Conquering the Land: Electoral Coalitions and Spatial Patterns of Vote in Brazilian Municipal Elections*

Gabriel C. Caseiro†

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Abstract

Why do parties form electoral coalitions? This research tries to shed new light on the understanding of electoral coalitions in local elections through a novel approach that considers the impacts of these alliances on candidates' spatial patterns of vote distributions. These spatial patterns provide information on the clustering of candidates' support and their dominance over local constituencies. I outline two hypotheses linking mayoral electoral coalitions to the interaction between mayoral and city council candidates' spatial voting performances that are empirically tested in the context of the Brazilian 2020 Municipal Elections. I find that mayoral and council candidates' spatial patterns of vote distribution become more positively dependent when their parties are allied in a mayoral electoral coalition and that what is behind this dependence increase are council candidates acting as local brokers for the mayoral candidate in their mayoral electoral coalition. These results are robust to a series of alternative specifications and robustness checks. To my knowledge, this research represents the first effort in studying spatial patterns of vote distribution in the context of local elections at the polling station level. The methodology applied here could be used to study further this and several other relevant questions.

Keywords: Electoral Coalitions; Spatial Voting Patterns; Brazilian Elections; Electoral Cooperation

JEL Codes: D72; R39

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†São Paulo School of Economics - FGV. E-mail: gabriel.caseiro@fgv.br

1 Introduction

Mobilizing supporters to turn out and persuading swing voters to their side are the main goals of electoral campaigns that aim to win an election. Legally, candidates can seek these goals everywhere in their electoral district. Nevertheless, many electoral studies document that candidates limit their campaigns geographically. In particular, two patterns stand out. First, candidates, in general, receive more votes in their hometowns, a pattern referred to as "friend and neighbors" voting (e.g. Lewis-Beck und Rice, 1983; Ames, 1995a; Meredith, 2013b). Second, in contrast to majoritarian elections, candidates participating in proportional elections can achieve victory by relying on smaller segments of the electorate, resulting in spatially more concentrated votes compared to majoritarian candidates (e.g. Ames, 1995b; Shugart u. a., 2005). Although there are few doubts about the individual benefits from these spatial voting patterns, which result from optimal campaign strategies for each candidate running for an office in a specific branch of government, there is still a need for a clearer understanding of how electoral cooperation among candidates vying for offices in different branches of government could lead to spillover effects, enhancing the advantages derived from these individual spatial voting patterns.

In this paper, I explore the interaction between candidates' spatial patterns of vote distributions and electoral coalitions in the context of two simultaneous majoritarian and proportional local elections in Brazil, one of the world's largest democracies, with over 150 million voters. Electoral coalitions are a common phenomenon in executive elections across Europe and South America (Golder, 2006; Kellam, 2017) in which parties with candidates running for offices in different branches of government become officially and publicly allied for the duration of the campaign. To thoroughly analyze spatial voting variation, I focus on the polling station level, which represents the most finely-grained and disaggregated geographic level available. In my analysis, I provide evidence that electoral cooperation through executive electoral coalitions results in spillover effects on candidates' spatial patterns of vote distributions. Specifically, these spatial patterns exhibit greater positive dependence when majoritarian and proportional candidates form alliances. To better understand and disentangle this increase in spatial dependence, I further examine the "friend and neighbors" voting variation, as proposed by Meredith (2013a). The findings reveal that the rise in spatial dependence is primarily due to the spatial voting concentration areas of supporting council candidates turning into the spatial voting concentration areas of the supported mayoral candidate.

Under Brazilian electoral legislation, political parties are allowed to form electoral coalitions within the same constituency for majority elections, which are held simultaneously with city council elections. An electoral coalition has the same prerogatives and obligations as a political party regarding the electoral process. It must function as a single party before Electoral Justice in the treatment of inter-party interests. Electoral data for the 2002-2020 period[1] shows that, in every local election year, at least one mayoral electoral coalition was formed in more than 97% of the 5.568 Brazilian municipalities, ranging from a mean of 4.81 allied parties in 2016 to a mean of 2.42 in 2020. Even though the literature on electoral alliances in Brazil is enormous, as pointed out by Limongi und Vasselai (2018), this recurring phenomenon in Brazilian local elections is still not fully understood. In particular, there is little research on the consequences of these electoral alliances on candidates' electoral strategies and voting performances, and even less, if any, on mayoral and city council candidates' strategies interactions or candidates' spatial patterns of vote distributions.

Thus, I propose a novel approach to the understanding of mayoral electoral coalitions in Brazilian local elections investigating their impacts on mayoral and city council candidates' spatial patterns of vote distribution interaction. These spatial patterns, originated from a strand of electoral analysis first suggested by Ames (1995b) and further developed by Avelino u. a. (2011) and Silva und Davidian (2013), provide information on the clustering of candidates' support and their dominance over local constituencies, consequences of their electoral campaign strategies. Furthermore, to thoroughly analyze spatial voting variation, I

[1] Complete summary in the appendix (Table 7).

focus on the polling station level, which represents the most finely-grained and disaggregated geographic level available. By examining voting patterns at this level, it is possible to gain a comprehensive understanding of how voter preferences and candidate support vary across different areas in a municipality, providing valuable insights into its electoral dynamics.

This paper analyzes data from the Brazilian 2020 Municipal Elections, which were the first local elections held after the prohibition of legislative electoral coalitions by Constitutional Amendment N.97 in 2017. Prior to this amendment, political parties in Brazil were allowed to form electoral coalitions within the same constituency for both executive and legislative elections. By focusing solely on the 2020 Municipal Elections, I isolate the effects of executive electoral coalitions, avoiding any potential confounding factors from studying both executive and legislative elections simultaneously.

To organize the analysis, I outline two hypotheses that will be subjected to empirical testing, relating mayoral electoral coalitions to their consequences in terms of mayoral and city council candidates' spatial patterns of vote distributions. The first hypothesis, named the "Spatial Dependence Hypothesis", establishes that electoral alliances between mayoral and city council candidates impact the spatial patterns of vote distributions for both sets of candidates, leading to increased spatial dependence. The second hypothesis, named the "Brokerage Hypothesis", establishes the mechanism behind the increase in spatial dependence observed in the first hypothesis, attributing it to the spatial voting concentration areas of supporting city council candidates turning into the spatial voting concentration areas of the supported mayoral candidate.

Initially, this study identifies key empirical regularities that contribute to the rationale behind the two hypotheses. Firstly, it is observed that council candidates' votes exhibit significantly higher spatial concentration compared to mayoral candidates' votes. Additionally, while the votes for the most voted mayoral and council candidates display some spatial scattering, the latter's votes remain notably more concentrated than the former's. These regularities indicate that candidates in proportional elections can indeed rely on smaller segments of the electorate to secure victory, as theorized by Cox (1990) and Myerson (1993), and discussed by Ames (1995b) in the context of Brazilian general elections.

Accordingly, proportional elections incentivize council candidates to establish and secure *redutos* (commonly known as “electoral” or “bailiwicks”), often achieved by building closer relationships with voters and maintaining long-term clientelistic connections, a phenomenon that has been described by Lopez (2004) and Nichter und Peress (2017). As a result, council candidates can serve as valuable local brokers for mayoral candidates’ electoral interests, a notion previously highlighted by Frey (2022). Thus, mayoral electoral coalitions enter the equation as a cooperation mechanism between mayoral candidates and potential local brokers, i.e., council candidates, making the alliance official and public. The parties of mayoral candidates actively seek the involvement of other parties in their mayoral electoral coalitions, primarily due to the potential contribution of local brokers they bring on board. These assumptions form the basis for my two hypotheses, guiding the investigation into the impacts of mayoral electoral coalitions on spatial voting patterns of both mayoral and council candidates in Brazilian local elections.

To rigorously test the two hypotheses, I outline and discuss two main empirical strategies. Firstly, to evaluate the Spatial Dependence Hypothesis, I employ fixed-effects regression. This approach involves regressing a pairwise measure of spatial vote dependence between mayoral and council candidates on a mayoral electoral alliance indicator while controlling for candidates’ and state-party-pair fixed-effects. Secondly, to assess the Brokerage Hypothesis, the main strategy consists of regressing the mayoral candidate’s measure of local vote concentration on the corresponding measure for the allied council candidates within her mayoral electoral coalition. In this analysis, I employ polling stations’ fixed-effects and an instrumental variable approach to investigate the relationship between mayoral and council candidates’ vote concentration. Inspired by the approach of Meredith (2013a), the polling places locations of allied council candidates (which are typically close to their place of residence, areas where they have local attachments) serve as a source of exogenous variation for their local vote concentration.

Furthermore, in addition to presenting the results of the main specifications, I report a series of robustness checks and extensions. These include specifications considering alternative spatial measures and analyses using restricted sets of candidates, ensuring the reliability and validity of the findings. Through these multiple analyses, the research provides a comprehensive and thorough examination of the hypotheses and their implications in the context of Brazilian local elections.

Overall, the main findings of the analysis strongly support the two hypotheses. The study shows that being part of the same mayoral electoral coalition does lead to increased spatial vote dependence between mayoral and council candidate pairs. Additionally, there is a significant positive causal association between an allied council candidate's local vote concentration and the supported mayoral candidate's local vote concentration, demonstrating the influence of allied council candidates as local brokers for the supported mayoral candidate. These results hold firm against various robustness checks, reinforcing the validity and reliability of the findings.

These results have important implications for the understanding of mayoral electoral coalitions and what motivates parties to ally. As local elections in Brazil consist of two simultaneous elections for the municipality's executive office of the mayor and legislative offices of city councilors, each constituent must cast two votes, one for a mayoral candidate and one for a council candidate. An electoral mayoral coalition is thus formed by two types of parties: one that launches the mayoral candidate and, potentially, council candidates, and another that only launches council candidates. This research's findings significantly contribute to understanding, particularly, why mayoral candidates' parties welcome and actively seek the participation of other parties in their electoral coalitions.

But why would council candidates' parties want to join an electoral mayoral coalition? The literature provides compelling answers to this question. Colonnelli u. a. (2020) and Barbosa und Ferreira (2019) show that being part of an electoral alliance can increase the chance of supporting parties' candidates in securing access to patronage and government benefits. Kellam (2017) argues that electoral coalitions can also help parties without executive candidates in pursuing some policy goals. As being part of an electoral coalition is public information, it might signal to voters the mayoral candidate that is most likely to pursue supporting parties' goals once elected. Looking at Brazilian general elections, Samuels (2000) finds that legislative candidates' parties can boost their candidates' voting performances by joining a majoritarian electoral coalition where the executive candidate has "the organizational backing of well-developed clientelistic networks", the *coattail effect*.

On the other hand, the existing literature offers limited insights into why mayoral candidacies welcome other parties in their electoral coalitions, leaving a research gap that my study aims to address. Mizuca (2007) investigates how mayoral electoral coalitions are related to ideological and coalitional matters at the federal level or the state level. His mostly descriptive analysis shows that parties organize themselves, in general, according to the governor's political position. A mayoral candidate would thus welcome other parties in her electoral coalition as a consequence of her party alliances at the state level. Yet, Mizuca also recognizes that many local alliances can not be fully explained by state-level party matters. In particular, there are at the municipality level many electoral alliances between otherwise opposing parties at the federal and state levels.[2]

Limongi und Vasselai (2018) and Silva (2022) explain majoritarian candidates' motivations in terms of the division of campaign resources; in particular, the division of free broadcast time (FBT). Brazilian parties can use radio/TV ads for campaigning solely during FBT and the division of FBT is proportional to the share of seats won by the mayoral electoral coalition parties in the previous election for the federal lower chamber (*Câmara dos Deputados*). Thus, by welcoming other parties into her electoral coalition, a mayoral candidate not only gain these parties' FBT share but also prevents other competing mayoral candidates from having it. Limongi und Vasselai (2018) considers this motivation in the

[2] Figure 14 in the appendix shows the proportion of electoral alliances between each pair of parties in municipalities where both parties launch candidates for the 2020 Brazilian Elections.

context of Brazilian general elections and Silva (2022) tests the argument using data from mayoral elections.

Even though both studies find that FBT division indeed affects parties with no majoritarian candidacy likelihood of being admitted to a majoritarian electoral coalition, there is a major drawback for the argument in municipality elections: FBT is not available in many municipalities. Brazilian electoral law only requires that radio/TV stations broadcast FBT to municipalities where they are located. In Silva (2022)'s sample, 41% of the municipality elections do not have access to FBT. Thus, there is much room for an alternative or complementary explanation of the motivations of parties that launched an executive candidate for admitting other parties in their mayoral electoral coalitions.

More broadly, this research contributes to at least four strands of the literature. First, as I aim to provide a novel approach to the understating of majoritarian electoral coalitions in Brazilian local elections, it is related to an enormous literature on electoral alliances in Brazil, starting with Soares (1964)'s seminal strategic interpretation of parties joining electoral alliances in order to maximize their electoral performances minimizing efforts. Even though much of this literature focuses on alliances in federal and state level elections (Machado, 2018; Limongi und Vasselai, 2018), electoral coalitions in municipality elections have also been a study topic, from more empirical (Silva, 2022; Mizuca, 2007) to more theoretical approaches (Griebeler und Resende, 2021).

Second, it relates to the literature on the spatial-geography analysis of elections in Brazil (Avelino u. a., 2011, 2016; Silva und Davidian, 2013; Silva und Silotto, 2018), which starts with Ames (1995b)' seminal work and is further developed by Avelino u. a. (2011) and Silva und Davidian (2013). The last two, in particular, adapt classical concepts and measures of urban economics, such as industrial agglomeration (Ellison und Glaeser, 1997), to the study of spatial patterns of vote distribution. Similarly, my research also adapts urban economics concepts and measures, providing a novel interpretation to (Ellison u. a., 2010)' coagglomeration index in terms of candidates' spatial patterns of vote distribution dependence. Through these measures and concepts, it is possible to gain new insights into candidates' electoral strategies for limiting or expanding geographically their campaigns and influence zones.

The research also contributes to the literature on electoral strategies under alternative voting rules, as it empirically shows that candidates' spatial patterns of vote distribution are much more concentrated in proportional elections than in majoritarian elections. Cox (1990) and Myerson (1993) provide the theoretical foundations of why office-seeking candidates in multi-seat proportional elections would pursue a voter cohort rather than the median voter, while Samuels (1999), Dow (2001) and Latner und McGann (2005) provide empirical evidence that goes in line with the theoretical reasoning.

And finally, since I hypothesize and empirically test that part of mayoral candidates' spatial patterns of vote distributions is driven by their allied council candidates in Brazilian municipality elections, this research relates yet to the literature on *coattail effects* (Ferejohn und Calvert, 1984; Rudolph und Leininger, 2021) and political brokerage (Carty, 1981; Gingerich und Medina, 2013). Ames (1994) and Samuels (2000) study *coattail effects* in Brazilian general elections, with the former showing the effects of local political organization, i.e. mayors, on the presidential election, and the former, the effects of the state gubernatorial races on legislative federal elections. To my knowledge, there are no studies on *coattail effects* in concurrent mayoral and council local elections in Brazil. Nevertheless, the role of council candidates as political brokers to mayoral candidates, as explored in this research, is considered in Frey (2022)'s investigation of Brazilian municipality legislature size electoral effects, which points out that mayors would exchange patronage for the councilors' electoral support.

The rest of this research is organized as follows. In the next section, I describe and discuss the main data sources and the measures of spatial vote concentration and dependence. Some important empirical regularities are presented and the two hypotheses to be empirically tested are laid out. In section 2, the empirical strategy is described; in section 3, the main results are reported and discussed; in section 4, heterogeneity analyses and robustness checks are performed; and section 5 finally concludes.

2 Spatial Vote Concentration and Dependence

2.1 Data and Measures

All electoral data for the Brazilian 2020 Municipal Elections was obtained from *Tribunal Superior Eleitoral* (TSE) open data. The main sources are: (i) election data at polling station level[3], from "*voto-seção*" file; (ii) coalition data, from "*coligações*" file; and (iii) candidates' information, from "*candidatos*" and "*filiados*" files. The final dataset covers executive and legislative 2020 local elections for all 5569 Brazilian municipalities.

From electoral data, I first define the S Index, an additive measure of spatial vote concentration at the polling station level in the spirit of Silva und Davidian (2013), who define a similar measure at the municipality level[4]:

$$S_{ilm} := \frac{V_{ilm}}{V_{im}} - \frac{V_{lm}}{V_m} \tag{1}$$

where V_{lm} is the turnout at polling station l in municipality m; $V_m := \sum_l V_{lm}$ is the total turnout at municipality m; V_{ilm} is candidate i's number of votes at polling station l in municipality m; and $V_{im} := \sum_l V_{ilm}$ is candidate i's total number of votes at municipality m. Note that as voters can vote for candidates, parties, or none (null and blank votes), we have that, in general, $V_{lm} \neq \sum_i V_{ilm}$ and $V_m \neq \sum_i V_{im}$.

Notice that if there is only one polling place in a municipality, the S Index is uninformative (i.e. there is no spatial vote variation). Therefore, 213 small municipalities with only one polling place are dropped from the population considered in this research. All further analyses are restricted to the remaining 5356 municipalities. Table 8, in the appendix, reports the complete distribution of municipalities' number of polling places.

The S Index compares a candidate's actual voting performance at a given polling place (i.e. $\frac{V_{ilm}}{V_{im}}$) to an expected voting performance equal to the pooling place size (i.e. $\frac{V_{lm}}{V_m}$), as

[3] In Brazil, a polling station (*local de votação*), is where the electronic ballot boxes are placed, usually a public schools, and where constituents are registered to vote.

[4] In fact, their HC Index is such that $HC_{ilm} = V_{im} * S_{ilm}$.

described by Avelino u. a. (2011). If candidate i has a vote concentration in polling station l (i.e. $S_{ilm} > 0$), then we shall call l a **dominance area** of candidate i. It is important to note that the S Index does not tell much about the overall voting performance of a candidate in a polling place. As an example, if candidate i has only one vote in the election at l, then $\frac{V_{ilm}}{V_{im}} = 1$ and $S_{ilm} > 0$; which just means that candidate i's voting is concentrated at l.

Two alternative measures of spatial vote concentration at the polling station level are defined in the appendix: the Horizontal Cluster ($\mathcal{HC}$) and the Locational Quotient ($\mathcal{LQ}$), which were adapted to the context of voting patterns by Silva und Davidian (2013). These alternative measures are further explored in robustness checks.

