg. Household % Income – Wage (2015)	58.93	59.34	-0.41	-1.47
	(5.60)	(5.55)		{0.91}
Avg. Household % Income – Wage (2016)	59.52	59.95	-0.47	-1.49
	(5.73)	(5.63)		{0.90}
Avg. Household % Income – Unemployment Benefits (2015)	1.72	1.71	0.01	0.27
	(0.78)	(0.73)		{0.45}
Avg. Household % Income – Unemployment Benefits (2016)	1.45	1.43	0.02	0.44
	(0.68)	(0.63)		{0.42}
Avg. Household Income (2015)	37207.89	37038.70	169.19	0.30
	(11326.64)	(10702.12)		{0.41}
Avg. Household Income (2016)	37961.97	37762.27	199.69	0.35
	(11714.16)	(11057.53)		{0.40}
% Households Income<40% Median (2015)	8.27	8.02	0.27	1.31
	(4.02)	(3.74)		{0.25}
% Households Income<40% Median (2016)	8.10	7.83	0.27	1.51
	(3.82)	(3.47)		{0.21}
% Households Income>160% Median (2015)	40.89	41.11	-0.22	-0.31
	(14.79)	(13.76)		{0.55}
% Households Income>160% Median (2016)	42.12	42.39	-0.27	-0.37
	(14.94)	(13.88)		{0.56}
80:20 Ratio (2015)	3.03	2.99	0.04	1.37
	(0.48)	(0.48)		{0.16}
80:20 Ratio (2016)	3.03	2.99	0.04	1.43
	(0.50)	(0.49)		{0.14}
% Pop > 64 (2015)	22.18	22.16	0.02	0.05
	(4.85)	(4.85)		{0.47}
% Pop > 64 (2016)	22.24	22.28	-0.04	-0.15
	(4.84)	(4.85)		{0.52}
% Pop < 18 (2015)	14.58	14.67	-0.09	-0.60
	(2.80)	(3.17)		{0.68}
% Pop < 18 (2016)	14.75	14.83	-0.08	-0.53
	(2.81)	(3.18)		{0.66}
Average Age (2015)	44.42	44.43	-0.01	-0.10
	(2.47)	(2.56)		{0.51}
Average Age (2016)	44.47	44.51	-0.04	-0.25
	(2.48)	(2.58)		{0.55}
Average Household Size (2015)	2.39	2.40	-0.01	-0.25
	(0.18)	(0.18)		{0.61}
Average Household Size (2016)	2.38	2.38	-0.00	-0.33
	(0.18)	(0.18)		{0.63}
Population (2015)	1484.81	1472.65	12.16	0.75
	(329.74)	(313.59)		{0.28}
Population (2016)	1478.97	1467.01	11.96	0.74
	(326.94)	(312.20)		{0.29}
% Spanish Population (2015)	84.07	84.91	-0.84**	-2.08
	(8.47)	(7.34)		{0.80}
% Spanish Population (2016)	83.03	83.91	-0.88**	-2.10
	(8.82)	(7.70)		{0.81}
% Sections with low shop Density (2016)	25.40	29.32	-3.92*	-1.74
	(43.56)	(45.55)		{0.90}
Turnout (2015)	72.43	72.86	-0.43	-1.53
	(5.79)	(5.27)		{0.67}

Notes: All variables are from 2015, before the two elections, except for the shop density variable, for which data is only available from 2016 onward. Average % Income from Wage refers to the combined household income that comes from work wages and not other sources of income – e.g. unemployment subsidies. % Households Income<40% Median refers to the share of households whose annual combined income is below 40% on the national median income. Average Age is the average age of the household. Average household size is the average number of residents (children included) in a household in that section. Low shop density is a binary variable equal to 1 if the number of shops per squared meter is below the 20th percentile of the city's distribution. En Comú Podem (ECP) and Esquerra Republicana de Catalunya (ERC) are considered left-wing parties. Ciutadans (Cs), Convergència Democràtica de Catalunya, and Partit Popular (PP) are considered right-wing parties. Standard errors are in parentheses. Randomization-inference p-values are in curly brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.20. **Balance Table – Left and Right-Wing Parties (2019), 500m Buffer**

