Why coalitions? Party system fragmentation, small party bias, and preferential vote in Brazil

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A B S T R A C T

Two distinct puzzles characterize the election of House members to the Brazilian Congress: first, in spite of Open-List Proportional Representation (OLPR) rules that allocate seats in proportion to vote shares, an overwhelming majority of parties prefer to form electoral coalitions and run joint lists of candidates. Second, under OLPR, the formation of coalitions consistently rewards smaller parties. Our research provides a single mechanism that integrates pro-small party biases and coalition making incentives under OLPR rules in Brazil. Results of our analysis also illustrate the mechanical properties of family relatives of Open List rules used in emerging democracies.

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Between 1994 and 2010, 74% of the candidates to the Brazilian Congress were elected in lists that included more than one party. Over 40% of coalitions included four parties or more, with some counting as many as 16 coalition partners. Most coalitions were locally forged, with parties joining in one State and competing against each other in another. Electoral coalitions included different Parties in each State, with an overwhelming majority of coalitions that failed to align either with the President or the Governors, but instead answered to more idiosyncratic concerns.

By any measure, the level of pre-electoral coalition making activity in Brazil is extraordinary. However, there has been only limited scholarly attention devoted to the study of its root causes compared to a vast body of research devoted to explaining the ideological heterogeneity of coalitions (Zucco, 2009, 2010; Melo and Alcántara Sáez, 2007) or the negative consequences of fragmentation on party labels (Samuels, 2003; Desposato, 2006a, 2006b;

Mainwaring, 2001; Stepan, 1989; Ames, 1994). Furthermore, no research has explained why the allocation of seats in Brazil consistently rewards small parties, an electoral trait that is to a large extent responsible for the observed fragmentation and, we argue, the uncommonly numerous effective number of electoral parties.

In this article we show that coalition incentives and pro-small party biases are explained by coordination failures by voters of large parties in Open List Proportional Representation (OLPR). As we will show, small and medium-sized district magnitudes reward majority lists, creating incentives to form coalitions by large and small parties. However, benefits to coalition partners under OLPR rules depend on the relative concentration or dispersion of preferential votes among different candidates. While the concentration of votes on the top candidates of small parties increases the odds of acquiring a seat; large parties need to *spread the wealth,* efficiently dispersing their vote among multiple candidates. Because optimal dispersion of votes among party candidates is difficult, large parties tend to subsidize their smaller coalition partners. Consequently, small parties not only survive but thrive under Brazilian Open List Proportional Representation (OLPR) rules.

Conversely, large parties derive more moderate benefits from forming coalitions.

While large parties could claim a larger share of seats if small parties did not compete in elections, pooling votes from a large number of partners makes coalitions attractive to large parties as well. Indeed, if large parties decide against forming coalitions with their smaller partners, other coalitions would still recruit high-yield candidates and pool votes to gain premium seats.

Small party biases under candidate-centric rules have already been noted in the extant literature. Cox (1996) as well as Taagepera and Shugart (1989) provide evidence that Single Non-Transferable Vote (SNTV) rules are *super-proportional* or *counter-majoritarian*, the result of coordination failures in the presentation of candidates.[1] Similarly, in a recent article, Bochsler (2010) provides evidence that small parties draw larger benefits from forming coalitions under OLPR rules while large parties benefit from apparentment laws. The counter-majoritarian biases described by Cox (1996) have similar coordination origins to those of OLPR, with voters of large parties being more likely to be penalized for overinvesting in a few top party candidates.

To explain coalition incentives in Brazil, as well as to describe the sources of pro-small party biases in OLPR, we present a general model of seats and votes that incorporates information about the relative concentration of votes on top party candidates. We show that the relative concentration or dispersion of votes among candidates alters the expected number of seats to be allocated to small and large parties. The model provides a rationale for the three most important features of the Brazilian OLPR electoral rules: the (i) large effective number of parties, the (ii) observed partisan biases, and the (iii) uncommonly large number of coalitions.