In order to introduce some stylized facts on candidates' spatial patterns of vote distribution in a municipality, I also define an aggregated index, the G Index, as in Avelino u. a. (2011):

$$G_{im} := \sum_{l} S_{ilm}^2 \tag{2}$$

which measures the dispersion of candidate i's distribution of vote concentration across all polling places. The greater the dispersion, the greater candidate's overall vote concentration in the municipality. The G Index has a lower bound at 0, which is reached when a candidate's voting distribution across the polling places (i.e. $\{\frac{V_{ilm}}{V_{im}}\}_l$) is identical to the distribution of polling places' size (i.e. $\{\frac{V_{lm}}{V_m}\}_l$).

Again, in the appendix, I define alternative measures of overall vote concentration at the municipality level: the candidate's maximum S (S_{max}), proposed by Pereira und Rennó (2001), and the C Index, which I propose based on the concept of *effective number of polling places*, adapted from Laakso und Taagepera (1979)'s *effective number of parties.*

The figures below provide a visual representation of S Index distributions for the four most-voted candidates in the mayoral and council 2020 elections in the municipality of Rio de Janeiro. The municipality map is segmented into Voronoi polygons defined from polling places coordinates set[5]. Thus, each polygon represents a polling place. Blue-shaded polygons indicate candidates' dominance areas.

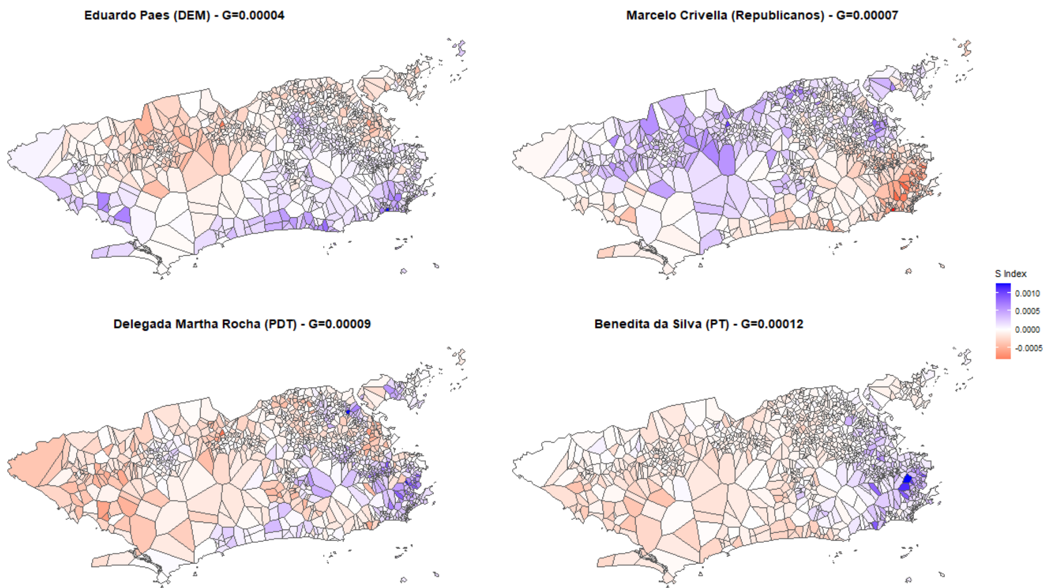

Figure 1: S Index Visual Example - Rio de Janeiro (Mayoral Candidates)

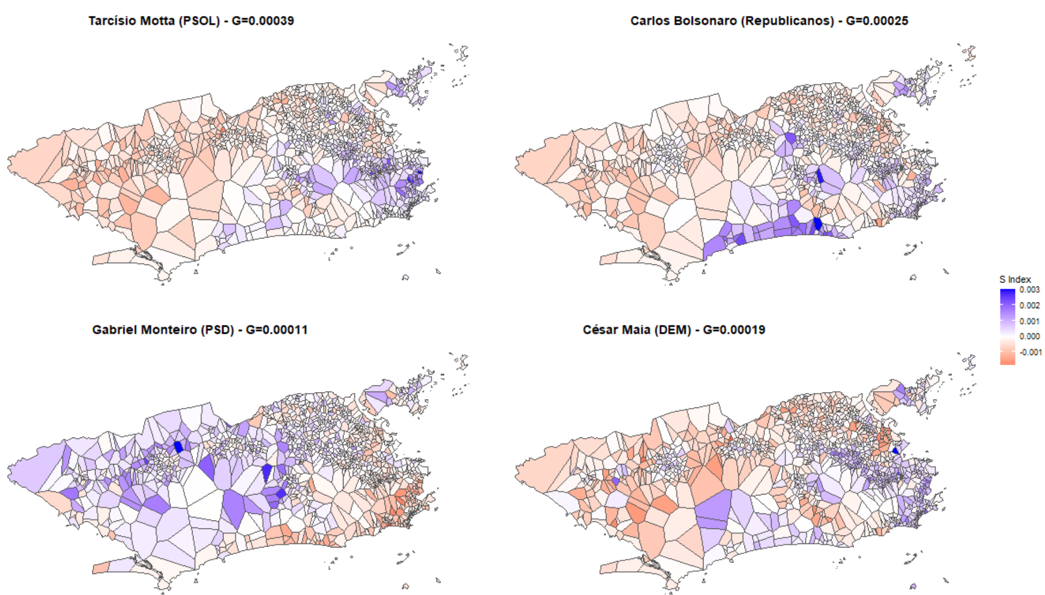

Figure 2: S Index Visual Example - Rio de Janeiro (Council Candidates)

In Rio de Janeiro's mayoral election, for example, Figure 1 indicates that Benedita da

[5]Coordinates data was also obtained from TSE open data.

Silva's (PT) dominance areas are concentrated in downtown, while Marcelo Crivella's are in the north and west regions. In the council election, Figure 2 indicates that Carlos Bolsonaro's (Republicanos) dominance areas are in Barra da Tijuca region, while Gabriel Monteiro's (PSD) are in the north and west regions. And among the candidates in the two figures, the overall vote concentration in the municipality, given by the G Index, is in general greater for council candidates. In the next section, this pattern will be further explored.

Finally, to access the impact of mayoral electoral coalitions on executive and legislative candidates' spatial patterns of vote distribution, a measure of pairwise spatial vote concentration dependence is defined. I adapt Ellison u. a. (2010)'s industrial coagglomeration index to the context of voting outcomes. Let i be a mayoral candidate and j, a council candidate in municipality m. The spatial vote dependence (SVD) Index for the candidate pair is defined as:

$$SVD_{ijm} := 100 * \frac{\sum_l S_{ilm} * S_{jlm}}{1 - \sum_l (\frac{V_{lm}}{V_m})^2} \tag{3}$$

which is a re-scaled covariance between $\{S_{ilm}\}_l$ and $\{S_{jlm}\}_l$. As pointed out in Ellison u. a. (2010)'s mathematical appendix, the correction factor (i.e. $1 - \sum_l (\frac{V_{lm}}{V_m})^2$) eliminate sensitivity to the fineness of the geographic breakdown, as the covariance between $\{S_{ilm}\}_l$ and $\{S_{jlm}\}_l$ could be lower due to a more concentrated polling station size distribution. The factor approaches 1 for more scattered distributions of polling places size. A positive SVD Index indicates that two candidates' votes are concentrated in the same polling places, having similar dominance areas, while a negative SVD Index indicates the opposite.

In the appendix, I present some descriptive tables and charts of the SVD Index distribution for the main studied population and some restricted populations. I also describe an alternative measure of pairwise spatial vote concentration dependence, the Spatial Adjusted Correlation (SAC), which is the scaled Pearson correlation between $\{S_{ilm}\}_l$ and $\{S_{jlm}\}_l$.

Even though I do not develop in this research a theoretical model to justify the use Ellison u. a. (2010)'s industrial coagglomeration index as the Locational Dependence Index for voting outcomes, it may be possible to draw an analogy between the intercity industry location problem (as in Ellison und Glaeser (1997) and O'Sullivan und Strange (2018)) and the candidate problem of deciding where to campaign for votes in an electoral district. Roughly, a candidate could be understood as a firm that maximizes profits (i.e. probability of being elected) and interacts with other firms (i.e. candidates) that have conflicting or mutually beneficial interests, choosing where to open its plants (i.e. where to focus her campaign).

2.2 Empirical Regularities

In this section, I introduce some empirical regularities on candidates' spatial vote concentration distributions in the 2020 Brazilian Municipal Elections. These regularities are relevant to understanding mayoral electoral coalitions as coordination device that links supported mayoral candidate and supporting council candidates' dominance areas.

Regularity 1: *Council candidates' votes are spatially more concentrated than mayoral candidates' votes.*

The graphs below present the G Index empirical cumulative density functions for council candidates and mayoral candidates. The left-hand side panel considers all candidates and on the right-hand side, only effective candidates[6].

[6]The number of effective candidates in municipality m election e, $EfCand_m^e$, follows the classic definition of Laakso und Taagepera (1979):

$$EfCand_m^e := \frac{1}{\sum_i \hat{V}_{im}^2}, \quad e = M, C \tag{4}$$

where $\hat{V}_{im} := \frac{\sum_l V_{ilm}}{\sum_{l,i \in I_m^e} V_{ilm}}$ is candidate i's share of total nominal votes in the mayoral election, if $e = M$, or in the council election, if $e = C$. I_m^e is the set of candidates participating in election e in municipality m. Hence, a candidate i is an effective candidate in municipality m election e when:

$$rank_m(i) \leq EfCand_m^e \tag{5}$$

where $rank_m(i) := \#\{s | V_{im} < V_{sm}\} + 1$.

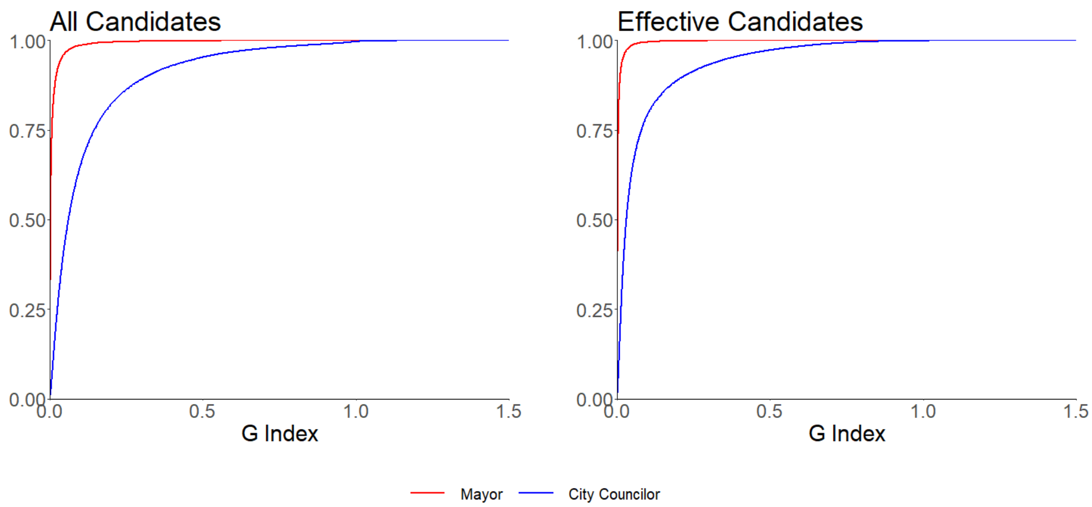

Figure 3: Empirical CDF - G Index

As council candidates' G Index empirical CDF is below mayoral candidates', council candidates' votes are more spatially concentrated than mayoral candidates' votes. The pattern does not change when considering only effective candidates. As pointed out by Ames (1995b), because small slices of the electorate may ensure victory in proportional elections, office-seeking candidates in these elections would pursue a voter cohort rather than the median voter (for theoretical reasoning, see, for example, Cox (1990)). Thus, when comparing the spatial patterns of vote distribution between candidates in executive and proportional elections, it would be expected, and the data for 2020 Brazilian local elections confirms, that the latter is more concentrated.

In the appendix, I show that when considering alternative measures of aggregated spatial vote concentration, the S_{Max} and the C Index, council candidates' votes remain more concentrated than mayoral candidates'.

Regularity 2: *Top-ranked mayoral candidates' votes are more spatially scattered.*

The bar chart below shows that higher-ranked mayoral candidates' votes are, on average, more scattered. In other words, the mayoral candidates that receive more votes do so with a more homogeneous voting distribution across the polling places (i.e. more similar to the distribution of polling places size). In the appendix, I show that when considering the rank up to the third most voted candidate, conditional on municipalities where three or more mayoral candidates have competed, there is an even sharper difference between the mean concentration of the second and the third most voted candidates. And as for alternative measures of aggregated vote concentration, there is no qualitative change in the regularity.

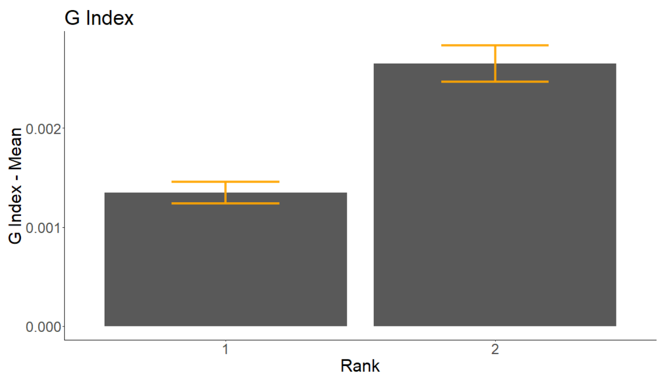

Figure 4: Mean Concentration by Voting Rank - Mayoral Elections

Regularity 3: *Top-tanked council candidates' votes are more spatially scattered, but still more concentrated than top-ranked mayoral candidates' votes.*

Finally, the bar chart below shows the third empirical regularity in the 2020 local elections' spatial vote concentration distributions. As well as for mayoral candidates, most voted council candidates' votes are, on average, more spatially scattered. Nevertheless, as might be expected from the first regularity, these votes are still much more concentrated than those of mayoral candidates, as the y-axis different scales in figures 4 and 5 show. While the most voted mayoral candidates' mean G Index is about 0.0015, for the council counterpart the mean G Index is almost 33 times larger (circa 0.05).

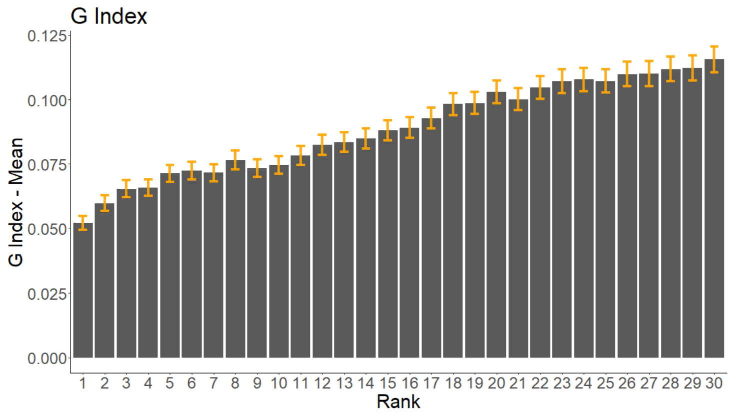

Figure 5: Mean Concentration by Voting Rank - Council Elections

2.3 Connecting the Dots

But what do these three empirical regularities tell us about mayoral electoral coalitions? My main hypothesis is that mayoral electoral coalitions increase the dependence between mayoral and allied council spatial patterns of vote concentration. In particular, to win the majoritarian election a mayoral candidate cannot rely on voters from a specific area only, as indicated by the second empirical regularity, and discussed by Ames (1995b) in the context of Brazilian general elections. Therefore, a mayoral candidate should try to maximize her votes in different areas throughout the municipality. But campaigning in different areas, convincing different groups of voters to vote for her, must be costly. Each group has specific needs that might be difficult to know if there is no previous or constant relationship. And that is where electoral coalitions enter.

As described by Lopez (2004) and Nichter (2018), city council candidates are typically closer to voters, and often secure their dominance areas (i.e. their *redutos*) with long-term clientelistic relationships. The first and the comparison between the second and the third empirical regularities presented above indeed show that council candidates' dominance areas are much more well-defined. A mayoral electoral coalition would thus be a way to connect the mayoral candidate to council candidates such that the latter's dominance areas, their local cluster of voters, also vote for the former, i.e. the allied mayoral candidate. In other words, council candidates would act as local brokers for their allied mayoral candidates. That council candidates can be useful local brokers to mayoral candidates is nothing new, as already pointed out by Frey (2022). Nevertheless, the role of mayoral coalitions in this brokerage relationship has not yet been studied.

From that reasoning, I develop two main hypotheses to be empirically tested in this research. The first is an equilibrium result, the "Spatial Dependence Hypothesis", which establishes how mayoral coalitions affect the relation between mayoral and council candidates' spatial vote concentration distributions

Hypothesis 1: *Mayoral and council candidates' spatial patterns of vote distribution become more positively dependent when their parties are allied in a mayoral electoral coalition.*

In other words, when mayoral and council candidates' parties are allied in a mayoral electoral coalition, we expect their dominance areas to be more similar than if they were not allied. But what is behind this increased dependence? My second hypothesis, the "Brokerage Hypothesis", tries to unveil the "mechanism" that explains the first hypothesis' equilibrium result.

Hypothesis 2: *Council candidates act as local brokers for the mayoral candidate in their mayoral electoral coalition, such that the spatial voting concentration areas of the former turn into spatial voting concentration areas of the latter.*

Thus, when mayoral and council candidates' parties are allied in a mayoral electoral coalition, we expect their dominance areas to be more similar than if they were not allied because council candidates act as local brokers for the allied mayoral candidate and the former's dominance areas become also the latter's dominance areas.

3 Empirical Strategy

In this section, I describe and discuss the empirical strategies to test the two main hypotheses in this research.

3.1 Spatial Dependence Hypothesis

My first hypothesis states that *mayoral and council candidates' spatial patterns of vote distribution become more positively dependent when their parties are allied in a mayoral electoral coalition.* In order to estimate the impact of being in the same mayoral electoral coalition on mayoral and council candidates pair's locational dependence, I follow a fixed-effects specification, similar to Steijn u. a. (2022). Let i be a mayoral candidate and j be a council candidate, both from municipality m in state s. The main fixed-effects specification is given by:

$$SVD_{ijms} = \beta Allied_{ijms} + \mu_{ims} + \gamma_{jms} + \omega_{ijs} + \epsilon_{ijms} \tag{6}$$

where μ_{ims} and γ_{jms} are individual candidates' fixed-effects, and ω_{ijs} is i and j's pair of parties fixed-effect in state s. $Allied_{ijms}$ is an indicator variable equal to 1 if i and j's parties are allied in i's mayoral electoral coalition, and to 0 otherwise. ϵ_{ijms} is the idiosyncratic error term. The parameter of interest, β, is the mayoral electoral coalition average effect on the mayoral and council candidates pair's spatial vote dependence, measured by the SVD Index. If it is correctly identified and the Spatial Dependence Hypothesis is true, we must find β to be positive and statistically different from zero.