	Left	Right	Difference	t-statistic
Avg. Household % Income – Wage (2015)	58.95	58.78	0.18	0.64
	(5.66)	(5.60)		{0.28}
Avg. Household % Income – Wage (2019)	60.43	59.98	0.45	1.51
	(5.96)	(6.05)		{0.12}
Avg. Household % Income – Unemployment Benefits (2015)	1.71	1.57	0.13***	3.67
	(0.79)	(0.71)		{0.07}
Avg. Household % Income – Unemployment Benefits (2019)	1.18	1.09	0.09***	3.35
	(0.57)	(0.52)		{0.09}
Avg. Household Income (2015)	37588.56	39137.65	-1549.10***	-2.64
	(11924.23)	(11984.06)		{0.94}
Avg. Household Income (2019)	42172.13	43954.66	-1782.53***	-2.67
	(13499.08)	(13661.70)		{0.94}
% Households Income<40% Median (2015)	8.12	7.82	0.30	1.65
	(3.90)	(3.59)		{0.27}
% Households Income<40% Median (2019)	7.29	7.04	0.25	1.59
	(3.39)	(3.12)		{0.29}
% Households Income>160% Median (2015)	41.20	43.80	-2.60***	-3.67
	(14.84)	(14.06)		{0.94}
% Households Income>160% Median (2019)	39.46	42.22	-2.76***	-3.78
	(15.31)	(14.45)		{0.95}
80:20 Ratio (2015)	3.01	3.06	-0.05**	-2.04
	(0.48)	(0.47)		{0.92}
80:20 Ratio (2019)	2.85	2.91	-0.05**	-2.51
	(0.42)	(0.41)		{0.95}
% Pop > 64 (2015)	22.20	22.12	0.08	0.33
	(4.84)	(4.55)		{0.35}
% Pop > 64 (2019)	22.14	22.10	0.04	0.17
	(4.90)	(4.74)		{0.381}
% Pop < 18 (2015)	14.75	14.68	0.07	0.44
	(2.97)	(3.03)		{0.46}
% Pop < 18 (2019)	14.56	14.51	0.05	0.34
	(2.95)	(3.07)		{0.51}
Average Age (2015)	44.40	4.40	-0.00	-0.03
	(2.52)	(2.39)		{0.42}
Average Age (2019)	44.50	44.47	0.03	0.24
	(2.51)	(2.41)		{0.35}
Average Household Size (2015)	2.40	2.39	0.01	0.87
	(0.19)	(0.19)		{0.42}
Average Household Size (2019)	2.39	2.39	0.00	0.84
	(0.18)	(0.18)		{0.46}
Population (2015)	1481.75	1473.54	8.21	0.52
	(330.77)	(309.96)		{0.37}
Population (2019)	1505.18	1494.24	10.93	0.67
	(344.49)	(324.82)		{0.30}
% Spanish Population (2015)	84.60	84.50	0.10	0.26
	(7.98)	(7.78)		{0.42}
% Spanish Population (2019)	80.18	80.03	0.15	0.33
	(9.48)	(9.37)		{0.40}
% Sections with low shop Density (2016)	24.28	23.39	1.00	0.48
	(42.96)	(42.36)		{0.61}
Turnout (2015)	72.68	73.06	-0.39	-1.44
	(5.61)	(5.35)		{0.58}

Notes: All variables are from 2015, before the two elections, except for the shop density variable, for which data is only available from 2016 onward. Average % Income from Wage refers to the combined household income that comes from work wages and not other sources of income – e.g. unemployment subsidies. % Households Income<40% Median refers to the share of households whose annual combined income is below 40% on the national median income. Average Age is the average age of the household. Average household size is the average number of residents (children included) in a household in that section. Low shop density is a binary variable equal to 1 if the number of shops per squared meter is below the 20th percentile of the city's distribution. En Comú Podem (ECP), Esquerra Republiana de Catalunya (ERC) and Partit dels Socialistes de Catalunya (PSC) are considered left-wing parties. Ciutadans (Cs), Convergència Democràtica de Catalunya, and Partit Popular (PP) are considered right-wing parties. Standard errors are in parentheses. Randomization-inference p-values are in curly brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