The findings in this article also shed light on the electoral systems of over twenty countries that use variations of open-list PR electoral rules.[2] There are a number of scholars who have noted the incentive to form coalitions as well as the pro-small party biases in other electoral systems. Togeby (2008) provides evidence of how preferential voting in the Danish PR system allowed ethnic minorities to concentrate their vote and improve representation in the Folketing. As in the case of Brazil, Togeby notes that ethnic minorities have an incentive to run their candidates with larger parties such as the Social Democrats in order to overcome high electoral thresholds. Meanwhile, Danish large parties have an incentive to incorporate high yield candidates from ethnic minorities. As in Brazil, ethnic minorities in Denmark concentrate their vote, thus allowing their candidates to be elected at higher rates than non-minorities.

Chang (2005) has shown that OLPR increases intra-party competition that generates incentives, cultivates minority vote, and increases corruption. There is also an extensive debate on how preferential voting OLPR systems such as in Brazil, Chile, Norway, and Poland affect women's representation (Matland, 1993; Jones and Navia, 1999). However, while all of these analyses have emphasized the importance of preferential voting on minority representation, women's representation, and corruption, there has been little work connecting these phenomena to the varying concentration of party votes on list candidates.

The organization of this article is as follows: first, we provide a discussion of the extant literature and its shortcomings. We also describe electoral rules and the partisan environment in Brazil, with an emphasis on the seat-vote properties of OLPR rules. Second, we describe a seat-vote model that estimates the allocation of seats under OLPR rules. Finally, we estimate the pro-small party bias in electoral rules as well as their effect on the formation of coalitions.

1. Open list PR and coalitions in Brazil

A number of different theories have been proposed to explain coalition formation in Brazil (Schmitt, 2005). Earlier research explained coalition formation as the result of ideological affinity (Lima Junior, 1983; Soares, 1964; Schmitt, 1999), with small conservative parties displaying a greater tendency to form or join coalitions. Evidence to support the ideological hypothesis, however, was mixed at best. Indeed, most current research finds very weak or no association between coalition formation and ideological congruence (Machado, 2007; Zucco, 2009).

Soares (1964) and Lima Junior (1983) were arguably the first scholars to associate the decision to form or join coalitions to electoral incentives. Since small parties tend to form or join coalitions more often than big ones, these scholars posited that small parties benefitted the most from OLPR rules. However, no formal or statistical model was proposed for explaining the higher propensity to join coalitions by small parties. Instead, researchers argued, coalitions allowed small parties to circumvent small district magnitudes and access seats they would not be able to obtain by running separate lists of candidates (Lavareda, 1991; Nicolau, 1996; Lima Junior, 1993). These theories, however, were unable to explain why large parties routinely form coalitions with smaller partners. Clearly larger parties neither form coalitions to overcome thresholds nor benefit from smaller parties taking seats they could allocate to their own party members.

A different group of researchers explained coalitions in Brazil as a majority-building device with policy-driven objectives. Indeed, Brazilian scholars have for a long time recognized that Presidents need (Abranches, 1988) and seek (Figueiredo and Limongi, 1999; Figueiredo et al., 2000) the support of legislative majority coalitions to approve

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[1] Researchers have coined the term super-proportional (Cox, 1996), anti-majoritarian or unresponsive (King and Browning, 1987), and counter-majoritarian (Calvo, 2009) to describe the effect of rules that provide premium seats to small parties. Similarly, to explain premium seats allocated to winning parties, scholars have used the term sub-proportional, responsive, and majoritarian. In all three cases, the underlying statistical model is very similar. In this article we use the term, counter-majoritarian, to describe electoral rules that consistently reward small parties in proportion to their votes, and majoritarian to describe rules that consistently reward large parties.

