Essays on Comparative Politics Methodology

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ABSTRACT

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Chapter 1

Introduction

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Part I

The Statistical Analysis of Electoral Coalitions

> Brazil is very uneven, just a mess. One cannot understand it.

Federal deputy and mayor Luciano Castro (PR-RR), commenting on the different political alliances at the national and local levels in Brazil.
Folha de So Paulo, June 29th 2008.

> (C)itizens (are) divided politically not because of party loyalties, much less ideological considerations, but because of personal ties, making party labels seriously misleading at both the local and the national level.

Graham [1990, p.148] on political parties in 19th century Brazil.

Why do parties form coalitions? Research into this question in comparative politics has mainly focused on the formation of *government* coalitions in parliamentary systems [Martin and Stevenson, 2001] and coalition support for the president in separation-of-powers systems [Neto, 2006; Altman, 2000]. More recently, some attention has been paid to the electoral coalition agreements among parties in parliamentary systems [Blais and Indridason, 2008; Golder, 2006].

In this paper, we focus on the electoral coalition decisions in local legislative elections in Brazil. Building on pioneering work by Soares [1964], the coalition formation theory we propose has the following characteristics. We assume that parties have ideal points in a one-dimensional policy space. When forming coalitions, parties want to maximize the number of seats won in the election while minimizing the ideological distance between the coalition members' ideal points. The incentives for coalition formation depend, then, on the ideological preferences of the potential coalition partners and the constraints imposed by political (the expected party share of the votes) and institutional (the magnitude of the district) context. We derive a statistical model from these assumptions, which allows us to estimate both the spatial location of parties and the structural parameters of the model.

The statistical model we propose is closely related to ideal point estimation methods that rely on roll call data. Such models require repeated decisions by the same actors in a large number of elections. The massive data available from the Brazilian local legislative elections provide us an excellent opportunity to estimate models of electoral coalition formation. In the elections of 2000, 368 thousand candidates competed for the 60 thousand municipal legislators seats available in the more than five thousand independent elections (one per municipality) across the nation. The

number of seats in each election varied from 9 (the constitutionally mandated minimum) to 55. The number of candidates in each election ranged from 9 (in So Julio, Piau state) to 1095 (in So Paulo, So Paulo state). Candidates competed as members of 31 political parties under open-list proportional representation using the D'Hondt method. Parties were free to form pre-electoral coalitions (*coligaes*) in each election. There were 2845 different electoral coalitions formed in the 2000 elections.

Since local political institutions in Brazil follow a separation-of-powers structure, we argue that these coalitions do not form in order to attain a majority in the legislature. These pacts, after all, are frequently different from those agreed upon for the competition for the Mayoral offices that occur simultaneously with the local legislative elections. We argue instead that electoral coalitions are simply pre-electoral agreements to share surplus votes when translating votes to seats.

We find that there is an important ideological component to the parties' decisions to form pre-electoral coalitions. Coalitions more frequently arise between parties that are closer to each other in the ideological space. The overall party ordering estimated using the coalition data is highly correlated with the positions estimated using roll calls in the national legislature, giving some face validity to the model. We also find that the institutional and political contexts, specifically the district magnitude and the size of the political party in the district, are just as important to the coalition decisions.

The paper is structured as follows. First we outline the institutional features of local legislative elections in Brazil and briefly summarize the literature on this question. We then discuss the problems of measuring ideology in Brazil and argue that the coalition data is a potentially good source for estimating party ideal points. Next, we present our statistical model of coalition formation and show the results from estimating our model using the 2000 elections. We conclude by discussing possible extensions to our model and its applicability in other contexts.

1.1 Electoral coalitions in Brazil

In the 2008 election for mayor in the Brazilian fourth largest city, Belo Horizonte, the two main opposing parties in Brazil – PT (Workers Party) and PSDB (Social Democratic Party) – formed an (informal) coalition. If one looks at roll calls in Congress, these parties couldn't be farther apart

[Leoni, 2002]. Yet, an alliance between the state governor (Acio Neves, PSDB) and the then mayor[1] (Fernando Pimentel, PT) was formed to (successfully) elect Mrcio Lacerda (PSB) as mayor.

The dissonance between local and national politics is seemingly maddening even for professional politicians and academics. In this paper, however, we show that there is an ideological structure in the electoral coalition decisions in local legislative elections in Brazil. The theory we propose is simple, taking into account electoral imperatives and ideological preferences. In addition, since these decisions are made by the rank-and-file of the political parties, this analysis of coalition decisions serves to illuminate the interplay of politics at the national and regional levels.

Local legislators in Brazil are elected under open-list proportional representation using a modified D'Hondt system. In this system, voters cast their vote for a specific candidate or for a political party. Votes are then aggregated up to the electoral list. The D'Hondt formula is used to distribute seats to lists, while candidates within each list are ordered according to how many individual votes they received in the election. The only modification to the D'Hondt system is that parties/coalitions that received less than one "electoral quotient" (sum of valid votes divided by the number of seats) do not receive any seats. This means that there is an effective threshold of 1/number of seats, ranging from 11 % in the smallest cities to 2% in the largest city. This provides a substantive incentive for small parties to form coalitions in small cities.

The mechanical effect of the modified D'Hondt system on total party shares of local legislators in Brazil is plotted n Figure 1.1.

Invalid votes and abstentions are excluded from the calculations. Votes are cast for individual candidates or parties, but 87% of the voters select a specific candidate. All votes are aggregated up to electoral lists. Electoral lists may be made up by more than one party, joined together in an electoral coalition (*coligao*). Fundamentally, an electoral coalition is an agreement to share "surplus" votes across political parties. Perhaps as importantly in the largest municipalities, parties also agree to share the assigned free television time they have. Elections for mayors and local legislators are held concurrently in the midterm of the national elections.

That parties and coalitions play a minor role in elections in Brazil can be glanced from political advertisement in Brazil. Figure 1.2 shows a typical political advertisement that can be found in the Brazilian streets during election season. The add is dominated by the face, name and number

[1]Executive political positions in Brazil (mayors, governors and Presidents) can only be re-elected once.