E. Regression Tables

Table OA.21. **Effects of Own Ad Density on Vote Shares by Buffers (2016)**

	Vote Share				
	300m	350m	400m	450m	500m
Ad Density	0.514**	0.619**	0.710**	0.831**	0.843**
	(0.198)	(0.218)	(0.239)	(0.259)	(0.278)
	[0.256]	[0.282]	[0.310]	[0.335]	[0.360]
Observations	5894	6146	6391	6629	6734
R^2	0.58	0.58	0.58	0.58	0.58
Section FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads in $100m^2$. All parties that had parties in a given election are included. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.22. **Effects of Own Ad Density on Vote Shares by Buffers (2019)**

	Vote Shares				
	300m	350m	400m	450m	500m
Ad Density	0.651***	0.746***	0.861***	1.011***	1.158***
	(0.174)	(0.193)	(0.212)	(0.232)	(0.251)
	[0.135]	[0.147]	[0.160]	[0.175]	[0.193]
Observations	8082	8082	8388	8703	8802
R^2	0.79	0.79	0.79	0.79	0.79
Section FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads in $100m^2$. All parties that had parties in a given election are included. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.23. **Effects of Own Ad Density on Vote Shares by Buffers (2016–2019)**

	Vote Shares				
	300m	350m	400m	450m	500m
Ad Density	0.560***	0.648***	0.742***	0.865***	0.952***
	(0.104)	(0.114)	(0.126)	(0.139)	(0.150)
	[0.130]	[0.143]	[0.158]	[0.173]	[0.187]
Observations	12579	13188	13710	14253	14472
R^2	0.73	0.73	0.73	0.73	0.73
Section FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads in $100m^2$. All parties that had parties in a given election are included. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.24. **Effects of Ads on Vote Shares**

	Vote Share		
	2016	2019	2016-2019
Ads	0.007**	0.009***	0.008***
	(0.003)	(0.001)	(0.001)
	[0.003]	[0.001]	[0.002]
Observations	5670	8802	14472
R^2	0.63	0.79	0.73
Section FEs	Yes	Yes	Yes
Year FEs	No	No	Yes
Party FEs	Yes	Yes	Yes
Party×Year FEs	No	No	Yes

Notes: Ads refer to the number of ads within a section and its buffer. There are section and party fixed effects. The total number of ads within a section is also added as a control. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets.
*** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table OA.25. **Effects of Own Ad Density on Raw Vote Shares (2016-2019)**

	Raw Vote Share				
	300m	350m	400m	450m	500m
Ad Density	0.425***	0.496***	0.572***	0.671***	0.748***
	(0.078)	(0.085)	(0.094)	(0.103)	(0.111)
	[0.098]	[0.107]	[0.117]	[0.127]	[0.137]
Observations	12579	13188	13710	14253	14472
R^2	0.74	0.74	0.73	0.73	0.73
Section FEs	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Raw Vote Share is the number of votes for a given party divided by the number of people registered to vote multiplied by 100. Ad density refers to the number of ads in $100m^2$. All parties that had parties in a given election are included. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.26. **Effects of the Change in Ad Density on the Change in Raw Vote Shares**

	Δ Vote Shares				
	300m	350m	400m	450m	500m
Δ Ad Density	0.292**	0.382**	0.483***	0.561***	0.648***
	(0.110)	(0.120)	(0.128)	(0.136)	(0.146)
	[0.146]	[0.161]	[0.171]	[0.183]	[0.197]
Observations	4560	4872	5136	5406	5556
R^2	0.01	0.01	0.01	0.01	0.02
Controls	Yes	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes	Yes

Notes: Δ Vote Share refers to the change in vote share for a given party between the 2016 and 2019 elections. Δ Ad density refers to the change in the number of ads in $100m^2$ between the 2016 and 2019 elections. All parties that had ads in both elections are included. All sections that had ads in both elections are included. Controls include the change between the two elections of the following variables: average age within the household, percentage of the population aged 18 or younger, percentage of the population aged 65 or older, average share of household income coming from wages, average share of household income coming from retirement pensions, percentage of Spanish nationals, average household size, share of households with an income below 40% of the nationwide median, share of households with an income above 160% of the nationwide median, 80:20 ratio. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.27. **Effects of Other Parties' Ad Density on Vote Shares (2016) – Both Dimensions**