[2] Austria, Belgium, Brazil, Bosnia and Herzegovina, Chile, Colombia, Cyprus, Denmark, Estonia, Fiji, Finland, Greece, Iceland, Indonesia, Iraq, Japan, Latvia, Liechtenstein, Luxembourg, Netherlands, Northern Cyprus, Norway, Poland, San Marino, Slovakia, Slovenia, Sweden, Switzerland, Sri Lanka.

their preferred legislation in Congress (Pereira and Mueller, 2004; Amorim Neto, 2002; Amorim Neto, Cox, and McCubbins, 2003). Should this be the case, we would then expect big parties to compete in separate lists, win as many seats as possible, and then form majority coalitions *after the election*. That is, binding agreements *ex-ante* make little sense if large parties end up subsidizing the seats of their smaller partners while sacrificing the election of their own members to Congress.

Other authors have argued that coalitions have spill-over effects for governance and that electoral coalitions for the election of house members bring parties together in support of gubernatorial and presidential candidates (Lavareda, 1991; Machado, 2012). However, this hypothesis cannot explain why or how electoral coalitions form legislative majorities, given that only ≈7% of coalitions since 1994 won an outright majority of the vote in any given district. Furthermore, evidence is overwhelming that electoral coalitions and legislative coalitions generally include very different coalition members across states.

No existing theory that we are aware of explains why small parties in Brazil consistently gain more seats than their proportions of votes. PR D'Hont rules may allow small parties to overcome thresholds but at most they should allocate seats in proportions to votes. However, as we will show here, small parties do not just overcome thresholds by running in coalitions, but in fact gain significant seat premiums. These counter-majoritarian—or super pro-portional—traits of Brazilian electoral rules have not been properly addressed in existing research.

In this paper, we propose a simpler mechanism that explains the existence of pro-small party biases and the incentives to form coalitions between small—small, small=large, and large—large coalition partners. Our explanation relies solely on the seat-vote benefits that coalition members derive from open-list PR electoral rules. In doing so, we are able to explain the three most salient features of the Brazilian electoral system:

1. First, we explain the high number of political parties that routinely compete in national and local elections. We provide a formal treatment and evidence that prefer-ential voting rules redistribute excess votes from high yield candidates to low yield candidates of the same list. While all parties benefit from adding high-yield candi-dates to their lists, small parties with a concentrated vote are more likely to see their candidates elected, and subsidized by large parties with a concentrated vote. The result is a prisoner's dilemma of sort, where each large party benefits from adding high yield candidates from smaller parties to their list, but all large parties are jointly punished by seat distributions that give a larger share of seats to candidates of smaller parties with a concentrated vote.
2. Second, our model explains the extraordinarily high levels of party fragmentation observed in Brazil. Model results show that preferential vote rules generate in-centives to overpay small parties, in line with findings previously reported for Single Non-Transferable vote (SNTV). These open-list incentives to fragmentation are

reinforced by campaign regulations that provide a steady stream of resources to small parties.
3. Third, our research explains why large parties benefit from forming or joining coalitions with small parties. As we will show, while small parties are *net borrowers* of large party votes, their top candidates still yield larger vote shares than the median candidates of the larger parties. In other words, if large parties fail to form coa-lition with these candidates, the majoritarian biases from small district magnitudes would benefit other co-alitions. Consequently, while large parties overpay small party partners, the coalition still collects a comparatively higher share of seats.

Finally, our research contributes to the larger literature on the coalition-inducing properties of electoral rules, integrating preferential vote in PR systems to existing models of seats and votes, a strategy that can be used in a number of other countries such as Poland, Mexico, and Chile.

1.1. Party system fragmentation and the OLPR debate

Party system fragmentation and the high survival of small parties is arguably the most important trait of the Brazilian party system (Mainwaring, 1991). Even though there have been attempts to explain the pervasive nature of party system fragmentation and the rise of electoral co-alitions in Brazil, none that we are aware of has been able to accommodate the wide range of coalition types and elec-toral results observed in national and state elections.