It is important to stress which mayoral and council candidates pairs are considered in Equation 6's estimation. As candidates from the same party are always allied (i.e. are always in the same mayoral electoral coalition), the estimation considers only council candidates from parties that do not launch a mayoral candidate in the municipality. In other words, I take mayoral candidacies as given and only consider pairs with council candidates from parties that could support any mayoral electoral coalition. That restriction is relevant because, taking mayoral candidacies as given, there is no counterfactual in which council candidates from a party that launches a mayoral candidate are not in that candidate's mayoral electoral coalition.

Finally, as there is no previous work that explores Ellison u. a. (2010)'s coagglomeration index in the context of voting outcomes, it might be difficult to interpret the magnitude of the estimated effect. If, for example, we find that β is positive and statically significant, it is important to assess its estimated magnitude relevance. Does the effect really mean something relevant to the elections? To provide a baseline comparison, I consider all mayoral and council candidates pairs and estimate the following regression:

$$SVD_{ijms} = \bar{\beta} SameParty_{ijms} + \bar{\gamma}_{jms} + \bar{\omega}_{ijs} + \bar{\epsilon}_{ijms} \tag{7}$$

where $SameParty_{ijms}$ is an indicator variable equals to 1 if i and j's parties are the same, and to 0 otherwise. As before $\bar{\mu}_{ims}$ and $\bar{\gamma}_{jms}$ are individual candidates' fixed-effects, but the pair of parties state fixed-effect is not included as it is collinear with $SameParty_{ijms}$. The parameter $\bar{\beta}$, the average effect on the SVD Index of mayoral and council candidates' parties being the same, can be used as a baseline comparison to β. If the dependence of candidates' spatial vote concentration distributions is greater when both are from the same party, as descriptive statistics in the appendix indicate, then showing how close the increase in this dependence due to being in the same mayoral electoral coalition is to the increase due to being from the same party can shed light on the relevance of the estimated β in the elections.

3.2 Brokerage Hypothesis

Now, to test the second hypothesis, which states that council candidates act as local brokers for the mayoral candidate in their mayoral electoral coalition, we must take a closer look inside mayoral electoral coalitions and their candidates' distributions of dominance areas across polling places. In particular, it is necessary to assess the impact of allied council candidates' dominance areas on the mayoral candidate's dominance areas. If the Brokerage Hypothesis is true, then we expect the impact to be positive and statistically different from zero. To test this, I consider only the population of mayoral candidates supported by a mayoral electoral coalition and follow a fixed-effects specification:

$$S_{ilm} = \beta S_{ilm}^{Coalition} + \alpha_{lm} + \epsilon_{ilm} \tag{8}$$

where S_{ilm} is mayoral candidate i's measure of local vote concentration at polling place l in municipality m, $S_{ilm}^{Coalition}$ is the same measure for the council candidates in i's mayoral electoral coalition, excluding candidates from the same i' party, and α_{lm} is the polling place fixed-effect. ϵ_{ilm} is the idiosyncratic error term. The parameter of interest is β, which is an average effect of a marginal change in $S_{ilm}^{Coalition}$ on S_{ilm}. If it is correctly identified and the Brokerage Hypothesis holds, this effect should be positive and statistically different from zero.

Attention must be drawn to why following a specification as that of Equation 8. As voters can vote for one and only council candidate, a change in council candidates in i's mayoral electoral coalition dominance areas must also change the dominance areas of other council candidates', party voting or blank and null voting, which, in turn, also affect mayoral candidate i's dominance areas. Hence, by not controlling for these other dominance areas from council elections in the main specification, β must be understood as an average **net** effect of a marginal change in $S_{ilm}^{Coalition}$ on S_{ilm}.

Even though voters' characteristics that affect all candidates' performances at each polling place, such as their mean ideological point and socioeconomic status, are controlled for by polling station fixed-effects (α_{lm}), as there are no control variables for mayoral candidacies at the polling station level (e.g. their campaign effort in each polling station), an omitted variable bias is still an identification concern in the specification of Equation 8.

Surely there are interactions between mayoral candidates' and voters' characteristics at the polling station level that affect both her dominance areas and that of her council candidates' allies, e.g. ideological affinity. Therefore, not controlling for these interactions might lead to omitted variable bias. Moreover, there may also be a reverse causality concern. Not only allied council candidates' dominance areas affect mayoral candidates' dominance areas, but also mayoral candidates' dominance areas could affect the dominance areas of their allied council candidates.

To address these potential concerns, I propose employing an instrumental variable approach. In this approach, I will use a *Friends-and-Neighbors*-like instrument, as described in (Meredith, 2013a), to instrument allied council candidates' dominance areas. This instrument exploits votes centered around a candidate's local ties and personal connections, which are considered a form of personal (Fiva und Smith, 2017). The instrument, Z_{ilm}, is defined as the proportion of i' allied council candidates that vote at polling station l.[7]

The *relevance restriction* is expected to hold, as candidates vote at polling stations close to where they live or grew up, which turn out to be the areas where they are typically closer to voters. So the greater the proportion of allied council candidates voting in a polling place, the greater their voting concentration at this polling place is expected to be.

Regarding the *exclusion restriction*, the proportion of allied council candidates voting at a polling station must affect the mayoral candidate's dominance areas only through the impact on the allied council candidates' dominance areas. As where candidates vote is, in general, defined at the moment of the first voter registration, which is mandatory in Brazil for individuals aged 18 and over, there is not much room for changes depending on the configuration of the elections. Thus, it seems plausible that where allied council candidates vote only affects the mayoral candidate's dominance areas if affecting these council candidates' own dominance areas.

[7] The data from TSE's *filiados* files that were used to assess at which polling place each candidate vote was last updated a year before the 2020 elections. So, there are candidates who had not yet joined a political party and it's not possible to assess these candidates' polling places. The instrument must be taken as a lower bound for the actual proportion of candidates voting in the polling place.

One interesting aspect of Equation 8's specification and the proposed instrumental variable approach is that they can be easily adapted to estimate the other way round: the effect of mayoral candidate's dominance areas on their allies council candidates' dominance areas. Theoretically, there is no reason to expect the effect to be one-sided only. As demonstrated by Zudenkova (2011) in a political agency model of coattail voting, a context similar to the one considered in this paper, "two-sided" coattail effects are possible observable outcome. For example, Garmendia Madariaga und Ozen (2015) find a reciprocal relationship between presidential and gubernatorial vote shares at the state level in the US elections. Considering the *Friends-and-Neighbors* variation and the identifiable local effect in the mayoral electoral coalition context, there might be both voters that become a mayoral candidate's voters because of the personal vote in a supporting council candidate and voters that become a council candidate's voters because of the personal vote in the supported mayoral candidate.

Nevertheless, from the Brokerage Hypothesis, we should expect that this "inverse" effect is not as relevant as the main effect, as what drives the increase in the dependence of mayoral and allied council candidates' dominance areas is council candidates acting as local brokers for the mayoral candidate. Thus, it is important also to estimate this inverse effect, comparing it to the main effect of interest, i.e. the impact of allied council candidates' dominance areas on mayoral candidate's dominance areas. The inverse specification is given by:

$$S_{ilm}^{Coalition} = \breve{\beta} S_{ilm} + \breve{\alpha}_{lm} + \breve{\epsilon}_{ilm} \tag{9}$$

and the inverse instrumental variable for S_{ilm}, $\breve{Z}_{ilm}$, is an indicator variable equal to 1 if mayoral candidate i votes at polling place l.

Finally, similarly to the discussion of the Spatial Dependence Hypothesis' empirical strategy, is it important to consider a baseline comparison for the estimated parameter of interest, i.e. the estimated β. Following that reasoning, I consider the same population of candidates from the estimation of Equation 8 (i.e. mayoral candidates supported by a mayoral electoral coalition) and estimate:

$$S_{ilm} = \bar{\beta} S_{ilm}^{SameParty} + \bar{\alpha}_{lm} + \bar{\epsilon}_{ilm} \tag{10}$$

where $S_{ilm}^{SameParty}$ is the local vote concentration measure at polling place l of council candidates from the same mayoral candidate i's party. The baseline comparison parameter, $\bar{\beta}$, is thus the average **net** effect of a marginal change in $S_{ilm}^{SameParty}$ on S_{ilm}. Same party council candidates' dominance areas, $S_{ilm}^{SameParty}$, is also instrumented by $\bar{Z}_{ilm}$, which is defined as the proportion of same party council candidates that vote at polling place l.

4 Main Results

4.1 Spatial Dependence Hypothesis

In table 1, I present the main results following the empirical strategy detailed in section 3.1 for the Spatial Dependence Hypothesis' test. In the first column, the estimated model consists of a simple OLS regression of the SVD Index on the mayoral electoral alliance indicator. Columns 2 to 4 add progressively state party-pair, mayoral candidate and council candidate fixed-effects. The model in column 4 is the main fixed-effects specification described in Equation 6. All standard errors are two-way clustered at the mayoral candidate and council candidate levels.

The estimates indicate that being in the same mayoral electoral coalition indeed increases mayoral and council candidates pair's spatial vote dependence. In other words, mayoral and council candidates' dominance areas become more similar when the two are allied in a mayoral electoral coalition, as stated in the Spatial Dependence Hypothesis. The full fixed-effects point estimate, 0.14, is positive and statistically significant at the 1% level. Considering the sample's SVD Index descriptive statistics in table 10, the estimated effect corresponds to almost a one-tenth standard deviation.

Dependent Variable:	SVD Index			
	OLS	FE		
Model:	(1)	(2)	(3)	(4)
Variables				
Allied	0.0759***	0.0974***	0.1346***	0.1444***
	(0.0051)	(0.0062)	(0.0066)	(0.0073)
Fixed-effects				
Party Pair & State		Yes		Yes
Mayoral Cand. i			Yes	Yes
City Council Cand. j			Yes	Yes
Fit statistics				
Observations	1,424,901	1,424,901	1,424,901	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 1: Spatial Dependence Hypothesis' Test

Next, table 2's column 2 reports Equation 7's estimate considering all pairs of mayoral and council candidates, including those with candidates from the same party. The target parameter is an average effect of mayoral and council candidates' parties being the same on the SVD Index, which can be interpreted as a baseline comparison for table 1 estimates. The first column considers a simple OLS model with no fixed-effects. Standard errors are again two-way clustered at the mayoral candidate and the council candidate levels.

Comparing the full fixed-effects point estimate in Table 1, 0.1444, with the full fixed-effects point estimate in table 2, 0.5095, the mayoral electoral coalition effect on candidates pair' SVD is about 28% of the same party effect. Thus, being in the same mayoral electoral coalition does not increase the candidate pair's dominance areas dependence as much as being in the same party, but still represents a non-negligible effect.

Dependent Variable:	SVD Index	
	OLS	FE
Model:	(1)	(2)
Variables		
Same Party	0.4099***	0.5095***
	(0.0139)	(0.0152)
Fixed-effects		
Mayoral Cand. i		Yes
City Council Cand. j		Yes
Fit statistics		
Observations	2,504,382	2,504,382

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 2: Spatial Dependence Hypothesis' Test - Baseline Same Party

4.2 Brokerage Hypothesis

Now turning to the Brokerage Hypothesis, table 3 below reports Equation 8 estimates considering three different measures of candidates' local vote concentration at polling stations: the S Index, the Horizontal Clustering (HC) and the Locational Quotient (LQ)[8]. Odd columns consider a fixed-effects specification, while even columns report 2SLS estimates instrumenting allied council candidates' local vote concentration with the proportion of these allied council candidates that vote at the particular polling station. Standard errors are clustered at the Municipality level.

The instrumental variable model's estimates confirm that a marginal increase in allied council candidates' local vote concentration increases the supported mayoral candidate's local vote concentration, as expected from the Brokerage Hypothesis. This positive and

[8]The Horizontal Clustering (HC) and the Locational Quotient (LQ) are defined by equations 12 and 13 in the Appendix.

statistically significant effect is robust to the different measures of local vote concentration. Table 21 in the appendix reports the first-stage results for even columns' 2SLS estimates, which show that the instrument is significantly correlated with allied council candidates' dominance areas in all three measures of local vote concentration.

Dependent Variables:	M Cand. S		M Cand. HC		M Cand. LQ	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Allied CC Cand. S	0.1477***	0.1495***				
	(0.0077)	(0.0107)				
Allied CC Cand. HC			0.2682***	0.4816***		
			(0.0319)	(0.0218)		
Allied CC Cand. LQ					0.0903***	0.1387***
					(0.0220)	(0.0075)
Fixed-effects						
Polling Place	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	247,792	247,792	247,792	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 3: Brokerage Hypothesis' Test

Considering the S Index, a 1 p.p. increase in allied council candidates' local vote concentration due to the *Friends-and-Neighbors* variation causes a 0.15 p.p. net increase in the mayoral candidate's local vote concentration. Put differently, if council candidates' share of votes at a polling station increases 1 p.p. above the polling station size (the "expected" share), then the supported mayoral candidate's share increases by 0.15 p.p., net on average. The Horizontal Clustering (HC) measure translates the S Index in terms of candidates' votes. Thus a 1 vote marginal increase in allied council candidates' local vote concentration causes a 0.48 net vote increase in the mayoral candidate's local vote concentration.

And what about the "inverse" effect; i.e. the effect of mayoral candidate's dominance areas on their allied council candidates' dominance areas? Table 4 reports Equation 9 estimates considering again the three different measures of candidates. Odd columns consider a fixed-effects specification, while even columns report 2SLS estimates instrumenting the mayoral candidate's local vote concentration with an indicator of whether she votes at the particular polling station. First-stage estimates are shown in appendix table 22.

Dependent Variables:	Allied CC Cand. S		Allied CC Cand. HC		Allied CC Cand. LQ	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
M Cand. S	0.5211***	0.2136***				
	(0.0230)	(0.0690)				
M Cand. HC			0.1897***	0.1256***		
			(0.0258)	(0.0226)		
M Cand. LQ					0.3219***	0.2165***
					(0.0333)	(0.0452)
Fixed-effects						
Polling Place	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	247,792	247,792	247,792	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 4: Brokerage Hypothesis' Test - "Inverse"

Point estimates in the instrumental variable models, for all three measures of spatial vote concentration, are positive and statistically significant, indicating that there is also a “inverse” effect: a marginal increase in the mayoral candidate’s local vote concentration also increases allied council candidates’ local vote concentration. But even though the “inverse” point estimates are, in general, close to the council brokerage’s point estimates in table 3, it is important to note that, as discussed in section 2.2, council candidates’ votes are much more spatially concentrated than mayoral candidates’ votes. Thus, when increasing mayoral and council candidates’ vote concentration by the same amount, the relative increase must be higher for the former. This argument becomes more clear in the appendix’s tables 24 and 25, which report tables 3 and 4’s estimates considering the standardized measures of spatial vote concentration. Comparing the estimates from both tables, it is clear that the brokerage effect of allied council candidates’ vote concentration increasing mayoral candidate’s vote concentration is stronger than the “inverse” effect of mayoral candidate’s vote concentration increasing allied council candidates’ vote concentration (by more than 3 times). Therefore, the evidence suggests that what drives the increase in the dependence of mayoral and allied council candidates’ dominance areas is indeed council candidates acting as local brokers for the mayoral candidate, as expected from the Brokerage Hypothesis.

Finally, Table 5 reports Equation 10’s estimates, considering the regression of the mayoral candidate’s local vote concentration on the local vote concentration of council candidates from her same party, for the three different measures of local vote concentration. Again, odd columns consider a fixed-effects specification, while even columns report 2SLS estimates instrumenting the same party council candidates’ local vote concentration with the proportion of these same party council candidates that vote at the particular polling station. First-stage estimates are shown in appendix table 23.

Comparing with the 2SLS estimates in Table 3, same-party council candidates’ dominance areas’ impact on mayoral candidate’s dominance areas is greater for all three measures of local vote concentration. Nevertheless, the differences are, in general, not so substantial. For the S Index, allied council candidates’ net impact is about 54% of the same-party council candidates’ impact. Thus, council candidates that are allied to a mayoral candidate in a mayoral electoral coalition can be as useful brokers to the supported mayoral candidate as same party council candidates.

Dependent Variables:	M Cand. S		M Cand. HC		M Cand. LQ	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Same Party CC Cand. S	0.2609***	0.2839***				
	(0.0094)	(0.0128)				
Same Party CC Cand. HC			0.5271***	0.6192***		
			(0.0349)	(0.0210)		
Same Party CC Cand. LQ					0.2478***	0.2621***
					(0.0128)	(0.0094)
Fixed-effects						
Polling Place	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	239,695	239,695	239,695	239,695	239,695	239,695

Clustered (Municipality) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 5: Brokerage Hypothesis' Test - Baseline Same Party

5 Extensions

In this section, I discuss some extensions and robustness checks to the main empirical specifications discussed in section 3. First, subsection 5.1 reports the extensions' exercises for the Spatial Dependence Hypothesis test. Subsection 5.2.1 reports the analogous and additional exercises for the Brokerage Hypothesis test.

5.1 Spatial Dependence Hypothesis

5.1.1 Alternative Measures

As mentioned in section 2.1, to assess the impact of mayoral electoral coalitions on mayoral and council candidates' patterns of vote distribution, I consider yet an alternative measure to the SVD Index, the Spatial Adjusted Correlation (SAC), which is the scaled Pearson correlation between the candidate's pairs patterns of vote distribution (see Equation 16 in the Appendix). Thus, to test the Spatial Dependence Hypothesis, I replicate the empirical strategy described in section 3.1, but considering the SAC as the dependent variable.

Table 12 in the Appendix report the main results analogously to table 1. The estimates again confirm that being in the same mayoral electoral coalition increases mayoral and council candidates pairs' spatial vote dependence. The full fixed-effects point estimate, 3.537, is positive and statistically significant at the 1% level. This effect represents approximately 7% of the sample mean, as the Spatial Adjusted Correlation mean is close to 50 by design.