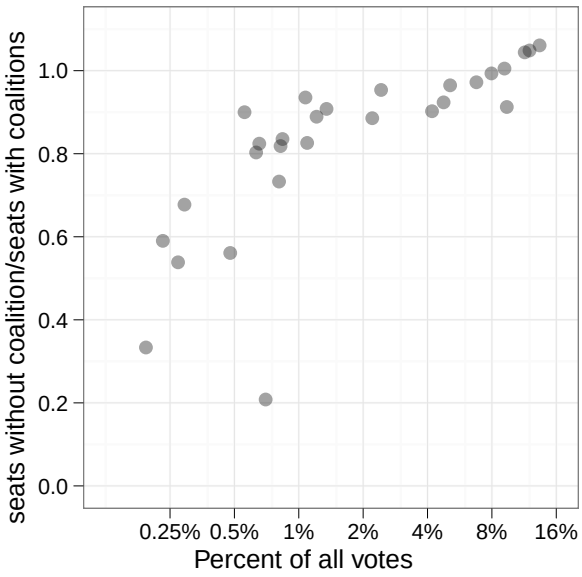


Figure 1.1: comparison

of the candidate. The number is important, since knowing it is necessary for the voter to cast his/her vote to a specific candidate in the voting booth. Brazil uses electronic voting since the 1996 elections. The party of the candidate occupies a very small space in the add. Finally, there is usually some reference to the candidate of the Executive post (Mayor, in this case).

There is a growing literature on the analysis of electoral coalitions in Brazil. The pioneering work was done by Soares [1964]. Making use of the Downs [1957]'s spatial theory of democracy, Soares proposed two theories/hypotheses to account for electoral coalition formation in Brazil. The "cost minimization theory" hypothesis states that parties will form coalitions in order to maximize their seat shares given the number of votes they expect to get in the forthcoming elections. The "ideological resistance" hypothesis states that parties prefer to form coalitions with parties that have similar ideological positions.

That article ignited a cottage industry of papers studying electoral coalitions in Brazil, which has been particularly active in the recent period.[2] This literature, however, faces a couple of serious short-comings. First, the ideology measures used are hard to replicate and not explicitly linked to any sort of political behavior. Secondly, the theoretical development seem to have stagnated with

[2]Miguel and Machado [2007] provide an excellent review of the literature.

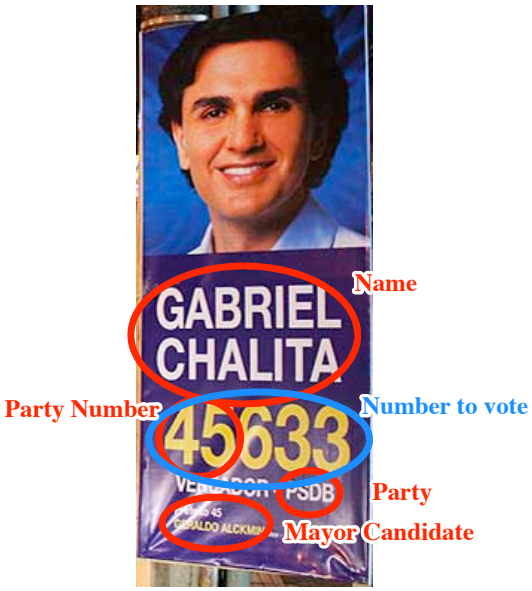


Figure 1.2: Add for a Vereador candidate in So Paulo. Note that the picture of the candidate covers most of the add and the party label is comparably very small. The coalition is nowhere to be seen.

Soares article from four decades ago. "Ideological resistance" and "cost minimization" are seen as "either-or" propositions, without an integrated way to think about how they both might affect party behavior. A final problem is the lack of a statistical model, without which the importance of ideology and/or "cost minimization" hypotheses on party behavior cannot be ascertained.

1.2 On ideology and its measurement

Ideology in modern political science is currently thought as a theory of political behavior. We start by assuming that the policy space is high dimensional. For instance, views about international trade, government support for child care, abortion, taxes, etc, can all vary independently across voters and politicians. However, research has shown that most of the issues governing the day are highly correlated, so that when one analyzes the actions of decision makers, just one or two dimensions might be sufficient to explain most of the behavior. This low dimensional space is called "predictive", "basic" [Poole, 2005, p.13-14] or, most commonly, "ideological" space [Hinich and Munger, 1994].

If we define ideological space as the predictive dimensions of political behavior, it is not sur-

prising to note that state of the art measurement models of ideology derive ideal point estimates from observed political action. There is a long and noble tradition of measuring ideology of legislators using their roll call votes.[Poole and Rosenthal, 1997, e.g.]. Clinton *et al.* [2004, p.355] go so far as stating that the "primary use of roll call data is the estimation of ideal points." As these authors note, roll calls are effective measures for describing the behavior of legislators. There are a many other things that legislators do, of course. But roll calls are both readily available in many legislatures, and also important since they record preferences over actual policies. Researchers also use roll calls in order to *test* spatial theories of political behavior. In this tradition, one starts by formulating a (formal) theory of behavior, derives the implications of such theory and then estimates a model that follows from it.[Poole, 2005, p.9]

One should note that there is nothing particularly special about roll call data: any other record of behavior that can be thought of as a consequence of the theory being tested is likely to be just as useful. What is in fact special about roll call data is the extraordinary quantity and time-span of such data for the United States Congress and many other legislatures across the world.

In Brazil a one dimensional model of roll call behavior seems to fit well the data [Leoni, 2002]. The two-dimensional ideal points for legislators in the legislative sessions from 1991 until 2006 are displayed in Figure 1.3, along with estimated cutting-lines[3] . The cutting-lines are estimates of the lines separating legislators voting *Yea* from those voting *Nay*. A one dimensional model predicts correctly around 88% of the roll call votes in the 1991-1996 session and 92% in the legislative sessions from 1995 until 2006.

The Figure is interesting for what it does *not* show: from 1995 to 2002 the roll call cutting-lines almost never separate parties in the majority. The majority is located in the right side of the space in the 1991-2002 sessions and in the left side of the space in the 2003-2006 session. Since roll calls do not split the majority parties, there is limited information available in them that is useful to differentiate parties *within* the majority.

Another, more serious, problem is that the estimated ideal points can only be treated as such (ideological ideal points) if roll call behavior is driven predominantly by spatial preferences. Let i index legislators and j index roll calls. A function linking preferences x_i to roll call behavior y_{ij} can be written as:

[3]We used the `wnominate` 2007 `R` package to perform estimation and plots.