Lamounier (1987) and Mainwaring (1991) were the first scholars to argue that party system fragmentation was related to, if not explained by, the adoption of PR open list rules. Both authors linked preferential voting to party sys-tem weakness and to candidate-centric incentives shaping the preferences of politicians in Brazil. Ames (1994) extended this line of reasoning, arguing that candidate centric incentives to cultivate minority support reduced the value of party labels, leading to the proliferation of new parties. In his model, Ames argued that such candidate-centric incentives were reinforced by earmark rules that allowed individual legislators to allocate funds to their preferred local constituencies (Ames, 2001). Because of high levels of fragmentation, Ames assumed that gridlock had to be a standing trait of the Brazilian Congress. Those implications have not been supported by empirical ana-lyses of lawmaking in Brazil, which have shown that the Brazilian Congress has consistently displayed high rates of legislative success, well above the regional average (Figueiredo and Limongi, 1999) and comparable to the success rates observed in parliamentary regimes (Saiegh, 2011).

As scholars refuted the hypothesis of a relationship between fragmentation and legislative paralysis in Brazil, research on the effect of open-list PR rules slowly faded away, neither proving nor disproving a link between open list PR and Brazil's exceptionally high number of parties. Consequently, while overwhelming consensus emerged on a relationship between open-list PR and the number of parties, little formal work was done to explain the precise

mechanisms that induced the proliferation of parties. Fragmentation became a descriptive trait of electoral competition, to be summarily explained by the joint effects of federalism, PR, preferential voting, and/or clientelism. Mechanisms linking fragmentation to these different likely culprits, however, was never made explicit or proved conclusively.

While a formal explanation of the mechanisms inducing fragmentation is lacking, party system fragmentation remains a fixture of most analyses of electoral politics in Brazil. Fragmentation has been shown to shape significantly the formation of post-election legislative coalitions in Congress (Cheibub et al., 2004; Amorim Neto, Cox, and McCubbins, 2003), party switching (Desposato, 2006a, 2006b), progressive ambition (Samuels, 2003), political media markets (Baker et al., 2006), etc. In spite of its centrality to existing studies of Brazilian politics, the determinants of the very high number of parties in Brazil have never been fully explained. In this paper we take on this important task to provide a more conclusive answer on the relationship between preferential voting, electoral rules, and the number of parties in Brazil.

Party system fragmentation in Brazil consistently ranks above that of any other country in the world. As shown in Fig. 1 (left), the effective number of parties in Brazil hovers around ≈ 10 and the effective number of legislative parties around ≈ 8. In Latin America, only Ecuador has at times exceeded Brazil in its effective number of electoral parties and no country can match the effective number of legislative parties. In spite of a median district magnitude of 10 and an average district magnitude of 19, the effective number of parties remains stubbornly high, well beyond that of countries with equivalent district magnitudes.

While some have argued that differences in district magnitude explain such high levels of fragmentation, Fig. 2 challenges this assumption. Indeed, the effective number of competing parties is roughly similar in low and high district magnitudes. Consequently, the permissiveness of PR rules would be unlikely to explain the high levels of electoral fragmentation observed in Brazil. Fig. 2 shows that the median effective number of parties competing for seats to the National Lower House in each of the Brazilian States is high, ≈ 8, not far from the national average. The median
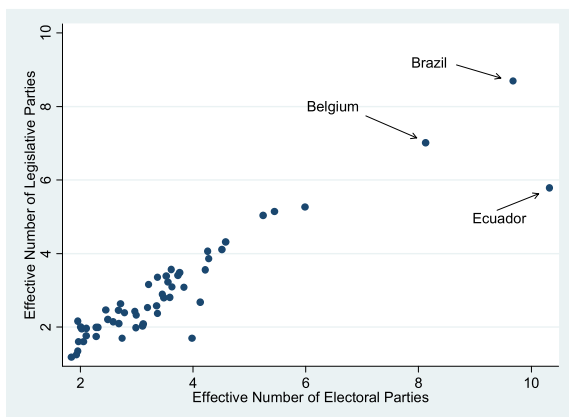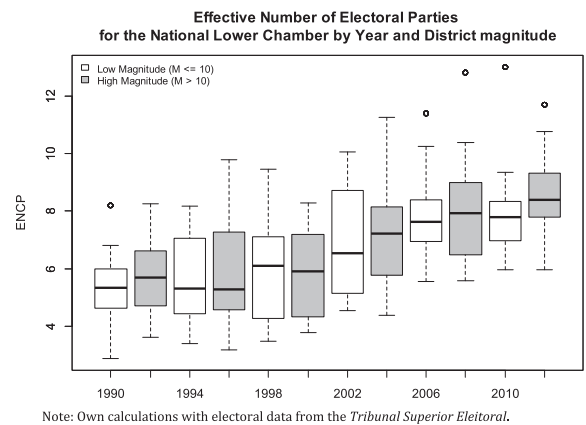
Fig. 2. Effective number of electoral parties for the national lower chamber and district magnitude. Low (≤10) and high (≥11) district magnitudes.