	Vote Share		
	(1)	(2)	(3)
Ad Density Close Parties	-0.671*	–	-1.501***
	(0.338)		(0.316)
	[0.378]		[0.335]
Ad Density Distant Parties	–	-0.403	-0.976**
		(0.324)	(0.368)
		[0.377]	[0.431]
Observations	4725	4725	4725
R^2	0.41	0.41	0.41
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. Ad density Distant parties refers to the number of ads of parties that are over 4 points away from party p using both scales. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.28. **Effects of Other Parties' Ad Density on Vote Shares (2019) – Both Dimensions**

	Vote Share		
	(1)	(2)	(3)
Ad Density Close Parties	-0.284**	–	-1.163***
	(0.101)		(0.130)
	[0.119]		[0.142]
Ad Density Distant Parties	–	-0.443**	-1.227***
		(0.166)	(0.222)
		[0.203]	[0.267]
Observations	6846	6846	6846
R^2	0.71	0.71	0.71
Section FEs	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. Ad density Distant parties refers to the number of ads of parties that are over 4 points away from party p using both scales. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.29. **Effect of Change in Other Party's Ad Density on Change in Vote Shares**

	Δ Vote Share					
	Left-Wing Parties			Right-Wing Parties		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Ad Density Close Parties	-0.848*	–	-0.903*	0.305	–	-0.095
	(0.332)		(0.354)	(0.149)		(0.157)
	[0.454]		[0.485]	[0.184]		[0.205]
Δ Ad Density Distant Parties	–	0.067	-0.137	–	-0.949***	-0.971***
		(0.179)	(0.196)		(0.099)	(0.111)
		[0.240]	[0.264]		[0.114]	[0.131]
Observations	1852	1852	1852	2778	2778	2778
R^2	0.06	0.05	0.06	0.28	0.29	0.29
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Ad density Close Parties refers to the number of ads of parties that are no more than 4 points away from party p using both scales. Left-wing parties are ECP, ERC, and PSC. Right-wing parties are CDC, Cs, PP, and VOX. Results shown using the 500m perimeter of influence. All parties that had ads in both elections are included. All sections that had ads in both elections are included. Controls include the change between the two elections of the following variables: average age within the household, percentage of the population aged 18 or younger, percentage of the population aged 65 or older, average share of household income coming from wages, average share of household income coming from retirement pensions, percentage of Spanish nationals, average household size, share of households with an income below 40% of the nationwide median, share of households with an income above 160% of the nationwide median, 80:20 ratio. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.30. **Effects of Ad Density on Vote Share by Party Type**

	Vote Share					
	2016			2019		
	(1)	(2)	(3)	(4)	(5)	(6)
Ad Density	-1.287**	5.903***	0.262	3.308***	2.892***	5.274***
	(0.462)	(0.529)	(0.529)	(0.365)	(0.281)	(0.389)
	[0.537]	[0.623]	[0.537]	[0.364]	[0.237]	[0.376]
Ad Density × Left Parties	6.711***	–	–	-2.845***	–	–
	(0.682)			(0.461)		
	[0.744]			[0.479]		
Ad Density × Regional Parties	–	-2.625***	–	–	2.882***	–
		(0.642)			(0.527)	
		[0.942]			[0.555]	
Ad Density × New Parties	–	–	6.076***	–	–	-0.905*
			(0.768)			(0.507)
			[0.785]			[0.442]
R^2	0.31	0.07	0.09	0.56	0.11	0.14
Observations	4725	4725	4725	6846	6846	6846
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Left wing parties are: ECP, ERC, and PSC. Right wing parties are: CDC, Cs, PP, and VOX. Regional parties are: CDC and ERC. National parties are: Cs, ECP, PP, PSC, VOX. New parties are: Cs, ECP, VOX. Old parties are: CDC, ERC, PP, PSC. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.31. **Effects of Ad Candidate Characteristics on Vote Share (2016)**