5.1.2 IV Analysis

It was mentioned in section 3.1 that the main concern in estimating the specification outlined in equation 6 is an omitted variable bias. There might be some party-pair variable at the municipality level that affects both the SVD Index and the mayoral electoral coalition indicator and is not controlled for in the proposed specification. To mitigate this issue, I propose instrumenting the mayoral electoral coalition indicator, $Allied_{ijms}$ with a *leave-*

one-out instrument. Consider a mayoral candidate i and a council candidate j, both from municipality m, and let P_i and P_j be their respective parties. If $M^{(1)}_{ms}$ is defined as the set of the municipalities excluding m and its border neighboring municipalities (i.e. neighboring municipalities up to the first degree, as indicated by the superscript "$^{(1)}$"), the *leave-one-out* instrument, Z_{ijms}, is given by:

$$Z_{ijms} := \frac{\left|\left\{ m' \in M^{(1)}_{ms} : \begin{array}{c} P_i \text{ and } P_j \text{ nominate candidates and are} \\ \text{in the same mayoral electoral coalition} \end{array} \right\}\right|}{\left|\left\{ m' \in M^{(1)}_{ms} : P_i \text{ and } P_j \text{ nominate candidates} \right\}\right|} \tag{11}$$

where the numerator is the number of municipalities, excluding m and its border neighboring municipalities, where the parties P_i and P_j are allied in a mayoral electoral coalition (which includes the cases where both parties do not launch a mayoral candidacy but support the same mayoral candidate from another party); and the denominator is the number of municipalities, excluding m and its border neighboring municipalities, where the parties P_i and P_j are participating in the elections (i.e. nominating mayoral or city council candidates).

To be a valid instrument, Z_{ijms} must be correlated with the mayoral electoral coalition indicator ($Allied_{ijms}$) and impact the candidates pair spatial vote dependence (SVD_{ijms}), conditional on the set of fixed-effects from Equation 6, only through the impact on the mayoral electoral coalition indicator.

The first restriction, the *relevance restriction*, is expected to be true, as the mean tendency of alliance in farther municipalities should be correlated with the tendency of alliance in a particular municipality due to, for example, programmatic similarities and national issues. As for the *exclusion restriction*, which can not be tested, it seems reasonable that, conditional on the set of fixed-effects from Equation 6, and, in particular, on the state pair of parties fixed-effect, the mean tendency of alliance in farther municipalities are affecting the spatial vote dependence only through the impact on the mayoral electoral coalition indicator.[9]

[9]Nevertheless, it should be acknowledged Betz u. a. (2018)'s critique on the use of spatial instruments, such as the *leave-one-out* instrument.

Table 6 bellow reports again the full fixed-effects estimate in column 1 and the 2SLS estimate in column 2. The point estimate, 0.17, is again positive and statistically significant at the 1% level. It is close to the full fixed-effects point estimate, 0.14, supporting the Spatial Dependence Hypothesis: being in the same mayoral electoral coalition increases mayoral and council candidates pair's spatial vote dependence.

Dependent Variable:	SVD Index	
	FE	2SLS
Model:	(1)	(2)
Variables		
Allied	0.1444***	0.1693***
	(0.0073)	(0.0160)
Fixed-effects		
Party Pair & State	Yes	Yes
Mayoral Cand. i	Yes	Yes
City Council Cand. j	Yes	Yes
Fit statistics		
Observations	1,424,901	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 6: Spatial Dependence Hypothesis' Test - IV Analysis

To attenuate concerns on the validity of the proposed instrument, in the Appendix, I also report a robustness check to the Spatial Dependence Hypothesis' *leave-one-out* instrument, defined in Equation 11. I consider alternative definitions, changing the set of municipalities excluded from the calculation of party pairs' probability of alliance. In the primary definition, the instrument is defined over the set $M_{ms}^{(1)}$, i.e. the set of municipalities excluding m and its bordering neighbors. The robustness exercise considers the sets $M_{ms}^{(0)}$ (excluding m), $M_{ms}^{(2)}$ (excluding m, its bordering neighbors and the bordering neighbor of its bordering neighbors;

i.e. excluding m and its neighbors up to the second degree), $M_{ms}^{(3)}$ (excluding m and its neighbors up to the third degree), $M_{ms}^{(4)}$ (excluding m and its neighbors up to the fourth degree) and $M_{ms}^{(5)}$ (excluding m and its neighbors up to the fifth degree).

The robustness exercise is reported in table 19. Considering the five different instrument definitions, the 2SLS estimates again confirm that being in the same mayoral electoral coalition increases mayoral and council candidates' spatial vote dependence. Point estimates are all positive and statistically significant, reinforcing that being in the same mayoral electoral coalition indeed increases mayoral and council candidates pair's spatial vote dependence, as stated in the Spatial Dependence Hypothesis. First-stage estimates are reported in table 20.

5.1.3 Heterogeneity

In the appendix, I report heterogeneity analyses in three dimensions that might impact the effect of mayoral electoral coalitions on candidates' spatial vote dependence: municipality size, mayoral candidate incumbency status, and mayoral candidate party. For each analysis, I consider a fixed-effects specification, as that of Equation 6, but interacting the mayoral electoral alliance indicator with categorical indicators representing the dimension of heterogeneity.

Table 13 reports the municipality size heterogeneity. The mayoral electoral alliance indicator is interacted with three indicators, each indicating if the municipality's number of polling stations is between the first and the second quartiles ($Q2\_PS$), between the second and the third quartiles ($Q3\_PS$) and above the third quartile ($Q4\_PS$). The estimates, both considering the SVD Index and the SAC as dependent variables, indicate the mayoral electoral coalition's positive effect on mayoral and council candidates pairs' spatial vote dependence decreases with the number of polling stations in a municipality. In other words, a mayoral electoral coalition in larger municipalities affects less the dependence of mayoral and council candidates' spatial patterns of vote distribution.

Table 14 reports the mayoral incumbency status heterogeneity. The mayoral electoral alliance indicator is interacted with an indicator that is equal to 1 when the mayoral candidate is the incumbent mayor or, if no candidate is the incumbent mayor when the mayoral candidate's party is the incumbent mayoral party, and equal to 0 otherwise. The estimates indicate that the mayoral electoral coalition's positive effect on mayoral and council candidate pairs' spatial vote dependence decreases when the mayoral candidacy is the incumbent candidacy. Nevertheless, the evidence is not robust to both the SVD Index and the SAC as dependent variables. The estimate is not statistically significant when considering the latter.

Finally, table 15 reports the mayoral party heterogeneity. The mayoral electoral alliance indicator is interacted with five indicators, each indicating if the mayoral candidate is from one of the five parties that launched the most mayoral candidates in 2020 municipality elections; i.e. MDB, PSD, PP, PSDB, and PT. The estimates indicate that evidence of heterogeneity in this dimension is weak. Overall, the point estimates are not statistically significant and are not robust to both the SVD Index and the SAC as dependent variables.

5.1.4 Party Aggregation and Effective Candidates

A possible problem related to the empirical strategy to test the Spatial Dependence Hypothesis, described in section 3.1, is that there might be mayoral and council candidates that are not competitive and get few votes. As discussed in section 2.1, the main local concentration measure, the S Index, which is the building block for both to the SVD Index and the SAC, can be distorted, assuming extreme values, when a candidate has few votes. Thus, I propose two alternative specifications to prevent this "weak-candidates" possible problem.

First, table 1's models are re-estimated considering the pairs of mayoral candidates and council candidates aggregated by party [10]. In the appendix, table 16 reports the exercise. Again, the estimates confirm that being in the same mayoral electoral coalition increases mayoral and council candidates pairs' spatial vote dependence. Considering council candidates aggregated by party, the full fixed-effects estimate, 0.25, is greater than the point

[10] And as before, the estimation considers only council parties that do not launch a mayoral candidate in the municipality

estimate in table 1, 0.14.

Secondly, table 1's models are re-estimated considering only the pairs of effective mayoral candidates and effective council candidates, as defined in Equation 5. Once more, the estimates, reported in table 17, confirm that being in the same mayoral electoral coalition increases mayoral and council candidates pairs' spatial vote dependence. The full fixed-effects point estimate, 0.24, is greater than the main specification's point estimate, 0.14. The mayoral electoral coalition effect on the pair's SVD is about 48% of the same party effect, which is greater than the relative effect considering mayoral and council candidate pairs.

Overall, both exercises go in hand with the main specification's results reported in table 1. The estimates support the Spatial Dependence Hypothesis.

5.1.5 Donations

Could the estimated mayoral electoral coalition effect on mayoral and council candidates' spatial vote dependence be explained by another relation between allied mayoral and council candidates? As mayoral inter-candidates campaign donations are only allowed when both candidates are in the same party or allied in the same mayoral electoral coalition, the mayoral electoral coalition effect could in fact be explained by this financial relationship. Put differently, it could be the case that what strengths mayoral and council candidates' spatial vote dependence is not being allied in a mayoral electoral coalition, but rather the inter-candidates' donations inside the coalition. To investigate it, I expand equation 6's specification, including an indicator variable equal to 1 when the mayoral candidate made a campaign donation to the council candidate in the pair, and to 0 otherwise.

Table 18 in the Appendix reports the expanded specification's results. Considering both the full fixed-effects model (column 4) and the 2SLS model (column 5), the inclusion of the campaign donation control does not change much the mayoral electoral coalition effect on mayoral and council candidates' spatial vote dependence, which indicates that it is not the financial relationship in the mayoral electoral alliance that explains the effect.

5.1.6 Placebo Coalitions

As a robustness check, I perform a placebo treatment exercise in the spirit of a permutation test. Taking mayoral candidacies in a municipality election as given, to construct a placebo mayoral electoral coalition I randomly select for each party participating in the city council election a mayoral candidacy to support, including the possibility of supporting no candidacy. I consider 100 repetitions of the exercise and, for each set of placebo mayoral electoral coalition, I estimate the models in table 1's column 4 and table 6's column 2 (i.e. the complete fixed-effects model and the 2SLS model). In the figure below I present the distribution of mayoral electoral placebo coalitions' estimated effect on the SVD Index. Tables 1 and 6's estimated effects are indicated by a vertical dotted line.

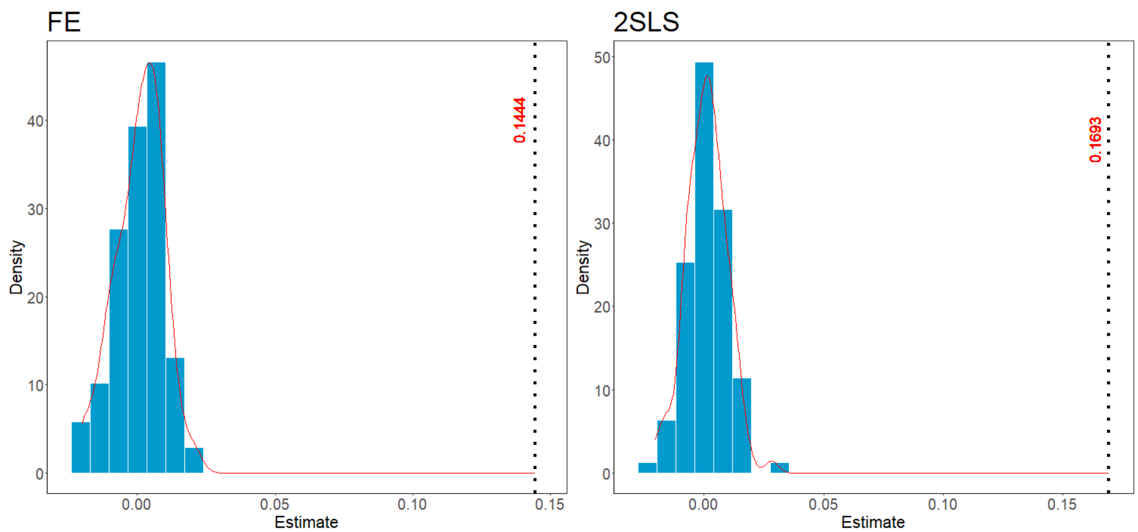

Figure 6: Placebo Coalitions - Estimates Histograms

Reassuringly, the mayoral electoral coalitions' estimated effects on the mayoral and council candidates pair's spatial vote dependence, both in the full fixed-effects and in the IV specifications, are outliers in the distributions of placebo mayoral electoral coalitions' estimated effects. Thus, the exercise reinforces that mayoral and council candidates' dominance areas indeed become more similar when they are allied in a mayoral electoral coalition, as stated in the Spatial Dependence Hypothesis.

5.2 Brokerage Hypothesis

5.2.1 Alternative Measures

As with the Spatial Dependence Hypothesis' test, I also consider alternative measures of spatial vote concentration to the S Index when testing the Brokerage Hypothesis. The two alternative measures, the Horizontal Clustering (HQ) and the Locational Quotient (LQ) are defined by equations 12 and 13 in the Appendix, following Silva und Davidian (2013). The estimates considering these alternative measures are present simultaneously with the S Index' estimates, in section 4.2's results tables. Overall, the estimates considering alternative measures of spatial vote concentration reported in table 3 (columns 3 to 6) confirm that a marginal increase in allied council candidates' local vote concentration increases the supported mayoral candidate's local vote concentration, as predicted by the Brokerage Hypothesis.

5.2.2 Coattail Effects Framework

In the introduction, it was pointed out that this research relates to the literature on *coattail effects*. Zudenkova (2011) defines the coattail effect as "*the tendency of a popular candidate for one level of government to attract votes to candidates from the same political party for other levels of government*". In this paper, the focus is on the spatial patterns of vote concentration rather than the raw vote shares, distinguishing it from most coattail effects literature (e.g. Ferejohn und Calvert, 1984; Ames, 1994; Samuels, 2000; Meredith, 2013a). Furthermore, the study centers on electoral coalition allies rather than same-party allies. Instead of examining whether supporting council candidates' vote shares turn into supported mayoral candidate's vote shares, the analysis tests whether the spatial voting concentration areas of supporting council candidates turn into the spatial voting concentration areas of the supported mayoral candidate.

Nevertheless, the specifications in equations 8 and 8 can be easily adapted to a more traditional “coattail effects framework” by replacing the measures of local vote concentration with the local vote shares (i.e. $\frac{V_{ilm}}{V_{lm}}$). Besides, the IV analysis should remain the same, instrumenting candidates' local vote shares with the *friends-and-neighbors* instrument as defined in section 3.2, which closely aligns with the original use of the instrument in Meredith (2013a). I report this exercise in appendix table 26.

Columns 1 and 2 are the OLS and 2SLS estimates for equation 8's specification adapted to the coattail effects framework, and columns 3 and 4, the analogous OLS and 2SLS estimates for the adapted inverse specification from equation 8. In the IV analysis, a 1p.p. increase in supporting council candidates' local vote share turns into a 0.43p.p. increase in the supported mayoral candidate's local vote share. On the other hand, the IV analysis reveals that a 1p.p. increase in the supported mayoral candidate's local vote share leads to a 0.16p.p. increase in supporting council candidates' local vote share. These results go hand in hand with the main local vote concentration's results, particularly supporting the Brokerage Hypothesis. There are two-side coattail effects, but the effect of supporting council candidates on the supported mayoral candidate is stronger.

5.2.3 Heterogeneity

In the appendix, heterogeneity analyses for the Brokerage Hypothesis' test are reported. Again, I consider three dimensions that might affect the effect of allied council candidates' local vote concentration on the supported mayoral candidate's local vote concentration: municipality size, mayoral candidate incumbency status, and mayoral candidate party. For each analysis, I consider the same specifications as that of equations 8 and 9, instrumenting the dependent variable with the same *Friends-and-Neighbors*-like instrument described in section 3.2, but restricting the sample of mayoral candidacies according to the each dimension's segmentation.

Table 28 presents the municipality size heterogeneity. In each column, the sample of mayoral candidacies is restricted according to the municipalities' number of polling stations.

The first column ($Q1\_PS$) considers the sample of mayoral candidacies supported by a mayoral electoral coalition in municipalities where the number of polling stations is below the first quartile of the municipalities' number of polling stations distribution. The second ($Q2\_PS$), between the first and the second quartiles; the third ($Q3\_PS$), between the second and the third quartiles; and the fourth ($Q4\_PS$), above the third quartile. The 2SLS point estimates indicate that the marginal effect of allied council candidates' local vote concentration on the supported mayoral candidate's local vote concentration is, in general, similar across the different sizes of municipalities.

Table 32 reports the mayoral incumbency status heterogeneity. The first column restricts the sample to incumbent mayoral candidacies (i.e. the mayoral candidate is the incumbent mayor or, if no candidate is the incumbent mayor, the mayoral candidate's party is the incumbent mayoral party), while the second column considers the complement (i.e. mayoral candidacies that are not incumbent mayoral candidacies). The 2SLS estimate indicates that the allied council brokerage effect is stronger when the mayoral candidacy is not the incumbent candidacy, but the marginal positive effect is statistically significant for both types of mayoral candidacies.

Finally, table 36 shows the mayoral party heterogeneity. Each column restricts the sample to mayoral candidacies from one of the five parties that launched the most mayoral candidates in the 2020 municipality elections; i.e. MDB, PSD, PP, PSDB, and PT. The 2SLS estimates indicate that the Brokerage Hypothesis is rejected only when considering PT's mayoral candidacies. For MDB, PSD, PP, and PSDB, the results show a positive and statistically significant marginal effect of the mayoral candidate's local vote concentration on allied council candidates' local vote concentration. Interestingly, its also only when considering PT's mayoral candidacies that the inverse model estimation (in table 38) finds a positive, strong and statistically significant marginal effect of the mayoral candidate's local vote concentration on allied council candidates' local vote concentration. In other words, the analysis shows that in PT's mayoral candidacies, it is not allied council candidates that act as local brokers for the mayoral candidate, but rather the mayoral candidate's dominance areas that affect her allied council candidates' dominance areas. Further analysis of this pattern is yet to be done.

5.2.4 Effective Candidates

As discussed before, a possible problem related to using the spatial vote concentration measures is that there might be mayoral and council candidates that are not competitive and get few votes. The main local concentration measure, the S Index, can be distorted, assuming extreme values, when a candidate has few votes (see section 2.1). Thus, I propose accessing the Brokerage Hypothesis through an alternative specification to prevent this "weak candidates" problem.

The alternative specification consists of estimating table 3's models considering only effective mayoral and city council candidates, as defined in Equation 5 following Laakso und Taagepera (1979)'s classical definition. The results are presented in table 40. Point estimates are close to tables 3's main estimates, supporting the Brokerage Hypothesis: a marginal increase in allied council candidates' local vote concentration does increase the supported mayoral candidate's local vote concentration, as expected from the Brokerage Hypothesis. Again, the positive and statistically significant effect is robust to the alternative measures of spatial vote concentration.

5.2.5 Controlling for Mayoral Candidate's Polling Place

Resuming the discussion on the instrumental variable strategy to test the Brokerage Hypothesis in section 3.2, the exclusion restriction for instrumenting allied council candidates' dominance areas with the proportion of these allied council candidates that vote at the polling place was that the instrumental variable should affect mayoral candidate's dominance areas only through the impact on the allied council candidates' dominance areas. As where candidates vote is, in general, defined at the moment of the first voter registration, I argued that there was not much room for changes depending on the configuration of the elections.