effective number of parties by State has been increasing from slightly above 5 in 1994 to around 8 in 2010, with no sign of decline in spite of the solid economic growth and the strengthening and streamlining of Executive support in Congress.

Fragmentation has also remained stubbornly high in spite of internal congressional rules (CN Resolution no. 2/1995) limiting the number and the monetary value of the members' individual amendments to the budget. While the Brazilian Congress provides very few opportunities to allocate pork through *gains-from-exchange*, smaller parties still thrive in both local and national legislative elections. Consequently, while electoral rules may provide representatives with the incentives to cultivate minority support through pork, Constitutional provisions and the internal rules of Congress severely constrain the freedom to allocate resources.

Fragmentation in Brazil has also been resilient to differences in district magnitude. While PR rules have often been considered the natural culprit in explaining the high numbers of parties, the effective number of parties is roughly the same under high and low district magnitudes.

Finally, existing research also points to ethnic cleavages as an important determinant of the effective number of parties (Cox and Amorim Neto, 1997; Golder, 2006). However, there is little evidence that the effective number of parties in Brazil is affected by district magnitudes or evidence of a link between socio-demographic cleavages and increases in the effective number of parties in the Brazilian States. In fact, there is no association between ethnic, religious, or social cleavages and the number of parties in the Brazilian States.

1.2. Describing Open List Proportional Representation rules: an example

Representatives to the Lower House in Brazil are elected in districts of variable magnitude that range from 8 in the smaller states to 70 in the most populous states. The quota presents an effective barrier to entry, where lists receiving less than 1/M votes are prevented from being allocated seats. Open-List rules allow each voter to cast one vote that

Fig. 1. National effective number of electoral and legislative parties.

signals preferences either for a particular candidate within the list (preferential vote) or for the list as a whole (list—*legenda*—vote). In selecting a candidate, the vote contributes to both the overall votes of the coalition and the personal tally of their preferred candidate.

Once all votes are counted, the party or coalition list is rearranged as in Table 1, with candidates ranked in accordance with the total number of votes each received. The combined total of votes for all candidates are then added together, combined with non-preferential votes for each list, and used to allocated seats to votes using D'Hont. To be elected, consequently, candidates need to gather enough votes to be eligible for one of the seats allocated to the coalition.

Given that coalitions are allocated seats in proportion to votes, there are small majoritarian premiums to the coalition in moderately sized districts (Rae et al., 1971). However, seats within the coalition depend on the relative ranking of individual candidates among partners. Consequently, party seat shares may deviate significantly from their vote share.

Note: The Coalition led by the PR included a total of eight different parties that presented a total of twenty (20) candidates: PR (2), PMN (2), PSC (4), DEM (2), PSDB (4), PSDC (2), PRTB (2), and the PP (2). *Party share in coalition* = Column H/1,084,282. *Candidate Share of Party Vote* = Column F/Column G.

Let us describe an allocation of seats with an example from the 2010 national legislative election in Brasilia, the Federal District, where the coalition led by the *Partido da Republica* (PR) won 31% of the vote and 3 out of the 8 seats in the district ($\approx 37\%$). As shown in Table 1, while this coalition obtained a small seat premium of 6%, the distribution of seats among partners differed significantly from their vote shares.