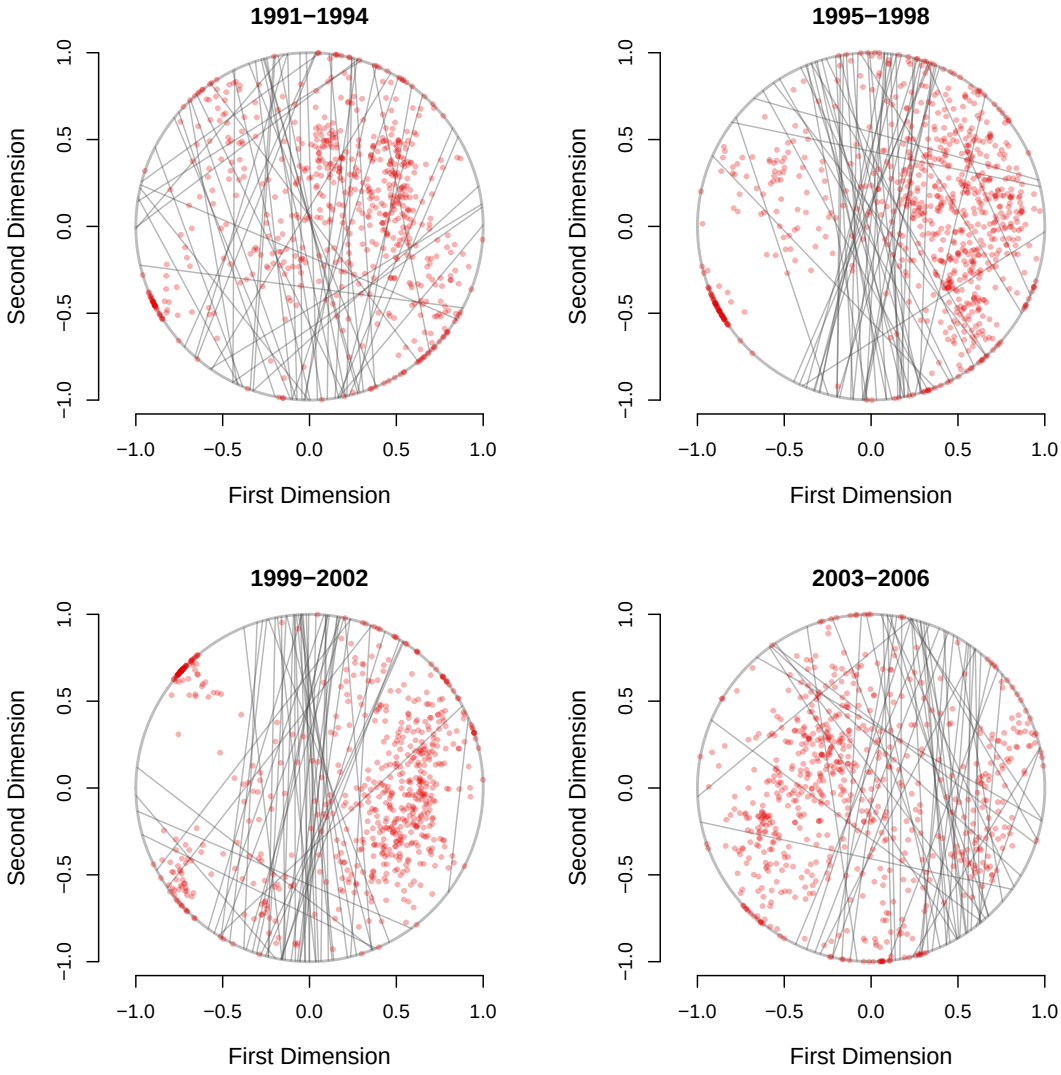


Figure 1.3: W-NOMINATE ideal point estimates of the Brazilian Chamber of Deputies, 1991-2006. Note how, starting in the 1995-1998 session, cutting lines are almost all vertical and concentrated in a small portion of the state.

$$y_{ij} = f(\alpha_j + x_i\beta_j + e_{ij}) \tag{1.1}$$

That is, the model assumes that only preferences drive behavior. More precisely, the errors e_{ij} are independent and identically distributed. If, however, there is some sort of vote buying z_{ij} that is not constant across legislators, then estimated ideal points will be biased. This would be of not much consequence if all we want is a description of roll call behavior, but insufficient if we want to test a theory of behavior. In the case of Brazil, part of the literature claims there is a *quid pro quo* between Presidents and legislators.[Alston and Mueller, 2006; Alston *et al.*, 2007; Zucco, 2007] Presidents have the authority to withhold expenditures under the Brazilian Constitution, so, according to the argument in these articles, they have leverage when dealing with legislators. Since such vote buying is in general inconsistent with pure spatial voting, the usual estimators of ideal points will lead to misleading estimates of preferences. This argument is more fully developed by Zucco [2009]. He combines roll call data with a self-positioning of legislators measured using surveys and finds that the influence of ideology (as measured by the surveys) on roll call behavior of deputies has declined over time in Brazil.

Another way to deal with the issue is to find data where such constraints (e.g. vote buying) are not as relevant. and Groseclose [2000] argue that measuring ideology lop-sided roll calls in Congress are closer to the "true" preferences of legislators, and the difference between these preferences measured using lop-sided votes and preferences measured using non lop-sided serve as a measure of party influence on roll call behavior. More generally, we want to find behavior that is important (behavior that "matters") but not overwhelmingly influenced by outside actors (e.g. the President). In this vein, Monroe *et al.* [2008] propose to measure ideal points using political text and speech; Alemán *et al.* [2009] use cosponsorship, that is, data on which legislators cosponsor each other bills, to estimate ideal points using singular value decomposition techniques; Finally Saiegh [2009] uses survey data from political elites.

Most of these measures, however, are restricted in their ability to estimate ideal points of small political parties. If there is only one or two legislators in Congress that are members of a particular political party, for example, there is not sufficient information to estimate an ideal point for that party. For the same reason, it is usually impossible to estimate intra-party (e.g. cross-district) variation of ideal points using roll call data. There are simply not enough data. Zucco faces the

same issues, relying on at most 250 legislators per legislature.

The massive amount of data on party coalition behavior in local elections in Brazil, we argue, can help us in this regard. In the next section we present a model of coalition formation. We derive from it a statistical model that is able to simultaneously estimate party ideal points and, as importantly, structural parameters that relate political context and structure to the likelihood of forming a coalition. Local coalition decisions are useful because they reflect decisions by the rank-and-file of the party at the lowest level of elected office in Brazil, with arguably little interference from the nation-wide party leadership.

Figure 1.5 displays coalitions decisions for the 31 parties competing in the 5559 local legislative elections in 2000 in Brazil. In the diagonal are the number of elections each party participated in. Each row displays the count of elections where the row-party formed a coalition with the column party. The parties are ordered using a seriation algorithm that puts similar parties (in terms of coalition behavior) together.[4] The color scale displays the proportion of the coalitions that includes the row-party that also include the column-party. For instance, more than 40% of the coalitions that the PCdoB formed also include the PT. On the other hand, only about 25% of the coalitions formed by the PT also include the PCDOB.