To strengthen the argument on the exclusion restriction validity, I propose to include in Equation 8' specification an indicator variable equal to 1 when the mayoral candidate votes at the polling place as a covariate. If the argument that candidates do not change where they vote depending on the configuration of the elections is true, then the inclusion of this indicator should not change the council candidates' vote concentration estimated effect on the supported mayoral candidate's vote concentration. In particular, a possible violation of the exclusion restriction should show up if allied council candidates vote at a particular polling place because it's where their supported mayoral candidate votes. If the inclusion of the mayoral candidate's polling place indicator as a covariate does not change the estimated effects, then it would be a piece of evidence supporting that candidates' polling places are indeed exogenously determined.

The results of this exercise are presented in the appendix's table 42. Reassuringly, points estimates are almost numerically identical to those presented from the main specification, in table 3, indicating that the inclusion of the mayoral candidate's polling place indicator as a covariate does not change council candidates' vote concentration estimated effects on the supported mayoral candidate's vote concentration, for all alternative measures of spatial vote concentration. This piece of evidence thus strengthens the argument for the validity of the instrument's exclusion restriction, with candidates' polling places being exogenously determined.

5.2.6 Placebo Coalitions

As with the Spatial Dependence Hypothesis test, I also perform a placebo treatment exercise in the spirit of a permutation test for the Brokerage Hypothesis test. I consider the same 100 repetitions of the exercise performed for the Spatial Dependence Hypothesis test, where mayoral candidacies in a municipality election are taken as given and a placebo mayoral electoral coalition is constructed by randomly selecting for each party participating in the city council election a mayoral candidacy to be supported, including the possibility of supporting no candidacy. For each set of placebo mayoral electoral coalition, I estimate the models in table 3's columns 1 and 2 (i.e. the fixed-effects model and the 2SLS model). In the figure below I present the distribution of placebo-allied council candidates' vote concentration estimated effect on the supported mayoral candidate's vote concentration; Table 3's estimated effects are indicated by a vertical dotted line.

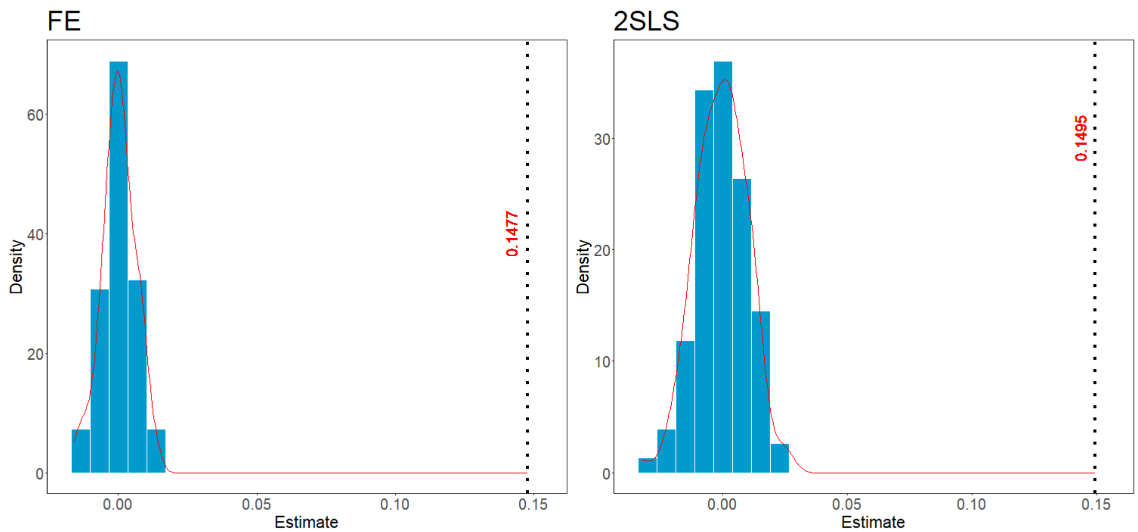

Figure 7: Placebo Coalitions - Estimates Histograms

Again, reassuringly, the estimated effects considering the real coalitions, both in the full fixed-effects and in the IV specifications, are outliers in the distributions of placebo coalitions' estimated effects. Thus, the exercise reinforces that a marginal increase in allied council candidates' local vote concentration indeed increases the supported mayoral candidate's local vote concentration, as expected from the Brokerage Hypothesis.

6 Conclusion

Why do parties form electoral coalitions? At least since Soares (1964), strategic interpretations of parties joining electoral alliances in order to maximize their electoral performances while minimizing campaign efforts have been put forth by an enormous literature on electoral alliances in Brazil. But while much effort has been devoted to understanding electoral coalitions in federal- and state-level elections, in local elections this recurring phenomenon remains not fully understood. In particular, the question of why majoritarian candidacies welcome other parties in their electoral coalitions needs a better answer in the context of local elections. The traditional answer due to the division of campaign resources (i.e. free broadcast radio/TV time) is insufficient, as most Brazilian municipalities do not have access to local radio/TV stations, which are necessary for broadcasting the free broadcast time.

This research tries to shed new light on the understanding of electoral coalitions in local elections through a novel approach that considers the impacts of these alliances on candidates' spatial patterns of vote distribution, a strand of electoral study first developed by Ames (1995b). As local elections in Brazil consist of two simultaneous elections for the municipality's executive and legislative offices, I provide evidence on how electoral cooperation among candidates vying for offices in different branches of government can lead to spillover effects, enhancing the advantages derived from individual spatial voting patterns.

To organize the analysis, I outline two hypotheses linking mayoral electoral coalitions to the interaction between mayoral and city council candidates' spatial voting performances. These hypotheses are empirically tested in the context of the Brazilian 2020 Municipal Elections. First, I find that mayoral and council candidates' spatial patterns of vote distribution become more positively dependent when their parties are allied in a mayoral electoral coalition, the "Spatial Dependence Hypothesis". Then, taking a closer look at the mechanism behind the first hypothesis' equilibrium result, I show that council candidates act as local brokers for the mayoral candidate, whit the spatial voting concentration areas of the former turning into the spatial voting concentration areas of the latte, as proposed by the "Brokerage Hypothesis". These results are robust to a series of alternative specifications and other robustness checks.

My results show that a mayoral electoral coalition can be understood as a cooperation device that connects mayoral candidates to council candidates such that the latter's local cluster of voters also vote for the former. Thus, mayoral candidates benefit from their allied council candidates' more well-developed local networks (i.e. their *redutos*), which are typically secured with long-term clientelistic relationship (Lopez, 2004; Nichter, 2018). Furthermore, the research also provides rich descriptive statistics that help characterize the reasoning behind the two main hypotheses. I show that city council candidates' votes are spatially much more concentrated than mayoral candidates' votes and that top-ranked candidates' votes are more spatially scattered, in both mayoral and council elections.

To my knowledge, this research represents the first effort of studying spatial patterns of vote distribution in the context of local elections at the polling station level. For that, I adapt concentration measures already in use for the study of spatial voting patterns at more aggregated levels (in particular, due to Avelino u. a. (2011) and Silva und Davidian (2013)), but also propose a "new" measure of spatial voting dependence, adapting Ellison u. a. (2010)'s industrial coagglomeration index to the context of voting outcomes. While I restricted the empirical analysis to the Brazilian 2020 Municipal Elections, it would be interesting to study how electoral coalitions affect candidates' spatial patterns of vote distribution in other elections and countries. Are the findings a particularity of Brazil (or, as we say, a *jabuticaba*)? The methodology applied here could be used to study further this and several other relevant questions.

References

[Ames 1994] AMES, Barry: The Reverse Coattails Effect: Local Party Organization in the 1989 Brazilian Presidential Election. In: *The American Political Science Review* 88 (1994), Nr. 1, S. 95–111. – URL http://www.jstor.org/stable/2944884

[Ames 1995a] AMES, Barry: Electoral Rules, Constituency Pressures, and Pork Barrel: Bases of Voting in the Brazilian Congress. In: *The Journal of Politics* 57 (1995), Mai, Nr. 2,

S. 324–343. – URL https://www.journals.uchicago.edu/doi/10.2307/2960309. – Zugriffsdatum: 2022-06-19. – ISSN 0022-3816, 1468-2508

[Ames 1995b] Ames, Barry: Electoral Strategy under Open-List Proportional Representation. In: *American Journal of Political Science* 39 (1995), Nr. 2, S. 406–433. – URL https://www.jstor.org/stable/2111619. – Zugriffsdatum: 2022-10-11. – Publisher: [Midwest Political Science Association, Wiley]. – ISSN 0092-5853

[Avelino u. a. 2011] Avelino, George ; Biderman, Ciro ; Silva, Glauco Peres d.: A Concentração eleitoral nas eleições paulistas: medidas e aplicações. In: *Dados* 54 (2011), S. 319–347. – URL http://www.scielo.br/j/dados/a/RjRDNdDPrvByznWxBsfc4dF/?lang=pt. – Zugriffsdatum: 2022-06-19. – Publisher: Instituto de Estudos Sociais e Políticos (IESP) da Universidade do Estado do Rio de Janeiro (UERJ). – ISSN 0011-5258, 1678-4588

[Avelino u. a. 2016] Avelino, George ; Biderman, Ciro ; Silva, Glauco Peres d.: A Concentração Eleitoral no Brasil (1994-2014). In: *Dados* 59 (2016), Dezember, S. 1091–1125. – URL http://www.scielo.br/j/dados/a/FjxvsM9jJPfVhX58gKLrgpv/abstract/?lang=pt. – Zugriffsdatum: 2022-06-19. – Publisher: Instituto de Estudos Sociais e Políticos (IESP) da Universidade do Estado do Rio de Janeiro (UERJ). – ISSN 0011-5258, 1678-4588

[Barbosa und Ferreira 2019] Barbosa, Klenio ; Ferreira, Fernando V.: *Occupy Government: Democracy and the Dynamics of Personnel Decisions and Public Sector Performance*. Januar 2019. – URL https://www.nber.org/papers/w25501. – Zugriffsdatum: 2023-01-09

[Betz u. a. 2018] Betz, Timm ; Cook, Scott J. ; Hollenbach, Florian M.: On the Use and Abuse of Spatial Instruments. In: *Political Analysis* 26 (2018), Nr. 4, S. 474–479

[Carty 1981] Carty, R. K.: Brokerage and Partisanship: Politicians, Parties and Elections in Ireland. In: *Canadian Journal of Political Science* 14 (1981), März, Nr. 1, S. 53–81. – URL https://www.cambridge.org/core/product/identifier/S0008423900035356/type/journal_article. – Zugriffsdatum: 2022-09-12. – ISSN 0008-4239, 1744-9324

[Colonnelli u. a. 2020] Colonnelli, Emanuele ; Prem, Mounu ; Teso, Edoardo: Patronage and Selection in Public Sector Organizations. In: *American Economic Review* 110 (2020), Oktober, Nr. 10, S. 3071–3099. – URL https://pubs.aeaweb.org/doi/10.1257/aer.20181491. – Zugriffsdatum: 2023-01-09. – ISSN 0002-8282

[Cox 1990] Cox, Gary W.: Centripetal and Centrifugal Incentives in Electoral Systems. In: *American Journal of Political Science* 34 (1990), Nr. 4, S. 903–935. – URL https://www.jstor.org/stable/2111465. – Zugriffsdatum: 2022-10-11. – Publisher: [Midwest Political Science Association, Wiley]. – ISSN 0092-5853

[Dow 2001] Dow, Jay K.: A comparative spatial analysis of majoritarian and proportional elections. In: *Electoral Studies* 20 (2001), März, Nr. 1, S. 109–125. – URL https://linkinghub.elsevier.com/retrieve/pii/S0261379499000414. – Zugriffsdatum: 2022-10-11. – ISSN 02613794

[Ellison u. a. 2010] Ellison, Glenn ; Glaeser, Edward L. ; Kerr, William R.: What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns. In: *American Economic Review* 100 (2010), Juni, Nr. 3, S. 1195–1213. – URL https://pubs.aeaweb.org/doi/10.1257/aer.100.3.1195. – Zugriffsdatum: 2022-05-23. – ISSN 0002-8282

[Ellison und Glaeser 1997] Ellison, Glenn ; Glaeser, Edward L.: Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach. In: *Journal of Political Economy* 105 (1997), Oktober, Nr. 5, S. 889–927. – URL `https://www.journals.uchicago.edu/doi/10.1086/262098`. – Zugriffsdatum: 2022-06-28. – ISSN 0022-3808, 1537-534X

[Ferejohn und Calvert 1984] Ferejohn, John A. ; Calvert, Randall L.: Presidential Coattails in Historical Perspective. In: *American Journal of Political Science* 28 (1984), Februar, Nr. 1, S. 127. – URL `https://www.jstor.org/stable/2110790?origin=crossref`. – Zugriffsdatum: 2022-09-21. – ISSN 00925853

[Fiva und Smith 2017] Fiva, Jon H. ; Smith, Daniel M.: Local candidates and voter mobilization: Evidence from historical two-round elections in Norway. In: *Electoral Studies* 45 (2017), Februar, S. 130–140. – URL `https://linkinghub.elsevier.com/retrieve/pii/S026137941630302X`. – Zugriffsdatum: 2023-05-11. – ISSN 02613794

[Frey 2022] Frey, Anderson: Larger Legislatures and the Cost of Political Brokerage: Evidence from Brazil. (2022), S. 48

[Garmendia Madariaga und Ozen 2015] Garmendia Madariaga, Amuitz ; Ozen, H. E.: Looking for two-sided coattail effects: Integrated parties and multilevel elections in the U.S. In: *Electoral Studies* 40 (2015), Dezember, S. 66–75. – URL `https://linkinghub.elsevier.com/retrieve/pii/S0261379415001134`. – Zugriffsdatum: 2023-07-10. – ISSN 02613794

[Gingerich und Medina 2013] Gingerich, Daniel W. ; Medina, Luis F.: The Endurance and Eclipse of the Controlled Vote: A Formal Model of Vote Brokerage Under the Secret Ballot. In: *Economics & Politics* (2013), Juli, S. n/a–n/a. – URL `https://onlinelibrary.wiley.com/doi/10.1111/ecpo.12020`. – Zugriffsdatum: 2022-06-28. – ISSN 09541985

[Golder 2006] Golder, Sona N.: *The logic of pre-electoral coalition formation*. Columbus : Ohio State University Press, 2006 (Parliaments and legislatures). – OCLC: ocm65425753. – ISBN 978-0-8142-1029-1

[Griebeler und Resende 2021] Griebeler, Marcelo de C. ; Resende, Roberta C.: A model of electoral alliances in highly fragmented party systems. In: *Journal of Theoretical Politics* 33 (2021), Januar, Nr. 1, S. 3–24. – URL `http://journals.sagepub.com/doi/10.1177/0951629820963182`. – Zugriffsdatum: 2022-09-21. – ISSN 0951-6298, 1460-3667

[Kellam 2017] Kellam, Marisa: Why Pre-Electoral Coalitions in Presidential Systems? In: *British Journal of Political Science* 47 (2017), April, Nr. 2, S. 391–411. – URL `https://www.cambridge.org/core/product/identifier/S0007123415000198/type/journal_article`. – Zugriffsdatum: 2023-01-09. – ISSN 0007-1234, 1469-2112

[Laakso und Taagepera 1979] Laakso, M. ; Taagepera, R.: “Effective” number of parties: A Measure with Application to West Europe. In: *Comparative Political Studies* 12 (1979), Nr. 1, S. 3–27. – URL `https://escholarship.org/uc/item/703827nv`. – Zugriffsdatum: 2022-10-06. – ISSN 0010-4140

[Latner und McGann 2005] Latner, Michael ; McGann, Anthony: Geographical representation under proportional representation: The cases of Israel and the Netherlands. In: *Electoral Studies* 24 (2005), Dezember, Nr. 4, S. 709–734. – URL `https://linkinghub.elsevier.com/retrieve/pii/S0261379405000247`. – Zugriffsdatum: 2022-10-11. – ISSN 02613794

[Lewis-Beck und Rice 1983] Lewis-Beck, Michael S. ; Rice, Tom W.: Localism in

Presidential Elections: The Home State Advantage. In: *American Journal of Political Science* 27 (1983), Nr. 3, S. 548–556. – URL https://www.jstor.org/stable/2110984. – Zugriffsdatum: 2023-07-23. – Publisher: [Midwest Political Science Association, Wiley]. – ISSN 0092-5853

[Limongi und Vasselai 2018] Limongi, Fernando ; Vasselai, Fabricio: Entries and Withdrawals: Electoral Coordination across Different Offices and the Brazilian Party Systems. In: *Brazilian Political Science Review* 12 (2018), November. – URL http://www.scielo.br/j/bpsr/a/RHYYxLhJh3VVX4qfbYnLWZs/abstract/?lang=en. – Zugriffsdatum: 2022-06-19. – Publisher: Associação Brasileira de Ciência Política. – ISSN 1981-3821

[Lopez 2004] Lopez, Felix G.: A política cotidiana dos vereadores e as relações entre executivo e legislativo em âmbito municipal: o caso do município de Araruama. In: *Revista de Sociologia e Política* (2004), Juni, Nr. 22, S. 153–177. – URL http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-44782004000100012&lng=pt&tlng=pt. – Zugriffsdatum: 2022-10-10. – ISSN 0104-4478

[Machado 2018] Machado, Aline: *Alianças Eleitorais: Casamento com prazo de validade - Aline Machado*. Rio de Janeiro : Alta Books Editora, 2018. – URL https://books.google.com.br/books?hl=en&lr=&id=EQKSDwAAQBAJ&oi=fnd&pg=PP1&dq=alian%C3%A7as+eleitorais+aline&ots=5blAI2he01&sig=7_oQqHCNUt_EQBp8_L9KW5pY_Dk&redir_esc=y#v=onepage&q=alian%C3%A7as%20eleitorais%20aline&f=false. – Zugriffsdatum: 2022-06-19

[Meredith 2013a] Meredith, Marc: Exploiting Friends-and-Neighbors to Estimate Coattail Effects. In: *American Political Science Review* 107 (2013), November, Nr. 4, S. 742–765. – URL https://www.cambridge.org/core/product/identifier/S0003055413000439/type/journal_article. – Zugriffsdatum: 2022-09-21. – ISSN 0003-0554, 1537-5943

[Meredith 2013b] Meredith, Marc: Heterogeneous friends-and-neighbors voting. In: *University of Pennsylvania mimeo* (2013)