As shown in Table 1, the most voted candidate, Jaqueline from the PMN, collected 100,051 votes (Column F). The vote total for the PMN candidate represented almost all of her party vote, $\frac{100.051}{103.344} = .97$, but less than 10% of the coalition vote (Column H) and less than 3% of the total vote in the district of Brasilia. The leading party in the coalition, the PR, collected 15.5% of the coalition vote with the second and third highest ranked candidates. Together, those three candidates won 25% of Coalition vote, a mere 7% of the total State vote and 3 out of 8 seats to the national legislature. Consequently, with 7% of the vote in Brasilia, the PMN collected 12.5% of total seats (1/8 of the State delegation) while the PR collected 25% of the seats (2/8 of the state delegation).

It is important to highlight that the first three candidates can be **high performers** and also **net borrowers** of votes from the other candidates in the list. In effect, together the top three candidates collect close to a third of the coalition vote while the remaining coalition candidates supply two third of the votes. Consequently, under OLPR, candidate's contribution to the collective value of the list may vary widely. A candidate that collects more votes than her/his quota will be a net supplier of votes to the rest of the list. An extreme example is Eneas Carvalho (PRONA-Sao Paulo) in the 2002 election, who collected 1,573,112 individual votes, representing 5.6 quotas equivalent to 6 seats.

Eneas Carvalho's votes single handedly elected five party members whose votes ranged from 41,505 to a meager 382 votes.[3]

Let us compare the prior example with that of Tirica, the most voted candidate in São Paulo in the 2010 election. In this election, Tirica amassed 1,353,820 votes or 4.3 quotas. If running a separate list, the party would have received at least 6 seats to be distributed among its members. Instead, Tiririca's party (*Partido da Republica*-SP) formed a coalition with the second most voted party, the Workers' Party (*Partido dos Trabalhadores*-SP) and three other smaller parties. The alliance gathered votes that corresponded to 21.7 quotas and was awarded 23 seats. Of those seats, only 4 were allocated to the *Partido da Republica* whereas the *PCdoB* received 2 seats with a fraction of the required quota. Indeed, the *Partido da Republica* paid a high price for concentrating a significant share of its votes in Tirica.

Now let us take a fresh look at the benefits of running in coalition. As shown in Table 1, the alliance contained 8 parties of which only three won seats. All parties that failed to win seats transferred their votes to the top ranked candidates. Without those votes, the *Partido da Republica* would have elected a single candidate and all other parties would have received none. However, all other parties were better off running in the coalition, as the odds of electing a candidate were considerable higher than if they had run separate campaigns.

Table 1 also shows significant differences in the level of concentration of party votes. As we will show in the next section, differences in the concentration of party votes will significantly affect the expected seats of coalition partners. Parties that concentrate most votes in their top candidates will be able to position them with higher probability at the top of the lists. This will benefit small parties that are net recipients of votes to a larger extent than larger parties, which are net suppliers of votes. Consequently, the dominant strategy for small parties will be to include few candidates in the list and to concentrate their vote. Meanwhile, the dominant strategy for large parties is to distribute optimally their vote among its top candidates.

This strategy, however, places large parties at a disadvantage. Because concentrating the vote on a single candidate is easier than optimally dispersing the vote among multiple candidates, the benefits of joining a coalition decline as the party vote share increases. Differences in the size and structure of parties, consequently, will provide different returns to coalition partners. Large parties with diverse constituencies will suffer while smaller parties with few candidates will thrive.

The results are paradoxical. Given that individual candidates from small parties provide positive but declining utility to members of the coalition, they are both recruited and overpaid. On their own, small parties would often fail to meet the district level threshold. As partners in a coalition, however, small parties overcome district level limitations

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[3] Eneas Carvalho did know he would receive a great deal of votes, having run three times for presidential office (from 1989 to 1998) and for mayor of Sao Paulo in 2000. In the 1994 election Eneas was the third most voted candidate in Brazil.

Table 1
Candidate Votes and Allocation of Seats for the *Partido da Republica Coalition* in the Federal District of Brasilia, Legislative Election, 2010.