The most important feature of the matrix is that it has relatively few zero entries. This implies that ideology is far from being the overwhelming driver of coalition decisions. The main left wing party (PT) formed coalitions with the main right-wing party (PFL) in about 2% of the elections it is a participant of. In fact, the PT (and only the PT) formed at least one coalition with every other party in Brazil in the 2000 elections: from the trotskist PCO to the nationalist right wing PRONA. Nevertheless, it is immediately obvious that the parties have preferred partners. The communist parties PCB and PCdoB, for example, have the PT in their coalition in almost half the elections they participate in. Coalition decisions, therefore, do seem to be at least partly driven by ideology.

[4] We use the `seriation` function of the `cba` R package Buchta and Hahsler [2006].

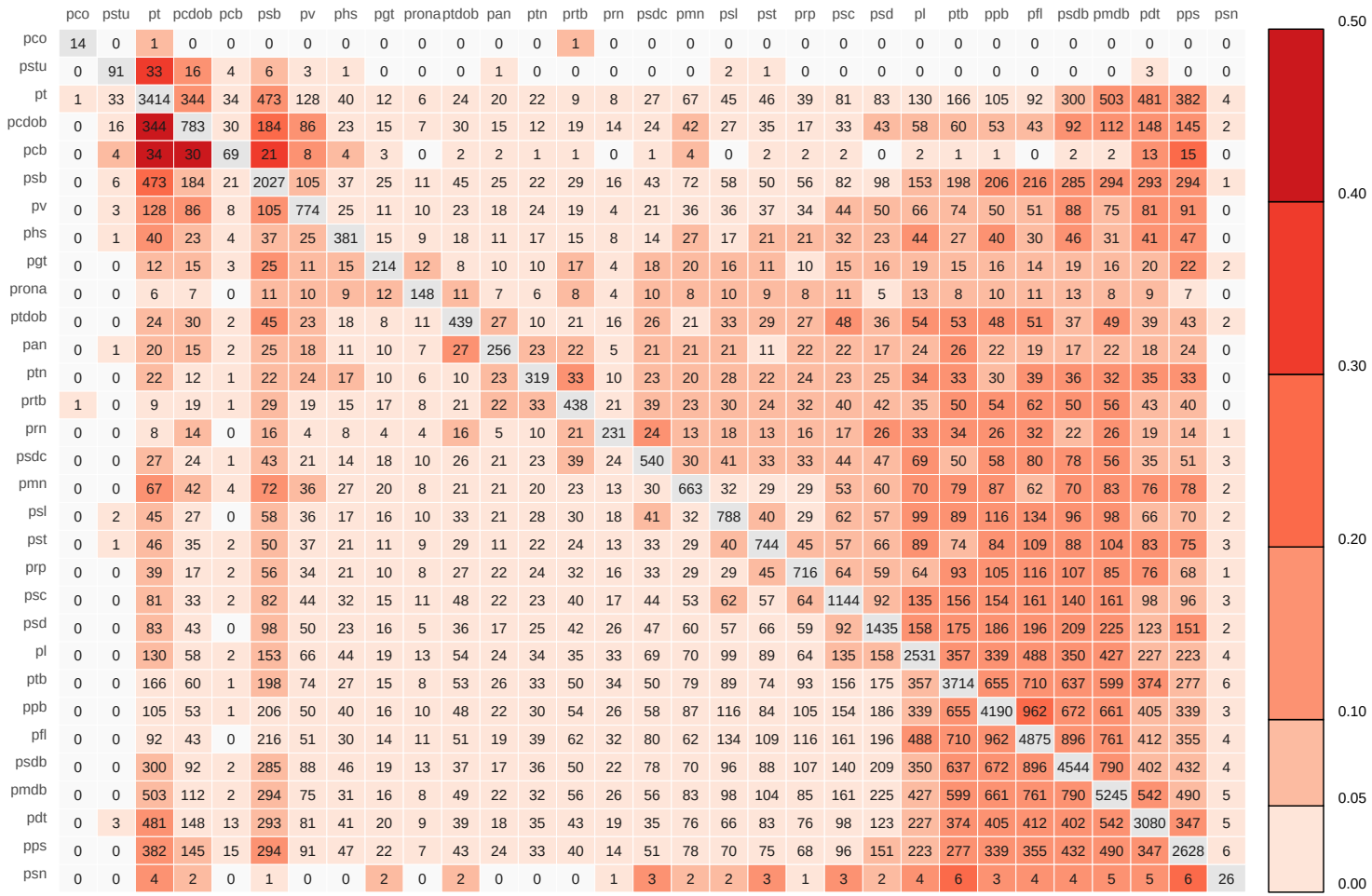


Figure 1.4: Counts of coalition decisions in the Brazilian local legislative elections of 2000. Each cell displays the counts of coalitions that include the row-party and the column-party. The color scale reflects counts as a proportion of all coalitions of the row party.

1.2.1 State level preferences

Brazil is large federal country, with important regional variations in terms of economic and social structure. Thus, it is likely that there is also regional variation of party preferences across states. In the United States, for example, for a long time there was a noticeable split between southern and northern Democrats in the United States on civil rights issues[Poole and Rosenthal, 1997]. In the case of Brazil, many scholars argue that state-level actors are not only independent on local matters, but also have a great deal of influence on national level politics. Mainwaring [1997] calls this "robust federalism":

> Brazil has long been the case of most robust federalism in Latin America ... By robust federalism, I mean that, during democratic periods, mayors and governors have been powerful actors with significant autonomy vis--vis the federal government and with significant resources. The catchall parties are decentralized, and parties and politicians generally follow a logic of federalism. Many of their actions are determined more by what goes on in their own states than by what goes on in national politics. In fact, the national parties are still to a considerable extent a federation of state parties.[Mainwaring, 1997, p.83]

Samuels [2003] and Abrucio [1998] argue that the legislative institutions at the national assembly, particularly the budgetary committees, are structured in order to privilege state-level actors. They argue that elections for congress are based on state-wide districts and governors are supposedly more influential on the election success of national legislators than the national parties or the President.

Even if the governors themselves had little influence on roll call behavior, the extensive regional differences across Brazil are likely to have effects on the preferences of legislators, even for legislators from the same party. Using roll call data both from the Senate and from the Cmara, Desposato [2003] found that national party cohesion is, in fact, lower than state-party cohesion.