[Mizuca 2007] Mizuca, Humberto Dantas d.: *Coligações em eleições majoritárias municipais: a lógica do alinhamento dos partidos políticos brasileiros nas disputas de 2000 e 2004*. São Paulo, Universidade de São Paulo, Doutorado em Ciência Política, Dezember 2007. – URL http://www.teses.usp.br/teses/disponiveis/8/8131/tde-26022008-141714/. – Zugriffsdatum: 2022-06-19

[Myerson 1993] Myerson, Roger B.: Incentives to Cultivate Favored Minorities Under Alternative Electoral Systems. In: *The American Political Science Review* 87 (1993), Nr. 4, S. 856–869. – URL https://www.jstor.org/stable/2938819. – Zugriffsdatum: 2022-07-13. – Publisher: [American Political Science Association, Cambridge University Press]. – ISSN 0003-0554

[Nichter 2018] Nichter, Simeon: *Votes for Survival: Relational Clientelism in Latin America*. 1. Cambridge University Press, Oktober 2018. – URL https://www.cambridge.org/core/product/identifier/9781316998014/type/book. – Zugriffsdatum: 2022-10-11. – ISBN 978-1-316-99801-4 978-1-108-42836-1 978-1-108-44950-2

[Nichter und Peress 2017] Nichter, Simeon ; Peress, Michael: Request Fulfilling: When Citizens Demand Clientelist Benefits. In: *Comparative Political Studies* 50 (2017), Juli, Nr. 8, S. 1086–1117. – URL http://journals.sagepub.com/doi/10.1177/0010414016666838. – Zugriffsdatum: 2022-10-11. – ISSN 0010-4140, 1552-3829

[O'Sullivan und Strange 2018] O'Sullivan, Arthur ; Strange, William C.: The Emergence of Coagglomeration. In: *Journal of Economic Geography* 18 (2018), März, Nr. 2, S. 293–317. – URL https://academic.oup.com/joeg/article/18/2/293/3897491. – Zugriffsdatum: 2022-06-19. – ISSN 1468-2702, 1468-2710

[Pereira und Rennó 2001] Pereira, Carlos ; Rennó, Lucio: O que é que o reeleito tem? Dinâmicas político-institucionais locais e nacionais nas eleições de 1998 para a Câmara dos Deputados. In: *Dados* 44 (2001), S. 133–172. – URL http://www.scielo.br/j/dados/a/cQsQ7GhP84S53fp64b5V63F/?lang=pt. – Zugriffsdatum: 2023-01-11. – Publisher: Instituto de Estudos Sociais e Políticos (IESP) da Universidade do Estado do Rio de Janeiro (UERJ). – ISSN 0011-5258, 1678-4588

[Rudolph und Leininger 2021] Rudolph, Lukas ; Leininger, Arndt: Coattails and spillover-effects: Quasi-experimental evidence from concurrent executive and legislative elections. In: *Electoral Studies* 70 (2021), April, S. 102264. – URL https://www.sciencedirect.com/science/article/pii/S0261379420301438. – Zugriffsdatum: 2022-09-21. – ISSN 0261-3794

[Samuels 1999] Samuels, David J.: Incentives to Cultivate a Party Vote in Candidate-centric Electoral Systems: Evidence from Brazil. In: *Comparative Political Studies* 32 (1999), Juni, Nr. 4, S. 487–518. – URL http://journals.sagepub.com/doi/10.1177/0010414099032004004. – Zugriffsdatum: 2022-06-19. – ISSN 0010-4140, 1552-3829

[Samuels 2000] Samuels, David J.: The Gubernatorial Coattails Effect: Federalism and Congressional Elections in Brazil. In: *The Journal of Politics* 62 (2000), Nr. 1, S. 240–253. – URL https://www.jstor.org/stable/2647606. – Zugriffsdatum: 2023-01-09. – Publisher: [University of Chicago Press, Southern Political Science Association]. – ISSN 0022-3816

[Shugart u. a. 2005] Shugart, Matthew S. ; Valdini, Melody E. ; Suominen, Kati: Looking for Locals: Voter Information Demands and Personal Vote-Earning Attributes of Legislators under Proportional Representation. In: *American Journal of Political Science* 49 (2005), Nr. 2, S. 437–449. – URL https://onlinelibrary.wiley.com/doi/abs/10.1111/j.0092-5853.2005.00133.x. – Zugriffsdatum: 2023-07-23. – _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.0092-5853.2005.00133.x. – ISSN 1540-5907

[Silva und Davidian 2013] Silva, Glauco Peres d. ; Davidian, Andreza: Identification of areas of vote concentration: evidences from Brazil. In: *Brazilian Political Science Review* 7 (2013), Nr. 2, S. 141–155. – URL http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1981-38212013000200006&lng=en&tlng=en. – Zugriffsdatum: 2022-04-12. – ISSN 1981-3821

[Silva und Silotto 2018] Silva, Glauco Peres d. ; Silotto, Graziele: Preparing the Terrain: Conditioning Factors for the Regionalization of the Vote for Federal Deputy in São Paulo. In: *Brazilian Political Science Review* 12 (2018), Juni. – URL http://www.scielo.br/j/bpsr/a/McxYdFZV8YPMkMjwfkbWsFp/abstract/?lang=en. – Zugriffsdatum: 2022-09-14. – Publisher: Associação Brasileira de Ciência Política. – ISSN 1981-3821

[Silva 2022] Silva, Patrick C.: Campaign resources and pre-electoral coalitions. In: *Party Politics* 28 (2022), Januar, Nr. 1, S. 105–114. – URL https://doi.org/10.1177/1354068820961623. – Zugriffsdatum: 2022-06-19. – Publisher: SAGE Publications Ltd. – ISSN 1354-0688

[Soares 1964] Soares, Glaucio Ary D.: Aliancas e Coligacoes Eleitorias: Notas para uma Teoria. In: *Revista Brasileira de Estudos Politicos* 17 (1964), S. 95–124. – URL https://heinonline.org/HOL/P?h=hein.journals/rbep17&i=95. – Zugriffsdatum: 2022-11-14

[Steijn u. a. 2022] Steijn, Mathieu P. ; Koster, Hans R. ; Van Oort, Frank G.: The dynamics of industry agglomeration: Evidence from 44 years of coagglomeration patterns. In: *Journal of Urban Economics* (2022), April, S. 103456. – URL https://linkinghub.elsevier.com/retrieve/pii/S009411902200033X. – Zugriffsdatum: 2022-06-19. – ISSN 00941190

[Zudenkova 2011] Zudenkova, Galina: A political agency model of coattail voting. In: *Journal of Public Economics* 95 (2011), Dezember, Nr. 11-12, S. 1652–1660. – URL https://linkinghub.elsevier.com/retrieve/pii/S0047272711001307. – Zugriffsdatum: 2023-07-10. – ISSN 00472727

Appendix A. Alternative Measures

Spatial Vote Concentration

- Horizontal Clustering (HQ):

$$\mathcal{HC}_{ilm} := V_{ilm} - V_{im} * \frac{V_{lm}}{V_m} \tag{12}$$

- Location Quotient (LQ):

$$\mathcal{LQ}_{ilm} := \frac{V_{ilm}}{V_{im}} / \frac{V_{lm}}{V_m} \tag{13}$$

- S_{Max}:

$$S_{im}^{Max} := \max_l \{S_{ilm}\} \tag{14}$$

- C Index:

$$C_{im} := \frac{\sum_l (\frac{V_{ilm}}{V_{im}})^2}{\sum_l (\frac{V_{lm}}{V_m})^2} \tag{15}$$

Spatial Vote Dependence

- Spatial Adjusted Correlation (SAC):

$$Corr_{ijm}^{L} := 100 * \frac{1 + corr(S_{ilm}, S_{jlm})}{2} \tag{16}$$

Empirical Regularities

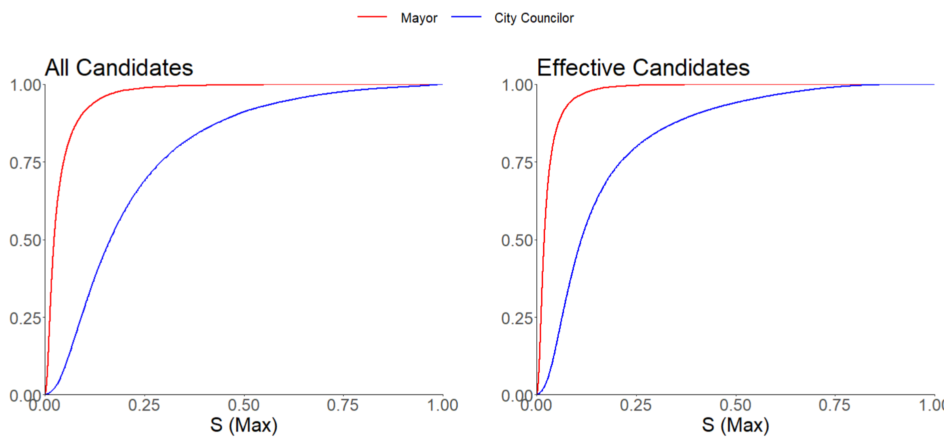

Figure 8: Empirical CDF - S_{Max}

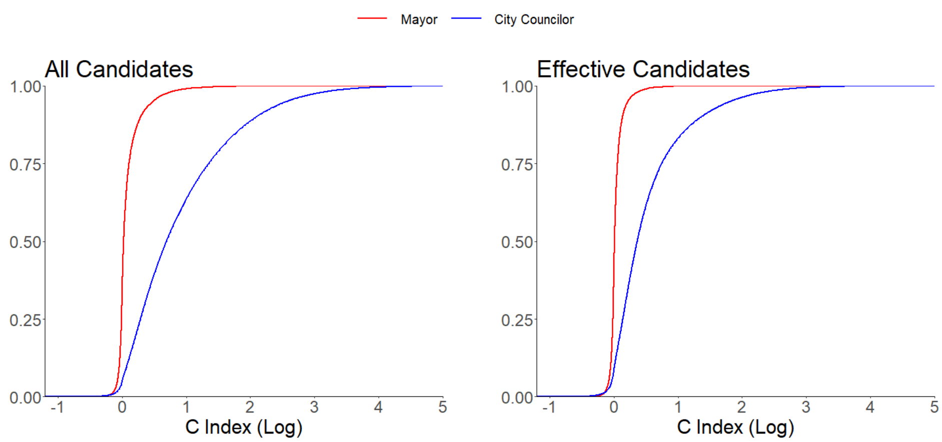

Figure 9: Empirical CDF - C Index

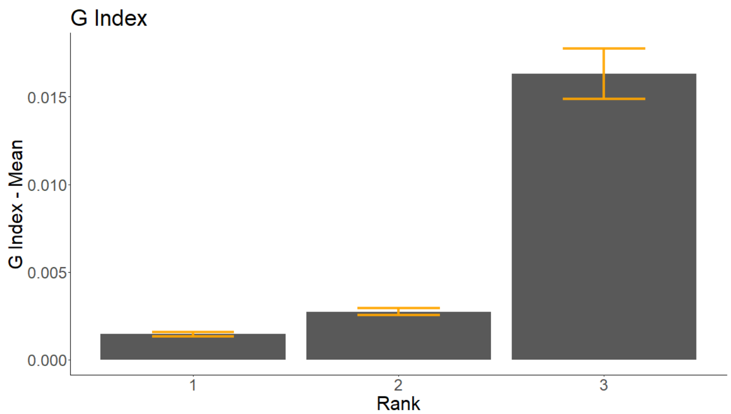

Figure 10: Mean Concentration by Voting Rank - Mayoral Elections (Top 3)

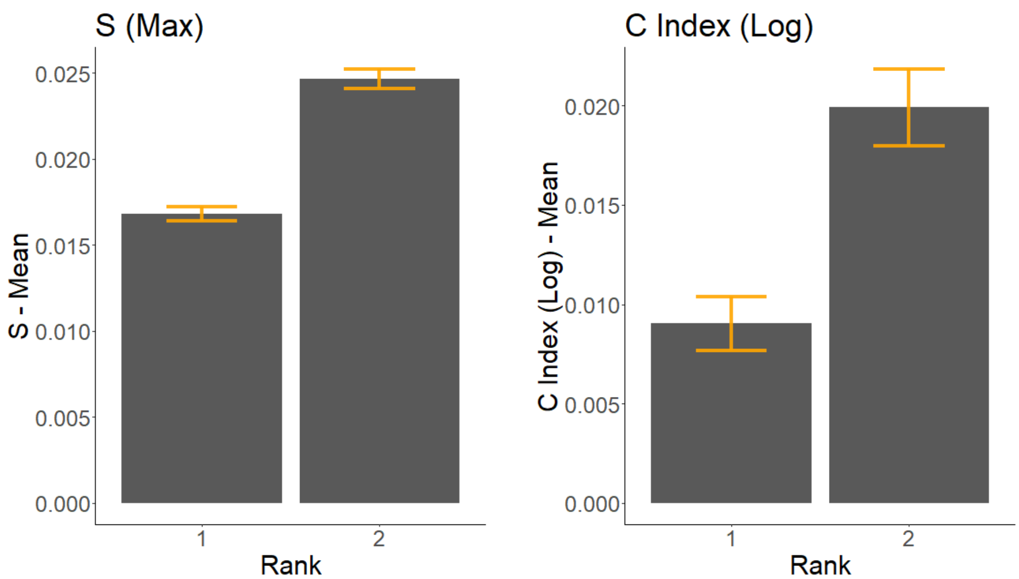

Figure 11: Mean Concentration by Voting Rank - Mayoral Elections (S_{Max} and C Index)

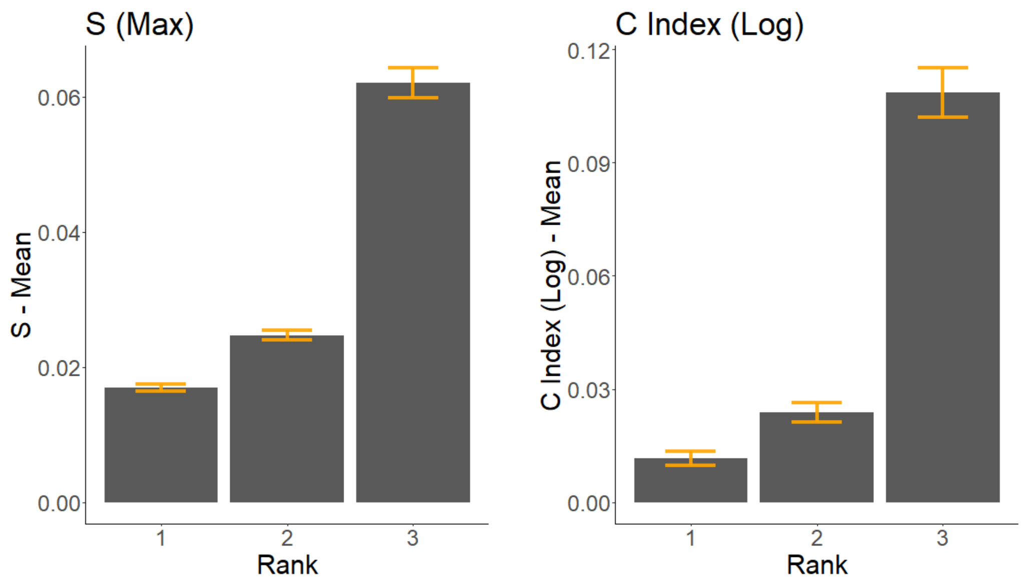

Figure 12: Mean Concentration by Voting Rank - Mayoral Elections (Top 3 - S_{Max} and C Index)

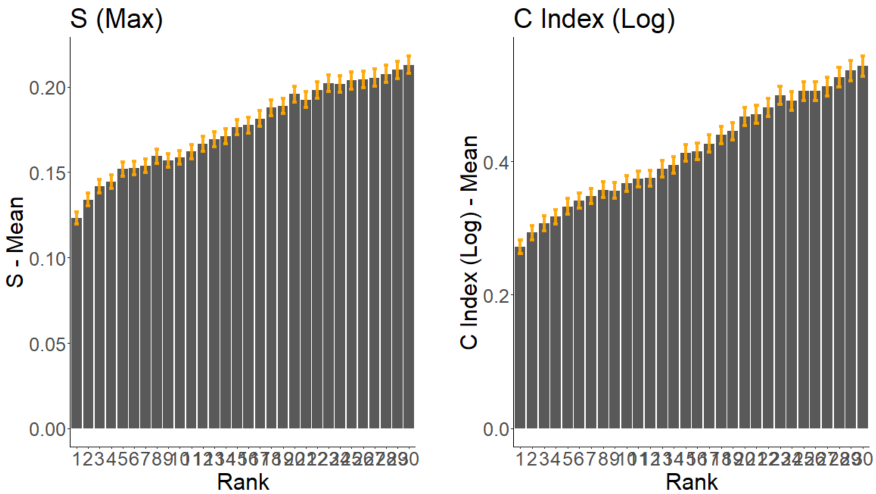

Figure 13: Mean Concentration by Voting Rank - Council Elections (S_{Max} and C Index)

Appendix B. Descriptive Statistics

Year	# Candidacies	Mean Candidacies by Municipality	% Candidacies with Coalition	% Municipalities with Coalition	Mean Allied Parties in Coalition
2000	15041	2.71	73.61	97.16	2.58
2004	15994	2.88	79.74	99.28	3.25
2008	15361	2.76	83.53	99.75	3.82
2012	15419	2.77	85.20	99.80	4.52
2016	16354	2.94	83.80	99.86	4.81
2020	18979	3.41	64.30	97.57	2.42

Table 7: Mayoral Coalitions in Brazilian Municipality Elections

# Pooling Stations	N
1	213
2	489
3	416
4	413
5	364
6	364
7	301
8	255
9	224
10	205
11	162
12	164
13	154
14	130
15+	1715

Table 8: 2020 Elections Municipalities' Number of Polling Places - Distribution

# Pooling Stations	
Mean	17
Median	8
Max	2062

Table 9: 2020 Elections Municipalities' Number of Polling Places - Summary

	Mean	Median	SD	#
All Pairs	0.0299	-0.0034	2.2427	2504382
Excluding Mayoral Parties' CC Cand	0.0122	-0.0050	1.9451	1424901
Effective Cand	0.0052	-0.0009	2.3647	604433
Excluding Mayoral Parties' CC Cand & Effective Cand	-0.0034	-0.0016	2.0504	309919