	Vote Share	
	(1)	(2)
Ad Density	-2.027***	-2.027***
	(0.531)	(0.531)
	[0.608]	[0.608]
Ad Density × Young Candidate	4.525***	–
	(0.602)	
	[0.673]	
Ad Density × New Candidate	–	4.525***
		(0.602)
		[0.673]
R^2	0.42	0.42
Observations	4725	4725
Section FEs	Yes	Yes
Party FEs	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. I include the main parties with ads for which I have data on candidate characteristics: CDC, Cs, ECP, ERC, and PP. Young Candidate refers to candidates that are less than 45 years old. New Candidate refers to candidates that have been in politics for four years or less. Note that, in this election, all young candidates were new and vice-versa. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.32. **Effects of Ad Candidate Characteristics on Vote Share (2019)**

	Vote Share			
	(1)	(2)	(3)	(4)
Ad Density	2.063***	1.601***	1.810***	1.729***
	(0.224)	(0.288)	(0.232)	(0.309)
	[0.273]	[0.349]	[0.278]	[0.378]
Ad Density × Young Candidate	-4.179***	–	–	-6.040***
	(0.333)			(0.641)
	[0.384]			[0.732]
Ad Density × New Candidate	–	-0.774	–	0.179
		(0.379)		(0.379)
		[0.465]		[0.445]
Ad Density × Woman Candidate	–	–	-2.052***	2.098***
			(0.383)	(0.656)
			[0.450]	[0.732]
R-Squared	0.72	0.71	0.71	0.72
Observations	6846	6846	6846	6846
Section FEs	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. I include the main parties with ads for which I have data on candidate characteristics: CDC, Cs, ECP, ERC, PP, PSC, and VOX. Young Candidate refers to candidates that are less than 45 years old. New Candidate refers to candidates that have been in politics for four years or less. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.33. **Disputed Areas and Ad Density**

	Vote Share					
	2016		2019		2016-2019	
Ad Density	0.845**	0.376	1.184***	0.765**	0.966***	0.442
	(0.306)	(0.615)	(0.162)	(0.287)	(0.150)	(0.292)
	[0.362]	[0.661]	[0.195]	[0.324]	[0.187]	[0.333]
Ad Density x Disputed Area	–	0.699	–	0.619*	–	0.777**
		(0.671)		(0.326)		(0.322)
		[0.659]		[0.353]		[0.341]
R^2	0.63	0.63	0.79	0.79	0.72	0.73
Observations	5604	5604	8694	8694	14298	14298
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	No	No	No	No	Yes	Yes
Party×Year FEs	No	No	No	No	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. Results shown using the 500m perimeter of influence. An section is a Disputed Section if the difference in vote shares between left-wing and right-wing parties in the 2011 elections is within a 10 percentage point range. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.34. **Left-Leaning Areas and Ad Density**

	Vote Share					
	2016		2019		2016-2019	
Ad Density	0.606*	-0.028	0.876***	0.725***	1.362***	1.054***
	(0.279)	(0.260)	(0.173)	(0.174)	(0.170)	(0.167)
	[0.361]	[0.319]	[0.222]	[0.220]	[0.205]	[0.211]
Ad Density × Left Area	–	4.256***	–	1.446***	–	2.610***
		(0.837)		(0.420)		(0.530)
		[0.904]		[0.447]		[0.576]
R^2	0.56	0.57	0.43	0.43	0.25	0.25
Observations	1868	1868	2898	2898	4766	4766
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	No	No	No	No	Yes	Yes
Party×Year FEs	No	No	No	No	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in 100m^2. Results shown using the 500m perimeter of influence. A section is a Left-leaning section if the difference in vote shares between left-wing and right-wing parties in the 2011 elections is larger than 10 percentage points in favor of left-wing parties. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.35. **Right-Leaning Areas and Ad Density**

	Vote Share					
	2016		2019		2016-2019	
Ad Density	-0.466	-0.277	0.014	-0.588**	-0.243	-0.733***
	(0.349)	(0.352)	(0.216)	(0.218)	(0.203)	(0.234)
	[0.445]	[0.438]	[0.282]	[0.242]	[0.259]	[0.293]
Ad Density × Right Area	–	-0.985	–	1.381***	–	1.677***
		(0.861)		(0.449)		(0.442)
		[0.884]		[0.508]		[0.504]
R^2	0.49	0.49	0.65	0.65	0.54	0.54
Observations	2802	2802	3864	3864	6666	6666
Section FEs	Yes	Yes	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	No	No	No	No	Yes	Yes
Party×Year FEs	No	No	No	No	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. Results shown using the 500m perimeter of influence. A section is a Right-leaning section if the difference in vote shares between left-wing and right-wing parties in the 2011 elections is larger than 10 percentage points in favor of right-wing parties. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Randomization inference p-values are in curly brackets. Significance stars are reported with respect to Conley standard errors. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.36. **Effect of Banner and Poster Density on Vote Shares**