As show in the right panel of Figure 1.5, the coalition data set is much richer than the Cmara dos Deputados roll call data set for estimating district level preferences of the Brazilian parties. The parties and states in the figure are ordered by the number of coalitions present in each party/state. Note that for none of the parties we have roll call information from every state. More worryingly,

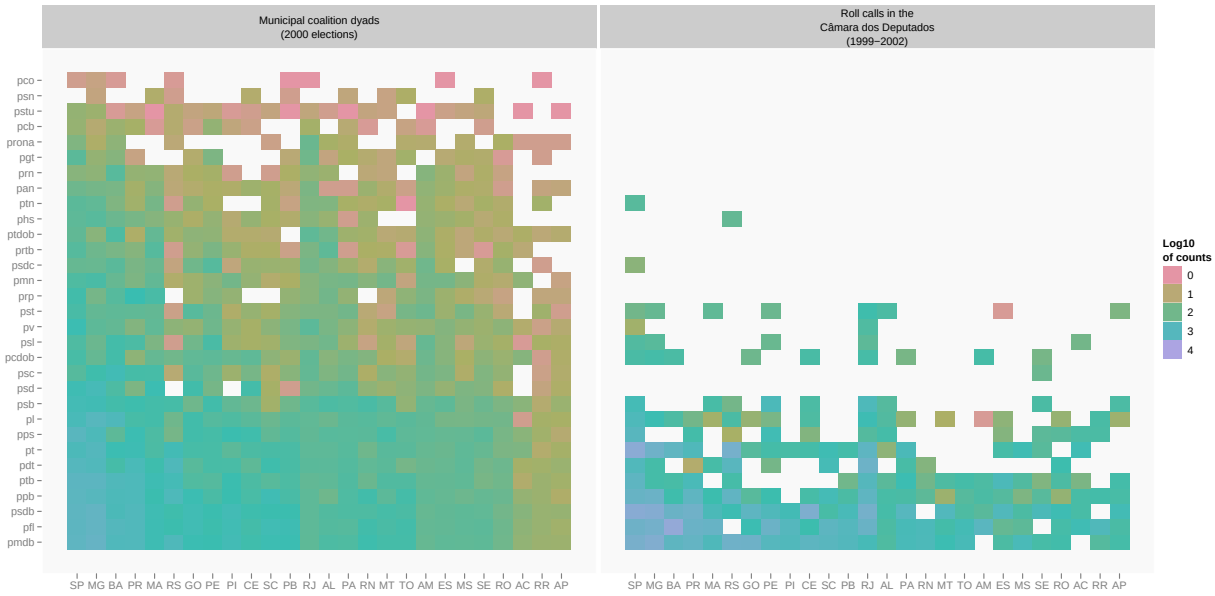


Figure 1.5: Coalition dyads and roll calls in the national lower house by state.

only about 6 or 7 parties have representatives from more than half the Brazilian states. The coalitions data, on the other hand, covers every state for the main political parties in Brazil.

1.3 A statistical model of electoral coalition formation

In this section we present a simple model of electoral coalition formation. There are N individual parties competing in M elections. Elections are held across S states. We assume that parties first choose the largest set of parties that they are willing to form a coalition with. Parties that choose the same set S_m form a coalition S'_m. This can be different from S_m, since it is not necessary that all parties in S_m accept to join the coalition for a subset of the coalition to form.[5] Therefore, if a coalition involving party i and party j is observed at election m, we know that $S_{im} = S_{jm}$ and $U_{im}(j \notin S_{im}) < U_{im}(j \in S_{im})$ and $U_{jm}(i \notin S_{jm}) < U_{jm}(i \in S_{jm})$. Conversely, if parties i and j are not in the same coalition in election m, we know that $S_{im} \neq S_{jm}$ and $U_{im}(j \notin S_{im}) > U_{im}(j \in S_{im})$ or $U_{jm}(i \notin S_{jm}) > U_{jm}(i \in S_{jm})$.

[5]We adopt the assumptions of the game named as Δ by Hart and Kurz [1983]. Note, however, that in our model parties do not behave strategically. This assumption is similar to the independence of irrelevant alternatives in multinomial logit models. See Train [2003] for a discussion.

We need a parametric form to proceed to empirical analysis. We define the utility for party i of adding a party j to the coalition as follows. We start by assuming that each party i in state s can be located at point x_{is} in a one-dimensional policy space. The utility function we propose has two additive components. The first is the policy cost of forming a coalition with a party that has, in general, different policy positions from one's own. This cost is modeled as $-|x_{is} - x_{js}|$. The second component is the non-spatial threshold parameter v_{im} for party i of adding party j to the coalition in election m. Party i offers party j a coalition proposal if:

$$-|x_{is} - x_{js}| + v_{im} \quad > \quad 0 \tag{1.2}$$

In more words, party i will extend an offer to party j if and only if the expected spatial cost is less than the threshold parameter v_{im}. This completes the deterministic component of the parties' utilities. To cast this decision in terms of a random utility model we add error terms e^1_{ijm} and e^0_{ijm} to $U_{im}(j \in S_{im})$ and $U_{im}(j \notin S_{im})$ respectively. These are the stochastic components of the utility functions. The probability that party i extends an offer to party j in election m is then:

$$\begin{aligned} P(z_{ijm}) &= P(-|x_{is} - x_{js}| + v_{im} + e_{ijm} > 0) && (1.3) \\ &= P(-|x_{is} - x_{js}| + v_{im} > -e_{ijm}) && (1.4) \end{aligned}$$

This is in general different from the probability that party j extends an offer to party i:

$$P(z_{jim}) = P(-|x_{is} - x_{js}| + v_{jm} > -e_{jim}) \tag{1.5}$$

Recall that we do not observe the offers being made, we only observe if parties i and j accept offers from each other. Let y_{ijm} be a binary variable reflecting the observation that parties i and j formed a coalition in election m. Given our assumptions, we know this occurs only if the inequalities in equations 1.3 and 1.5 are simultaneously satisfied. We further simplify the problem by assuming that e_{ijm} and e_{jim} are independent and have each variance 1 and mean 0. With this assumption we now have:

$$P(y_{ijm}) = P(U_i(j \in S_{im}) > U_i(j \notin S_{im})) \cdot P(U_j(i \in S_{jm}) > U_i(i \notin S_{jm})) \tag{1.6}$$

$$= P(v_{im} - |x_{is} - x_{js}| + e_{jim} > 0) \cdot P(v_{jm} - |x_{is} - x_{js}| + e_{ijm} > 0) \tag{1.7}$$

$$= \Phi(v_{im} - |x_{is} - x_{js}|) \cdot \Phi(v_{jm} - |x_{is} - x_{js}|) \tag{1.8}$$