Table 10: SVD Index - Summary

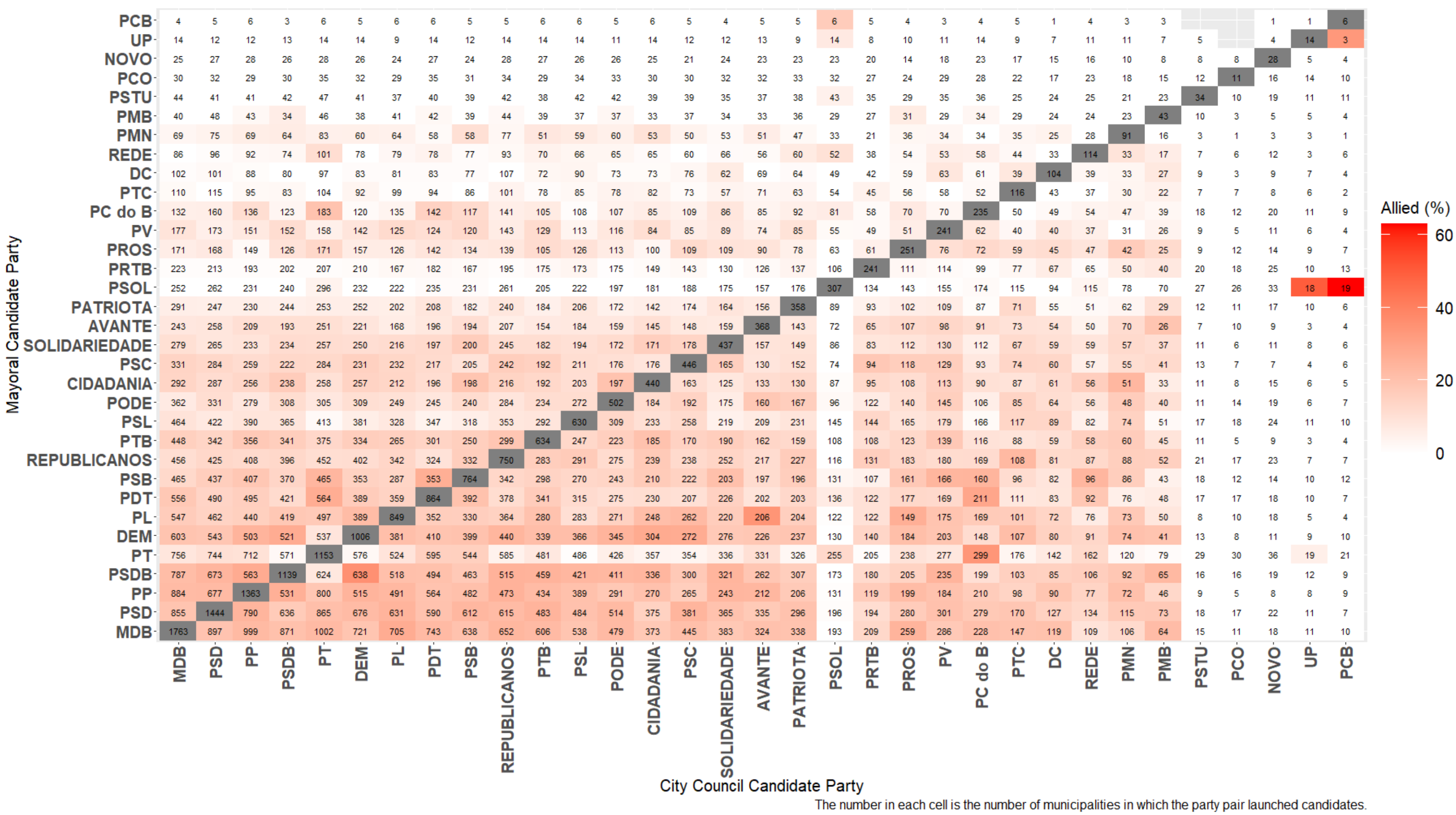

Figure 14: 2020 Elections - Mean Alliance in Electoral Coalitions

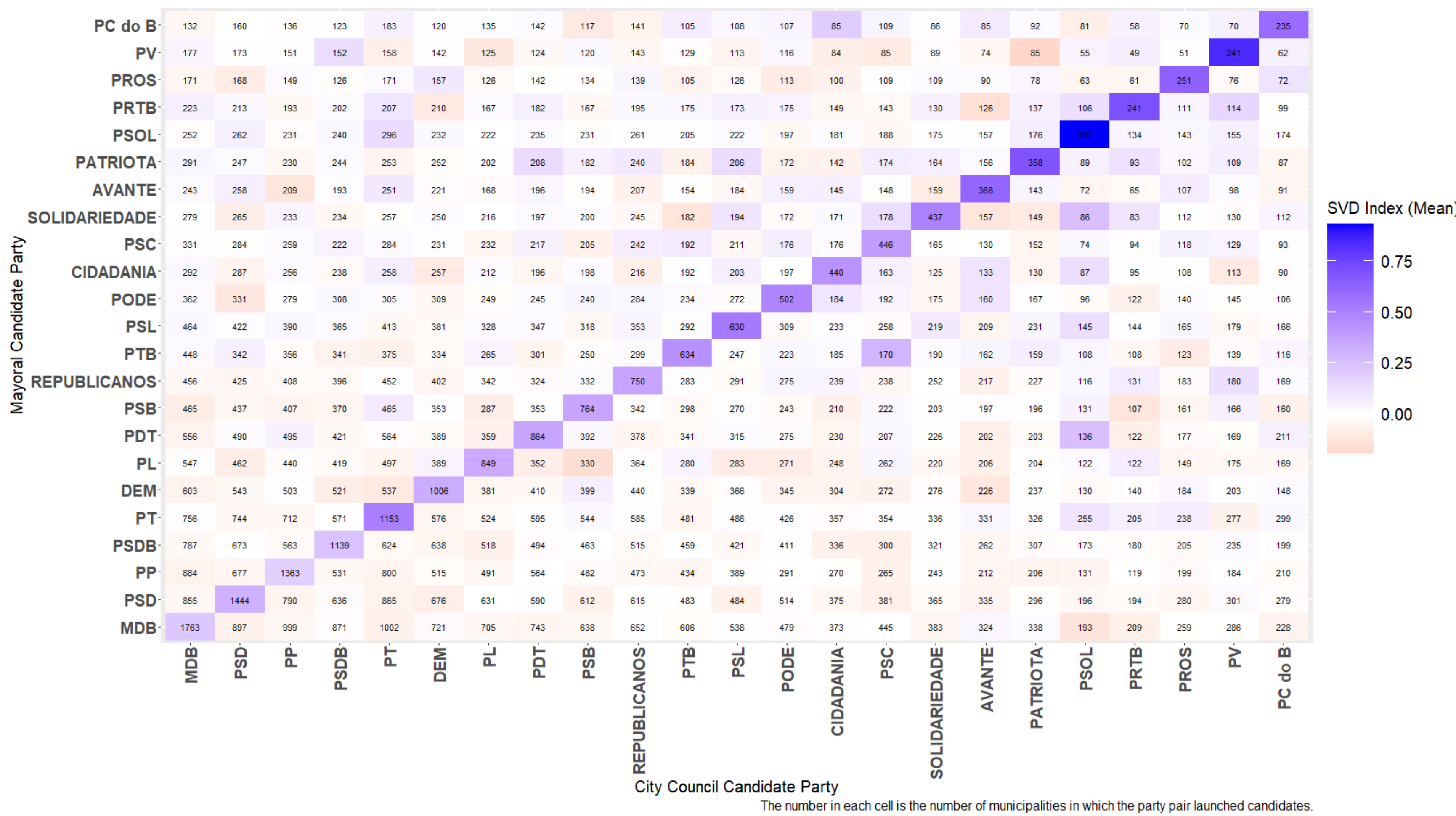

Figure 15: Mean SVD Index - All Pairs

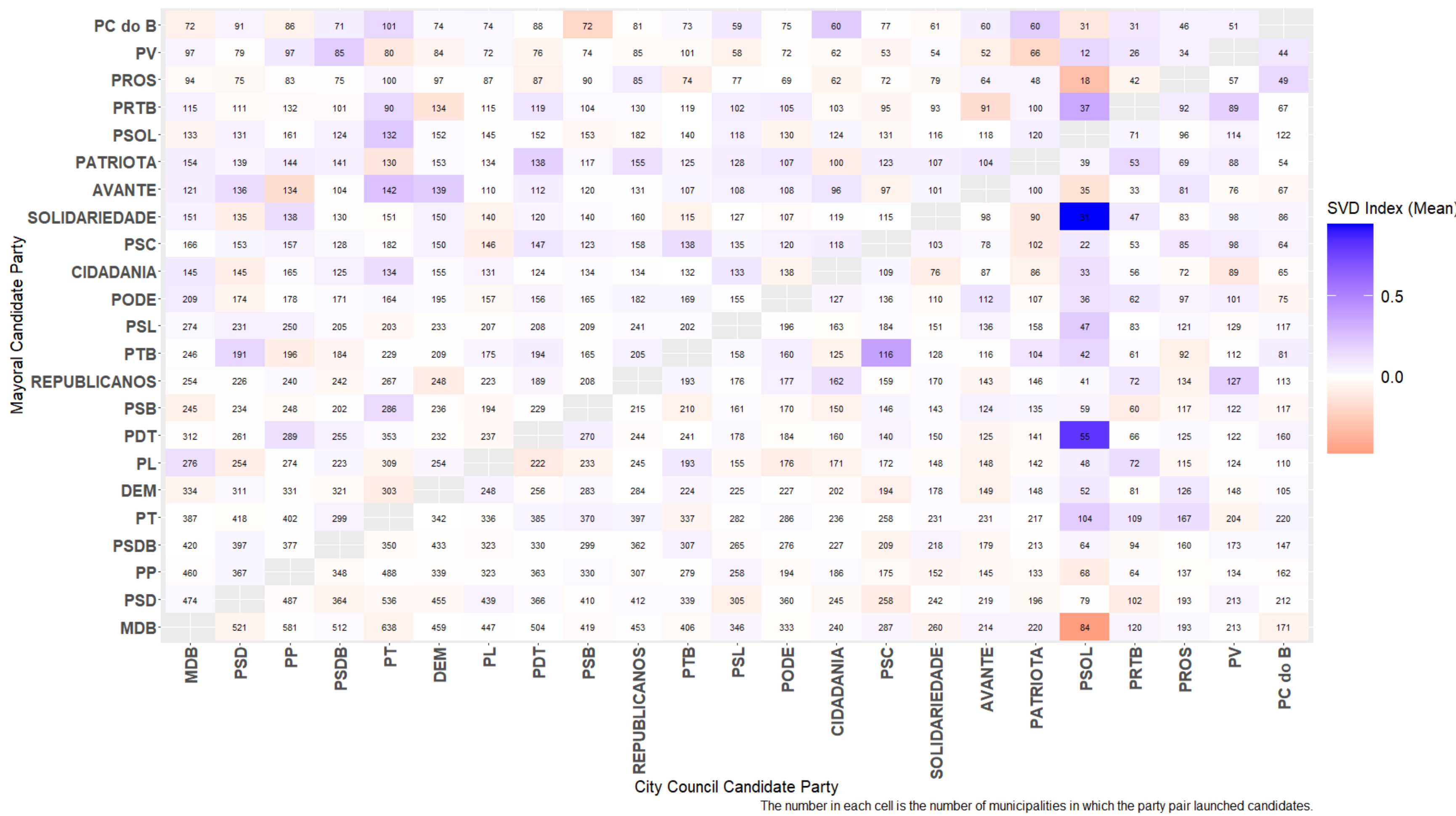

Figure 16: Mean SVD Index - Excluding Mayoral Parties' Council Candidates

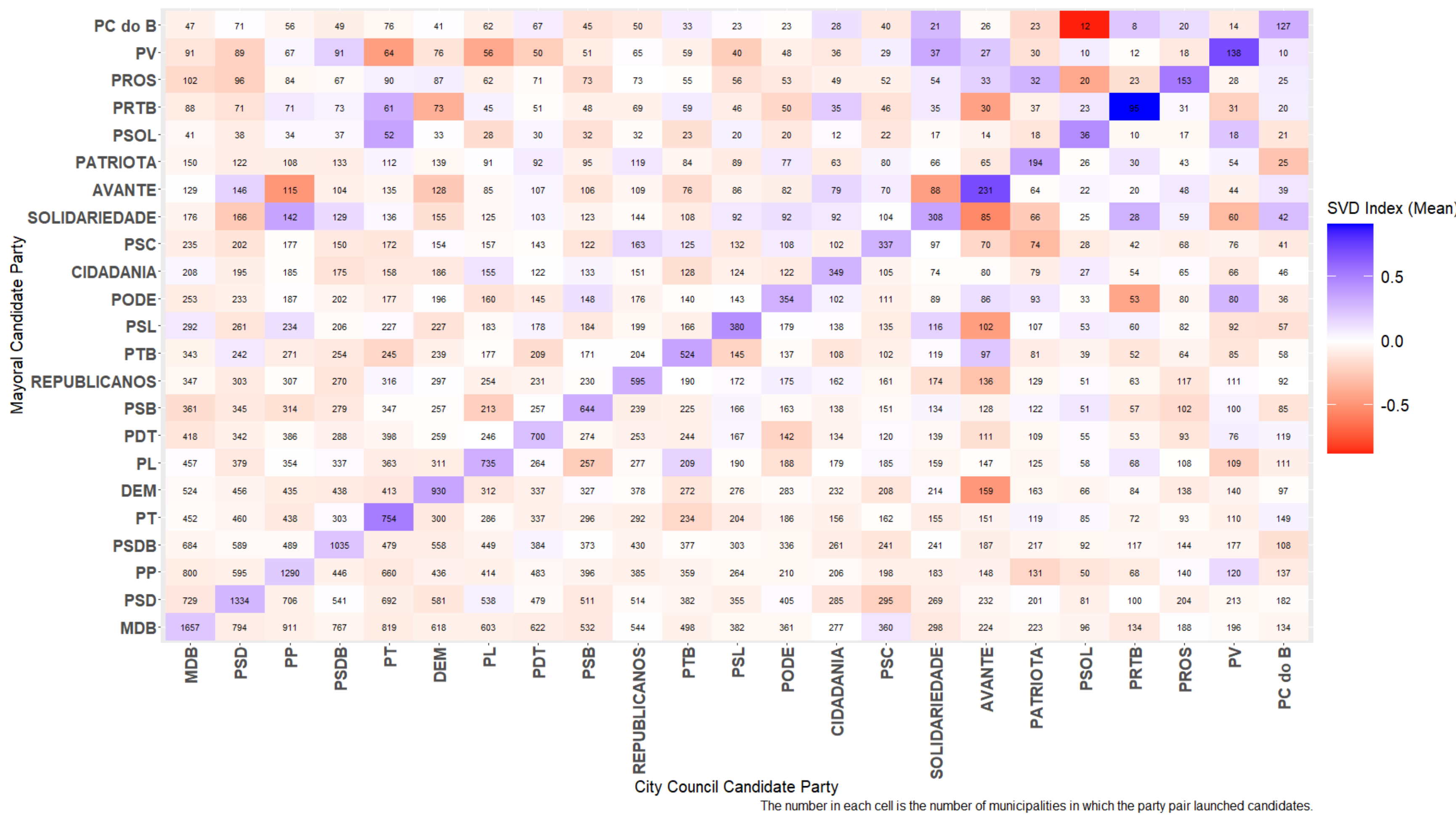

Figure 17: Mean SVD Index - Effective Candidates

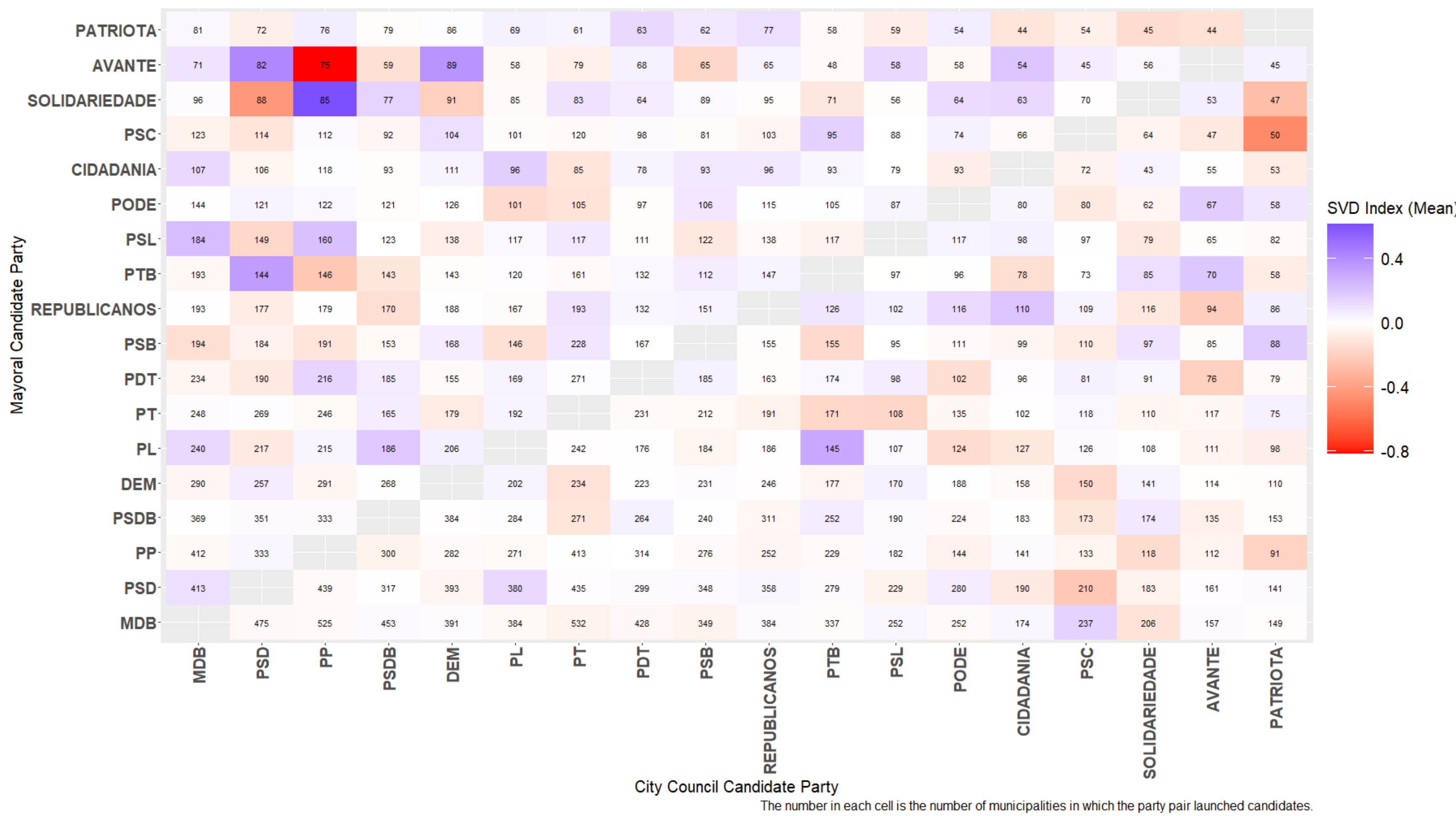

Figure 18: Mean SVD Index - Excluding Mayoral Parties' Council Candidates and Only Effective Candidates