	Δ Vote Share		
	(1)	(2)	(3)
Δ Banner Density	0.622**	–	0.621**
	(0.212)		(0.205)
	[0.2867]		[0.277]
Δ Poster Density	–	43.740*	43.491*
		(17.293)	(17.158)
		[22.938]	[222.721]
R^2	0.13	0.13	0.13
Observations	4560	4290	5556
Controls	Yes	Yes	Yes

Notes: Δ Vote Share refers to the change in vote share for a given party between the 2016 and 2019 elections. Δ Banner (Poster) density refers to the change in the number of banners (posters) in $100m^2$ between the 2016 and 2019 elections. All parties that had ads in both elections are included. All sections that had ads in both elections are included. Controls include the change between the two elections of the following variables: average age within the household, percentage of the population aged 18 or younger, percentage of the population aged 65 or older, average share of household income coming from wages, average share of household income coming from retirement pensions, percentage of Spanish nationals, average household size, share of households with an income below 40% of the nationwide median, share of households with an income above 160% of the nationwide median, 80:20 ratio. Heteroskedasticity-robust standard errors are reported in parentheses, Conley standard errors are reported in squared brackets. ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

Table OA.37. **Ad Exposure and Turnout**

	Turnout	
	Group 1 vs. Group 3	Goup 2 vs. Group 3
Group1 × $Year_{2016}$	-0.398	–
	(0.518)	
	[0.542]	
Group2 × $Year_{2019}$	–	0.616
		(0.472)
		[0.478]
R^2	0.81	0.81
Observations	1890	1956
Mean Outcome	67.91	7.91
Controls	Yes	Yes

Notes: Group1 is a binary variable indicating whether a given section saw ads only in the 2016 election, Group2 is a binary variable indicating whether a given section ads only in the 2016 election. Controls include a vector of control variables including percentage of the population aged 65 or older, average share of household income coming from wages, share of households with an income below 40% of the nationwide median, and the 80:20 ratio. Group 3 refers to the sections that saw ads in both elections and acts as the control group. Mean Outcome is the average turnout in control sections in 2016. Heteroskedasticity-robust standard errors are shown in parentheses and Conley standard errors are reported in brackets. Significance stars are reported with respect to Conley standard errors. Results shown using the 500m perimeter of influence.

Table OA.38. **Ad Characteristics and Turnout (2016-2019)**

	Turnout			
	(1)	(2)	(3)	(4)
Ad Density	0.032	0.041	0.037	0.030
	(0.047)	(0.057)	(0.044)	(0.059)
	[0.033]	[0.053]	[0.031]	[0.054]
Ad Density × Young Candidate	0.052	–	–	0.045
	(0.076)			(0.094)
	[0.071]			[0.091]
Ad Density × New Candidate	–	0.021	–	-0.012
		(0.075)		(0.089)
		[0.081]		[0.097]
Ad Density × Woman Candidate	–	–	0.083	0.068
			(0.090)	(0.095)
			[0.082]	[0.089]
R-Squared	0.98	0.98	0.98	0.98
Observations	11571	11571	11571	11571
Section FEs	Yes	Yes	Yes	Yes
Party FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Party×Year FEs	Yes	Yes	Yes	Yes

Notes: Ad density refers to the number of ads of a party p in $100m^2$. I include the main parties with ads for which I have data on candidate characteristics: CDC, Cs, ECP, ERC, PP, PSC, and VOX. Young Candidate refers to candidates that are less than 45 years old. New Candidate refers to candidates that have been in politics for four years or less. Results shown using the 500m perimeter of influence. Heteroskedasticity-robust standard errors are reported in parentheses. Conley standard errors are reported in squared brackets. Significance stars are reported with respect to Conley standard errors.
***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.