The threshold parameter is modeled as a function of party size. district magnitude and an election specific error term. We reason as follows. Let the (expected) proportion of votes for party i in election m be p_{im}. Let z_m be the magnitude of the district in election m. Under the open-list D'Hondt electoral system, candidates from parties attaining less than $1/z_m$ votes do not get elected. Note that this happens even if p_{im} is greater than the proportion of votes necessary to elect the least successful candidate of some other party with a share of votes higher than $1/z_m$. Thus, the D'Hondt system favors large parties/coalitions at the expense of smaller parties. However, the degree of proportionality in proportional representation systems increases with district magnitude. Hence, the incentives for coalition formation decrease with $\frac{p_i}{1/z_m} = p_i \cdot z_m$, and this effect should get smaller as p_i and/or z_m get larger. We model this multiplicative effect using natural logs[6]:

$$v_{im} = \gamma_1 + \gamma_2 \log(p_{im}) + \gamma_3 \log(z_m) + g_m \tag{1.9}$$

Parameter γ_1 is the overall intercept of the statistical model. We expect both γ_2 and γ_3 to be negative. The error term g_m is assumed to have a normal distribution with variance σ^2_{city}.

1.4 Estimation

We observe parties forming coalitions in M separate elections, nested within the 26 Brazilian states. The decisions in each election are represented in a Y_m lower-triangular matrix. The parameters x and γ are unobservable quantities and have to be estimated. Since these quantities are not observed, the estimation turns out to be a difficult maximization problem. For each additional party i in state s we have to estimate an additional parameter x_{is}. And for each additional election m we have a new g_m to estimate. Thus, as the sample size increases, so does the number of parameters in

[6]We will exclude parties with zero votes from the estimation.

the model. This causes problems to the maximum likelihood estimation.[Clinton *et al.*, 2004, p.358] These are, however, of not very much consequence to the Bayesian estimation, since the Bayesian approach holds the data fixed and approximations, when necessary, depend only on the number of simulations performed and not on the size of the data.

The likelihood of the model is:

$$L(x, \gamma|Y) = \tag{1.10}$$

$$\prod_{m=1}^{M} \prod_{i=2}^{N} \prod_{j=1}^{i-1} \{\Phi(v_{im} - |x_{is} - x_{js}| + g_m)\Phi(v_{jm} - |x_{is} - x_{js}| + g_m)\}^{y_{ijm}} \tag{1.11}$$

$$\times \{(1 - \Phi(v_{im} - |x_{is} - x_{js}| + g_m)(1 - \Phi(v_{jm} - |x_{is} - x_{js}| + g_m)\}^{(1-y_{ijm})} \tag{1.12}$$

Estimating state-specific ideal points for the parties introduces comparability problems, since parties in any given state interact only with other parties in the same state. Thus, to compare party ideal point locations across states we need further assumptions. We follow Martin and Quinn [2002] in using a hierarchical model. These authors use a dynamic hierarchical prior on ideal points, more specifically a random walk prior that is conditional on the ideal point in the last period.(p. 135) In our case, instead of time the relevant grouping structure is state. Since states are unordered, the model is not dynamic (and therefore much simpler to estimate.) The prior for the ideal point of party i in state s is:

$$x_{is} \sim N(\bar{x}_i, \sigma_x^2) \tag{1.13}$$

Bayesian estimation requires us to specify prior distributions for all unknown parameters. We chose the following weakly informative priors [Gelman *et al.*, 2008] [7] $\bar{x}_i \sim N(0, 10^2)$; $\gamma_k \sim N(0, 10^2)$; $g_m \sim N(0, \sigma_{city}^2)$; $\sigma_{city} \sim U(0, 10)$; $\sigma_x \sim U(0, 10)$.

We still need to set restrictions on the policy space due to additive and multiplicative aliasing to identify the model.[Bafumi *et al.*, 2005] In a one-dimensional policy space, two linear restrictions are required in order to identify such models.[Rivers, 2004] We choose to fix the prior mean ideal points of two of the parties, Partido dos Trabalhadores (Workers Party, PT) and Partido da Frente

[7] Note that we follow the advice of Gelman [2004] on the estimation of the variance parameters.

Liberal (Liberal Front Party, PFL). These are the most important parties at, respectively, the left and the right of the Brazilian political spectrum.[Figueiredo and Limongi, 1995] The scale is set so that $\bar{x}_{pt}$ is -1 $\bar{x}_{pfl}$ is 1.

We estimate the model using the general-purpose `JAGS` [Plummer, 2008] software for Bayesian posterior simulation.[8] The identification constraints on x are imposed after the simulations are complete, as suggested by Bafumi *et al.* [2005]. Specifically, we calculate for each posterior simulation:

$$\lambda = \frac{\bar{x}_{pfl} - \bar{x}_{pt}}{2} \tag{1.14}$$

$$\bar{x}_i^* = (\bar{x}_i - \bar{x}_{pt})/\lambda - 1 \tag{1.15}$$

$$x_{is}^* = (x_{is} - \bar{x}_{pt})/\lambda - 1 \tag{1.16}$$

$$\gamma^* = \gamma/|\lambda| \tag{1.17}$$

$$\sigma^* = \sigma/|\lambda| \tag{1.18}$$

1.5 Data issues and preliminary results

In this section we report the still preliminary results of estimating our model and some data challenges we are currently facing.

1.5.1 Data issues

Expected number of votes At this preliminary stage we use the actual number of votes the party received in the election. In the future we will model expected party votes using the electoral results from past elections. Since: a) less than 15% of the voters vote for parties instead of candidates and; b) of those voting for candidates, only a small proportion know the party of the candidate they voted for, we conjecture that the results would change very little if the previous vote is used.

Non-competing parties We only model decisions where both parties received more than zero

[8] JAGS is a compiler for code written using the BUGS language. The code we used is displayed on the appendix.

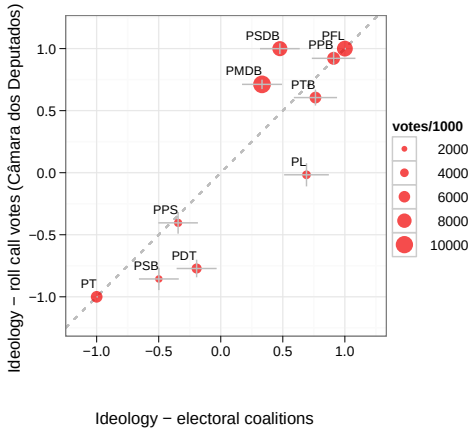


Figure 1.6: Comparison of party ideal points estimated using data from a random subset of Brazilian municipalities and party ideal points estimated using roll call data from the national lower house (1999-2002). There correlation between the two sets of points is .8.

votes in the election. Our model, then, is conditional on entry. We argue that the decision to enter the competition can be usefully analyzed separately from the decisions to form coalitions.