Appendix C. Results and Extensions

Spatial Dependence Hypothesis

2SLS First Stage

Dependent Variable:	Allied
Model:	(1)
Variables	
d_coli_v1	-136.2***
	(4.429)
Fixed-effects	
Party Pair & State	Yes
Mayoral Cand. i	Yes
City Council Cand. j	Yes
Fit statistics	
Observations	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 11: Spatial Dependence Hypothesis' Test - First Stage

Alternative Measure

Dependent Variable:	Spatial Adjusted Correlation (SAC)			
	OLS	FE		
Model:	(1)	(2)	(3)	(4)
Variables				
Allied	1.583***	2.031***	3.429***	3.537***
	(0.0813)	(0.0861)	(0.0838)	(0.0879)
Fixed-effects				
Party Pair & State		Yes		Yes
Mayoral Cand. i			Yes	Yes
City Council Cand. j			Yes	Yes
Fit statistics				
Observations	1,424,899	1,424,899	1,424,899	1,424,899

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 12: Spatial Dependence Hypothesis' Test - SAC

Heterogeneity

Dependent Variables:	SVD Index	Spatial Adjusted Correlation (SAC)
Model:	(1)	(2)
Variables		
Allied	0.4158***	6.225***
	(0.0781)	(0.7546)
Allied*Q2_PS	-0.2045**	-1.368*
	(0.0837)	(0.8160)
Allied*Q3_PS	-0.2253***	-1.948**
	(0.0798)	(0.7766)
Allied*Q4_PS	-0.3239***	-3.437***
	(0.0780)	(0.7593)
Fixed-effects		
Party Pair & State	Yes	Yes
Mayoral Cand. i	Yes	Yes
City Council Cand. j	Yes	Yes
Fit statistics		
Observations	1,424,901	1,424,899

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 13: Spatial Dependence Hypothesis - Municipality Size Heterogeneity

Dependent Variables:	SVD Index	Spatial Adjusted Correlation (SAC)
Model:	(1)	(2)
Variables		
Allied	0.1618***	3.635***
	(0.0106)	(0.1087)
Allied*Incumbent Mayor	-0.0510***	-0.2744
	(0.0195)	(0.2076)
Fixed-effects		
Party Pair & State	Yes	Yes
Mayoral Cand. i	Yes	Yes
City Council Cand. j	Yes	Yes
Fit statistics		
Observations	1,411,225	1,411,223

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 14: Spatial Dependence Hypothesis - Mayoral Incumbency Heterogeneity

Dependent Variables:	SVD Index	Spatial Adjusted Correlation (SAC)
Model:	(1)	(2)
Variables		
Allied	0.1581***	3.620***
	(0.0114)	(0.1186)
Allied*MDB	-0.0024	0.1458
	(0.0287)	(0.3166)
Allied*PSD	-0.0552**	-0.5512*
	(0.0262)	(0.3256)
Allied*PP	-0.0184	-0.4302
	(0.0307)	(0.3486)
Allied*PSDB	-0.0524**	0.0505
	(0.0232)	(0.3358)
Allied*PT	-0.0117	-0.1989
	(0.0468)	(0.4493)
Fixed-effects		
Party Pair & State	Yes	Yes
Mayoral Cand. i	Yes	Yes
City Council Cand. j	Yes	Yes
Fit statistics		
Observations	1,424,901	1,424,899

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 15: Spatial Dependence Hypothesis - Mayoral Party Heterogeneity

Party Aggregation and Effective Candidates

Dependent Variable:	SVD Index				
	OLS		FE		2SLS
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Allied	0.1610***	0.1855***	0.2460***	0.2487***	0.2685***
	(0.0103)	(0.0123)	(0.0146)	(0.0152)	(0.0257)
Fixed-effects					
Party Pair & State		Yes		Yes	Yes
Mayoral Cand. i			Yes	Yes	Yes
City Council Cand. j			Yes	Yes	Yes
Fit statistics					
Observations	98,622	98,622	98,622	98,622	98,622

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 16: Spatial Dependence Hypothesis' Test - Council Parties

Dependent Variable:	SVD Index				
	OLS		FE		2SLS
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Allied	0.1492***	0.1625***	0.2230***	0.2365***	0.2447***
	(0.0087)	(0.0098)	(0.0129)	(0.0150)	(0.0276)
Fixed-effects					
Party Pair & State		Yes		Yes	Yes
Mayoral Cand. i			Yes	Yes	Yes
City Council Cand. j			Yes	Yes	Yes
Fit statistics					
Observations	309,919	309,919	309,919	309,919	309,919

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 17: Spatial Dependence Hypothesis' Test - Effective Candidates

Donations

Dependent Variable:	SVD Index				
	OLS		FE		2SLS
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Allied	0.0695***	0.0923***	0.1208***	0.1304***	0.1719***
	(0.0055)	(0.0065)	(0.0077)	(0.0087)	(0.0249)
Donation (i to j)	0.0159**	0.0124	0.0345***	0.0343**	-0.0064
	(0.0080)	(0.0086)	(0.0132)	(0.0140)	(0.0263)
Fixed-effects					
Party Pair & State		Yes		Yes	Yes
Mayoral Cand. i			Yes	Yes	Yes
City Council Cand. j			Yes	Yes	Yes
Fit statistics					
Observations	1,424,901	1,424,901	1,424,901	1,424,901	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 18: Spatial Dependence Hypothesis' Test - Inter-Candidates Donations

IV Analysis

Dependent Variable:	SVD Index					
	2SLS (V0)	2SLS (V1)	2SLS (V2)	2SLS (V3)	2SLS (V4)	2SLS (V5)
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Allied	0.1542***	0.1693***	0.1618***	0.1839***	0.2442***	0.2566***
	(0.0090)	(0.0160)	(0.0302)	(0.0394)	(0.0564)	(0.0726)
Fixed-effects						
Party Pair & State	Yes	Yes	Yes	Yes	Yes	Yes
Mayoral Cand. i	Yes	Yes	Yes	Yes	Yes	Yes
City Council Cand. j	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	1,424,901	1,424,901	1,424,901	1,424,901	1,424,901	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 19: Spatial Dependence Hypothesis' Test - Instrument Robustness

Dependent Variable:	Allied					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
d_coli_v0	-525.7***					
	(11.93)					
d_coli_v1		-136.2***				
		(4.429)				
d_coli_v2			-63.03***			
			(1.697)			
d_coli_v3				-37.31***		
				(1.030)		
d_coli_v4					-24.10***	
					(0.7916)	
d_coli_v5						-16.69***
						(0.6739)
Fixed-effects						
Party Pair & State	Yes	Yes	Yes	Yes	Yes	Yes
Mayoral Cand. i	Yes	Yes	Yes	Yes	Yes	Yes
City Council Cand. j	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	1,424,901	1,424,901	1,424,901	1,424,901	1,424,901	1,424,901

Clustered (Mayoral Cand. i & City Council Cand. j) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 20: Spatial Dependence Hypothesis' Test - Instrument Robustness (First Stage)

Brokerage Hypothesis

2SLS First Stage

Dependent Variables:	Allied CC Cand. S	Allied CC Cand. HC	Allied CC Cand. LQ
Model:	(1)	(2)	(3)
Variables			
Allied CC Cand. voting at PS (%)	0.0020***	2.171***	0.0357***
	(6.14×10^{-5})	(0.0632)	(0.0014)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 21: Brokerage Hypothesis' Test - First Stage

Dependent Variables:	M Cand. S	M Cand. HC	M Cand. LQ
Model:	(1)	(2)	(3)
Variables			
M Cand. voting at PS	0.0110***	48.79***	0.1982***
	(0.0006)	(2.298)	(0.0111)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 22: Brokerage Hypothesis' Test - "Inverse" First Stage

Dependent Variables:	Same Party CC Cand. S	Same Party CC Cand. HC	Same Party CC Cand. LQ
Model:	(1)	(2)	(3)
Variables			
Same Party CC Cand. voting at PS (%)	0.0017***	2.857***	0.0302***
	(5.15×10^{-5})	(0.0744)	(0.0009)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	239,695	239,695	239,695

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 23: Brokerage Hypothesis' Test - Baseline First Stage

Standardized Variables

Dependent Variables:	M Cand. S	M Cand. HC	M Cand. LQ
		2SLS	
Model:	(1)	(2)	(3)
Variables			
Allied CC Cand. S	0.3275***		
	(0.0235)		
Allied CC Cand. HC		0.4428***	
		(0.0200)	
Allied CC Cand. LQ			0.2766***
			(0.0150)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 24: Brokerage Hypothesis' Test - Standardized

Dependent Variables:	Allied CC Cand. S	Allied CC Cand. HC	Allied CC Cand. LQ
		2SLS	
Model:	(1)	(2)	(3)
Variables			
M Cand. S	0.0975***		
	(0.0315)		
M Cand. HC		0.1366***	
		(0.0246)	
M Cand. LQ			0.1086***
			(0.0227)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 25: Brokerage Hypothesis' Test - "Inverse" Standardized

Coattail Effects Framework

Dependent Variables:	M Cand. Vote Share (%)		Allied Vote Share (%)	
	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)
Variables				
Allied Vote Share (%)	0.7534***	0.4303***		
	(0.0201)	(0.0209)		
M Cand. Vote Share (%)			0.5070***	0.1654***
			(0.0132)	(0.0297)
Fixed-effects				
Polling Place	Yes	Yes	Yes	Yes
Fit statistics				
Observations	247,792	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 26: Brokerage Hypothesis - Coattails Effects Framework

Dependent Variables:	Allied Vote Share (%)	M Cand. Vote Share (%)
Model:	(1)	(2)
Variables		
Allied CC Cand. voting at PS (%)	0.2465***	
	(0.0077)	
M Cand. voting at PS		3.896***
		(0.1900)
Fixed-effects		
Polling Place	Yes	Yes
Fit statistics		
Observations	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 27: Brokerage Hypothesis - Coattails Effects Framework First Stage

Heterogeneity

Dependent Variable:	M Cand. S			
	#PS - Q1	#PS - Q2	#PS - Q3	#PS - Q4
Model:	(1)	(2)	(3)	(4)
Variables				
Allied CC Cand. S	0.1857***	0.1226***	0.1594***	0.1488***
	(0.0581)	(0.0244)	(0.0170)	(0.0149)
Fixed-effects				
Polling Place	Yes	Yes	Yes	Yes
Fit statistics				
Observations	3,167	12,852	31,861	199,912

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 28: Brokerage Hypothesis - Municipality Size Heterogeneity

Dependent Variable:	Allied CC Cand. S			
	#PS - Q1	#PS - Q2	#PS - Q3	#PS - Q4
Model:	(1)	(2)	(3)	(4)
Variables				
Allied CC Cand. voting at PS (%)	0.0020***	0.0022***	0.0021***	0.0017***
	(0.0004)	(0.0001)	(0.0001)	(7.22×10^{-5})
Fixed-effects				
Polling Place	Yes	Yes	Yes	Yes
Fit statistics				
Observations	3,167	12,852	31,861	199,912

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 29: Brokerage Hypothesis - Municipality Size Heterogeneity First Stage

Dependent Variable:	Allied CC Cand. S			
	#PS - Q1	#PS - Q2	#PS - Q3	#PS - Q4
Model:	(1)	(2)	(3)	(4)
Variables				
M Cand. S	0.7094***	-0.2165	0.2751**	0.2600***
	(0.2281)	(0.2473)	(0.1310)	(0.0675)
Fixed-effects				
Polling Place	Yes	Yes	Yes	Yes
Fit statistics				
Observations	3,167	12,852	31,861	199,912

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 30: Brokerage Hypothesis - Municipality Size Heterogeneity "Inverse"

Dependent Variable:	M Cand. S			
	#PS - Q1	#PS - Q2	#PS - Q3	#PS - Q4
Model:	(1)	(2)	(3)	(4)
Variables				
M Cand. voting at PS	0.0154***	0.0122***	0.0120***	0.0096***
	(0.0037)	(0.0017)	(0.0011)	(0.0006)
Fixed-effects				
Polling Place	Yes	Yes	Yes	Yes
Fit statistics				
Observations	3,167	12,852	31,861	199,912

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 31: Brokerage Hypothesis - Municipality Size Heterogeneity "Inverse" First Stage

Dependent Variable:	M Cand. S	
	Incumbent Mayor (Cand|Part)	Opponents
Model:	(1)	(2)
Variables		
Allied CC Cand. S	0.0645***	0.1271***
	(0.0193)	(0.0106)
Fit statistics		
Observations	69,487	176,884

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 32: Brokerage Hypothesis - Mayoral Incumbency Heterogeneity

Dependent Variable:	Allied CC Cand. S	
	Incumbent Mayor (Cand|Part)	Opponents
Model:	(1)	(2)
Variables		
Allied CC Cand. voting at PS (%)	0.0004***	0.0007***
	(2.1×10^{-5})	(2.41×10^{-5})
Fit statistics		
Observations	69,487	176,884

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 33: Brokerage Hypothesis - Mayoral Incumbency Heterogeneity First Stage

Dependent Variable:	Allied CC Cand. S	
	Incumbent Mayor (Cand|Part)	Opponents
Model:	(1)	(2)
Variables		
M Cand. S	-0.3337*	0.2641***
	(0.1929)	(0.0920)
Fit statistics		
Observations	69,487	176,884

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 34: Brokerage Hypothesis - Mayoral Incumbency Heterogeneity "Inverse"

Dependent Variable:	M Cand. S	
	Incumbent Mayor (Cand|Part)	Opponents
Model:	(1)	(2)
Variables		
M Cand. voting at PS	0.0041***	0.0075***
	(0.0004)	(0.0004)
Fit statistics		
Observations	69,487	176,884

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 35: Brokerage Hypothesis - Mayoral Incumbency Heterogeneity "Inverse" First Stage

Dependent Variable:	M Cand. S				
	MDB	PSD	PP	PSDB	PT
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Allied CC Cand. S	0.1126***	0.0891***	0.1005***	0.1835***	0.0219
	(0.0294)	(0.0254)	(0.0261)	(0.0416)	(0.0331)
Fit statistics					
Observations	23,136	21,313	18,372	19,501	16,774

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 36: Brokerage Hypothesis - Mayoral Party Heterogeneity

Dependent Variable:	Allied CC Cand. S				
	MDB	PSD	PP	PSDB	PT
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Allied CC Cand. voting at PS (%)	0.0005***	0.0005***	0.0005***	0.0003***	0.0008***
	(4.74×10^{-5})	(4.08×10^{-5})	(5.18×10^{-5})	(3.38×10^{-5})	(7.16×10^{-5})
Fit statistics					
Observations	23,136	21,313	18,372	19,501	16,774

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 37: Brokerage Hypothesis - Mayoral Party Heterogeneity First Stage

Dependent Variable:	Allied CC Cand. S				
	MDB	PSD	PP	PSDB	PT
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
M Cand. S	-0.1427	0.2055	0.3894	-0.3933	0.8165**
	(0.2417)	(0.3427)	(0.3522)	(0.5205)	(0.3427)
Fit statistics					
Observations	23,136	21,313	18,372	19,501	16,774

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 38: Brokerage Hypothesis - Mayoral Party Heterogeneity "Inverse"

Dependent Variable:	M Cand. S				
	MDB	PSD	PP	PSDB	PT
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
M Cand. voting at PS	0.0063***	0.0040***	0.0053***	0.0030***	0.0067***
	(0.0009)	(0.0008)	(0.0007)	(0.0008)	(0.0013)
Fit statistics					
Observations	23,136	21,313	18,372	19,501	16,774

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 39: Brokerage Hypothesis - Mayoral Party Heterogeneity "Inverse" First Stage

Effective Candidates

Dependent Variables:	M Cand. S		M Cand. HC		M Cand. LQ	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
s_EFCAND	0.1269***	0.1171***				
	(0.0066)	(0.0078)				
hc_EFCAND			0.2664***	0.4151***		
			(0.0319)	(0.0190)		
r_EFCAND					0.0791***	0.1013***
					(0.0129)	(0.0052)
Fixed-effects						
Polling Place	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	201,874	201,874	201,874	201,874	201,874	201,874

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 40: Brokerage Hypothesis' Test - Effective Candidates

Dependent Variables:	s_EFCAND	hc_EFCAND	r_EFCAND
Model:	(1)	(2)	(3)
Variables			
D_lv_EFCAND	0.0016***	1.886***	0.0302***
	(4.64×10^{-5})	(0.0519)	(0.0014)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	201,874	201,874	201,874

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 41: Brokerage Hypothesis' Test - Effective Candidates (First Stage)

Controlling for Mayoral Candidate's Polling Place

Dependent Variables:	M Cand. S		M Cand. HC		M Cand. LQ	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Allied CC Cand. S	0.1466***	0.1482***				
	(0.0076)	(0.0105)				
M Cand. voting at PS	0.0107***	0.0107***	47.15***	45.87***	0.1944***	0.1923***
	(0.0005)	(0.0005)	(2.236)	(2.187)	(0.0110)	(0.0109)
Allied CC Cand. HC			0.2672***	0.4764***		
			(0.0318)	(0.0215)		
Allied CC Cand. LQ					0.0901***	0.1374***
					(0.0220)	(0.0074)
Fixed-effects						
Polling Place	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	247,792	247,792	247,792	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 42: Brokerage Hypothesis' Test - Mayoral Candidate's Polling Place Indicator

Dependent Variables:	Allied CC Cand. S	Allied CC Cand. HC	Allied CC Cand. LQ
Model:	(1)	(2)	(3)
Variables			
Allied CC Cand. voting at PS (%)	0.0020***	2.169***	0.0357***
	(6.14×10^{-5})	(0.0631)	(0.0014)
M Cand. voting at PS	0.0019**	5.592***	0.0341***
	(0.0007)	(1.157)	(0.0102)
Fixed-effects			
Polling Place	Yes	Yes	Yes
Fit statistics			
Observations	247,792	247,792	247,792

Clustered (Municipality) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 43: Brokerage Hypothesis' Test - Mayoral Candidate's Polling Place Indicator (First Stage)