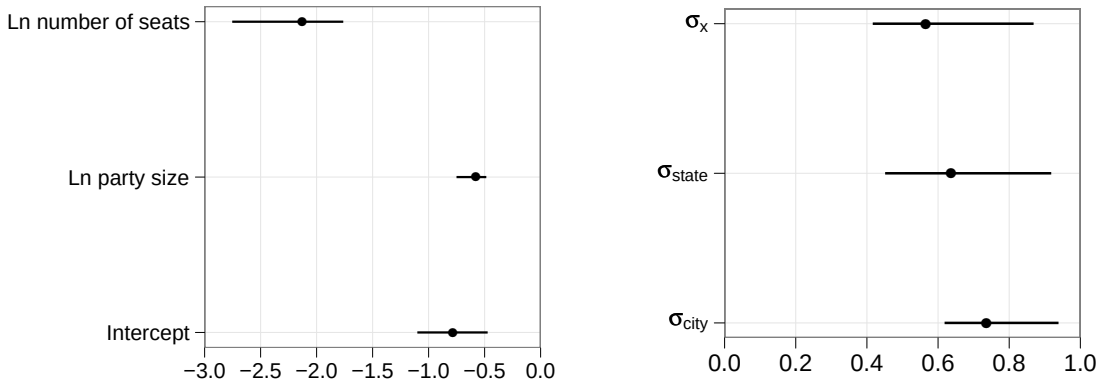
Very small parties In order to decrease computing time, we limit the analysis to the ten parties that received the most votes in the local legislative elections of 2000. In decreasing order of size: PMDB, PFL, PSDB, PPB, PTB, PT, PDT, PL, PPS, PSB. There are 103594 coalition dyads across the 5345 Brazilian municipalities in this subset of the data.

1.5.2 Preliminary results

In Figure 1.6 we compare the national party prior mean distributions ($\bar{x}$) to the party means estimated using roll call votes from the national level Cmara dos Deputados in 1999 and 2000. The correlation coefficient between the two sets of estimates is around 0.8.[9] The horizontal lines displays the estimation uncertainty of the coalition model (95% confidence interval[10]) while the vertical lines display the uncertainty of the roll call model. The confidence intervals for the coalition model are noticeably larger than those of the model using roll call data.

[9]We exclude from the calculations the positions for PFL and PT, since they are constrained to be 1 and -1 respectively.

[10]FIX



(a) Coefficients of the structural parameters.

(b) Standard deviation of the random effects.

Figure 1.7: Bayesian confidence intervals for the parameters of the model. The dots mark the median of the posterior distributions. In panel (a) we display the structural parameters of the model. As expected, larger parties and parties in municipalities with large legislatures are on average less likely to form coalitions. In panel (b), note that the random effects standard deviations are roughly of the same magnitude.

The coefficients for the structural parameters of our model, number of seats and party size, have negative signs as expected. We display them in panel (a) of Figure 1.7. Larger parties and parties in municipalities with a larger number of seats are on average less likely to form coalitions. Panel (b) displays the standard deviation of the group level parameters. Note that the state level residual variation of party positions (σ_x) and municipality specific intercepts (σ_{city}) are of roughly the same magnitude.

To aid interpretation, we plot predictions from our model in Figure 1.8. Each panel displays the predicted probabilities for different combinations of party size. When both parties are small (top-left panel), each with 5% of the votes, the probability of a coalition being formed is quite high. For example, there is a 50% chance that parties of that size will form a coalition if they are very close to each other and the number of seats available is at the minimum (9). However, this probability drops to around 10% if there are 20 seats available. We can also see that the predicted drop in the probability of coalition formation as spatial distance increases abrupt, highlighting the importance of spatial locations in the coalition decisions of parties in Brazil.

Since we are the first to estimate state-level preferences of political parties in Brazil, there are no other measures to compare ours to. Instead, we gather from the Brazilian politics literature

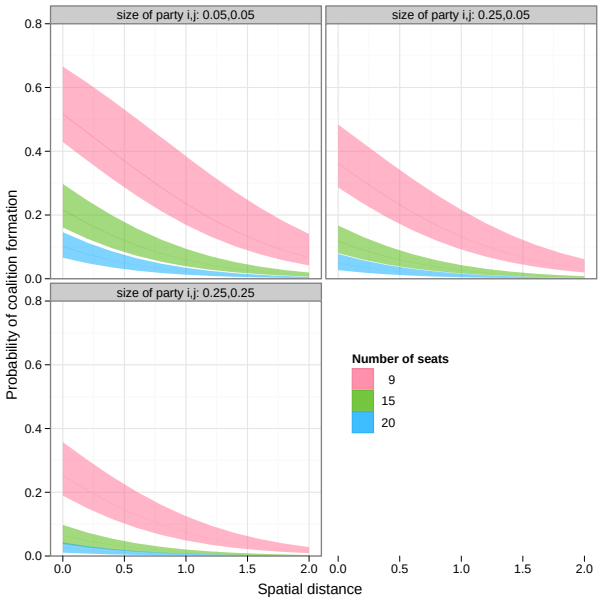


Figure 1.8: Predicted probabilities with 95% Bayesian confidence intervals of coalition formation. The panels display the probabilities for different party sizes.

and local news a set of stylized facts/hypotheses about regional party preferences in Brazil that we should be able to find using the coalition data:

1. **PSDB in Bahia should be far from the PFL**. The main leader of PSDB in Bahia, Jutahy Magalhes Junior, is a long time foe of the head of the PFL in the state, Antonio Carlos Magalhes (no relation.) The dissension is so extreme that the PSDB in Bahia supported the PT candidate in the 1994 presidential race *against* the PSDB candidate, Fernando Henrique Cardoso, who was ultimately elected along with Marco Marciel, a PFL politician, as vice-president.

2. **PMDB in Pernambuco should be on the right.** The main leader of the PMDB in Pernambuco, Jarbas Vasconcelos, is known to be on the right wing of the eternally fractured PMDB. The current Senate president and big-wig of the party, Jos Sarney, claimed in 2009[11] "Jarbas is closer to the PSDB than to the PMDB". (The PSDB is usually placed to the right of PMDB in Braizl.)

[11] `http://blogdofavre.ig.com.br/2009/03/o-jarbas-hoje-e-mais-psdb-que-pmdb-diz-sarney/`, `http://www.chicobruno.com.br/index.php?data=2007-01-12`

3. **Politics should be polarized in Rio Grande do Sul (RS) and consensual in Minas Gerais (MG).** Rennó [2004] studied two municipalities in his PhD. dissertation, one in Minas Gerais and the other in Rio Grande do Sul. He found that in Caxias do Sul (RS) politics was polarized between "the Workers Party and a coalition of the other parties"(p.25). In Juiz de Fora (MG), on the other hand, "the political system ... is organized around individual political leaders. Politics is carried out mostly on a personalistic base and parties are weakly institutionalized." (p. 24) If these characteristics are more generally held in each state, we would expect politics to be more polarized in Rio Grande do Sul than in Minas Gerais.

In Figure 1.9 we show the state-level estimated preferences of political parties in Brazil. The colored circles plot the positions of the four largest parties, while party labels plot the position of the remaining parties. The states are ordered by the range of party positions, which serves as a rough indicator of polarization of the state party system. Consistent with hypothesis 3, we find that Rio Grande do Sul is the second most polarized state while Minas Gerais is the second least polarized state. Confirming hypothesis 2 the PMDB in Pernambuco is at the right of the local ideological space. Finally, in line with hypothesis 1, the PSDB is quite far from the PFL in Bahia.

1.6 Project outlook

In this paper, we outlined a statistical model of electoral coalitions and applied it to the case of Brazil. Using a Bayesian hierarchical model, we provided estimates of the structural parameters driving coalition behavior (party size and number of seats) and arguably the first state-level estimates of party ideological positions. Being the first unfortunately also means not having other measures to compare to. The results, however, are consistent with hypotheses we gathered from the literature and punditry.

One of the reasons why Brazil is an interesting case is that intra-party conflicts are resolved in the electoral arena. The combination of open-list proportional representation and lax control of national party leadership over local parties decisions mean that in Brazil we actually get to observe what in other systems is usually decided behind the curtains. More specifically, the heterogeneous coalitions observed at the local level, while some times seen as a symptom of a inchoate party system, provides an opportunity to observe the underlying political preferences of politicians in

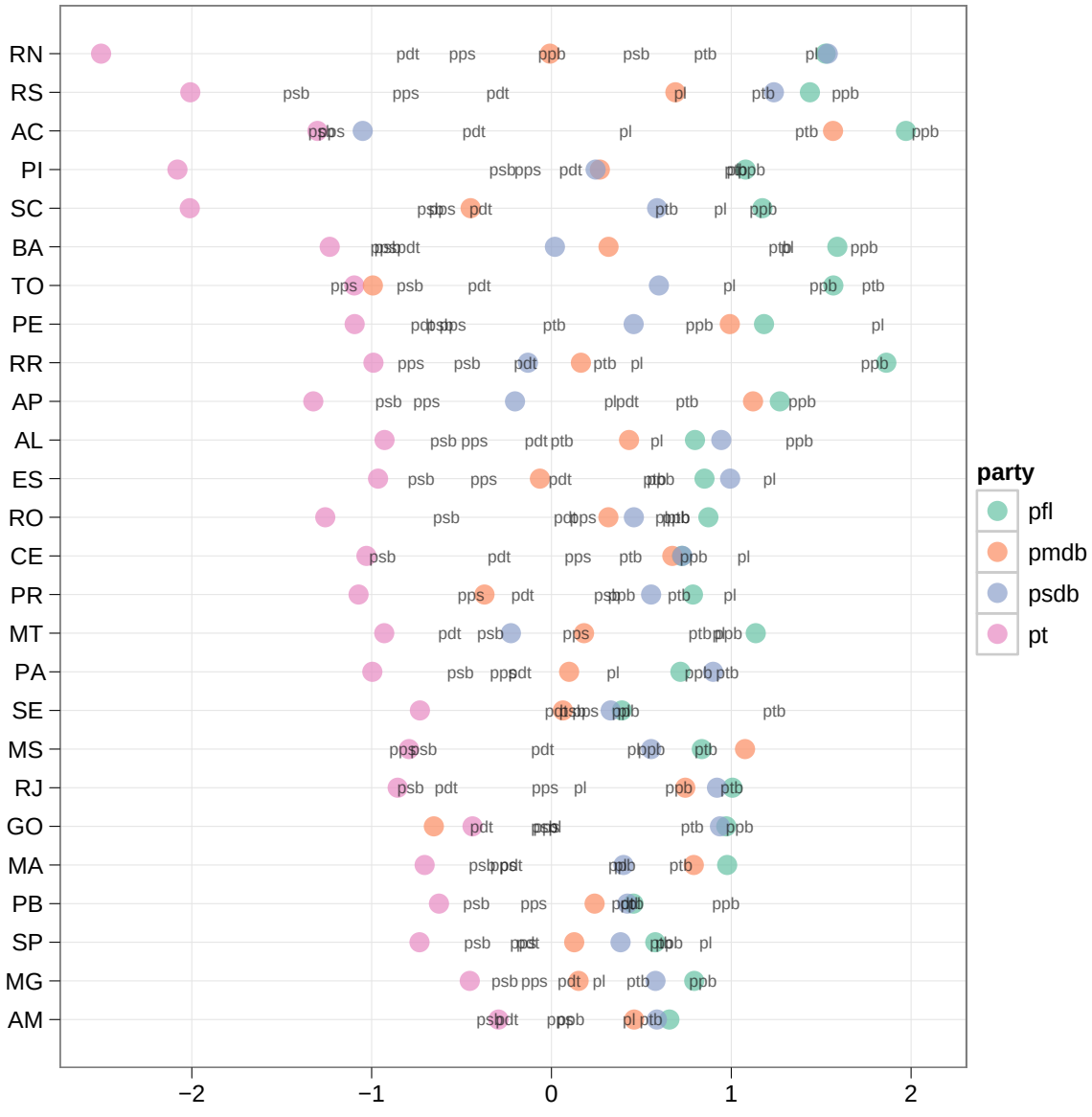


Figure 1.9: State party preferences.

action.

The state-level preferences of political parties will be useful in our parallel project of estimating the consequences of malapportionment in Brazil. We also plan to extend the current analysis to the more recent elections of 2004 and 2008. We expect more stability in the ideological preferences estimated using coalition data than there is in the Cmara dos Deputados roll call data. This would lend credibility to the ideological preferences estimated using coalition data.

The methods we propose are extremely data intensive, thus the applicability of this model to coalition data elsewhere is possibly low.

Part II

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