Year	State	Coalition	Party	Candidate name	Candidate votes	Party votes	Party share in coalition	Candidate share of Party vote	District magnitude	Seats
A	B	C	D	E	F	G	H	I	J	K
2010 National Legislative Election	Federal District of Brasilia	Total Coalition Votes 1,084,282. Vote Share 0.31 (31%)	PMN	JAQUELINE	100,051	103,344	0.095	0.968	8	1
			PR	IZALCI LU	97,914	168,397	0.155	0.581	8	1
			PR	RONALDO F	67,920	168,397	0.155	0.403	8	1
			PSC	LAERTE RO	51,796	59,999	0.055	0.863	8	0
			DEM	ADELMIR A	45,712	63,172	0.058	0.724	8	0
			PSDB	VIRGILIO	17,871	38,667	0.036	0.462	8	0
			DEM	ROBERTO E	6861	63,172	0.058	0.109	8	0
			PRTB	CLARINDO	3424	4369	0.004	0.784	8	0
			PSDB	WEBER DE	3338	38,667	0.036	0.086	8	0
			PP	PABLO DE	2409	4123	0.004	0.584	8	0
			PSDB	LUDMILA D	1867	38,667	0.036	0.048	8	0
			PSC	PEDRO MAU	945	59,999	0.055	0.016	8	0
			PMN	ALEXANDRE	745	103,344	0.095	0.007	8	0
			PSDC	ANTONIO C	654	1404	0.001	0.466	8	0
			PSC	IDACY ARA	622	59,999	0.055	0.010	8	0
			PSDC	ANTONIO C	548	1404	0.001	0.390	8	0
			PP	GILVANDO	524	4123	0.004	0.127	8	0
			PRTB	ANA BEATR	186	4369	0.004	0.043	8	0
			PSDB	MARGARIDA	105	38,667	0.036	0.003	8	0
			PSC	MARISTELL	95	59,999	0.055	0.002	8	0

Note: The Coalition led by the PR included a total of eight different parties that presented a total of twenty (20) candidates: PR (2), PMN (2), PSC (4), DEM (2), PSDB (4), PSDC (2), PRTB (2), and the PP (2). *Party share in coalition* = Column H/1,084,282. *Candidate Share of Party Vote* = Column F/Column G.
Source: Data from the tribunal superior eleitoral.

and are also able to better position their own candidates at the top of the list. If a few large parties decided not to forge coalitions, the remaining large parties would be better off forming a coalition with high yield candidates from smaller parties. Large parties could only do better if they collectively decide not to include smaller parties in their coalitions.

2. The allocation of seats to votes under open-list PR

Preliminary evidence will certainly prove suggestive. Fig. 3 describes the relationship between seats and votes for each party competing in the national legislative elections for the Brazilian Lower Chamber between 1994 and 2010. The dotted diagonal line describes a strictly proportional allocation of seats, with parties on the lower triangle of Fig. 3 winning fewer seats than votes and parties in the upper triangle of Fig. 3 winning more seats than votes. Fig. 3 uses black squares to describe parties running on their own and grey circles to describe parties running in coalition. As shown in Fig. 3, small parties running in coalition (gray circles) enjoy seat premiums and are very often able to win more seats than votes. By contrast, an overwhelming majority of small parties running outside a coalition won fewer seats than their vote share between 1994 and 2010.

While PR D'Hont should provide a small reward to large parties —through effective thresholds as well as the majoritarian properties of D'Hont—, Fig. 3 shows that small parties running in coalition receive larger premiums, sometimes being able to get as little as 3% of the vote while collecting 13% of the seats. By contrast, no small party running outside coalitions won seat premiums with less than 10% of the vote, and in those cases the seat premium was negligible. Consequently, running in coalition is certainly a dominant strategy for all small parties.

To explain the extra seats won by small parties running in coalition we proceed in three steps: firstly, we describe significant differences in the level of concentration of party votes on the top candidates of small and large parties. That is, we show that small parties tend to concentrate their vote in a few candidates while large parties tend to "spread" the wealth. The concentration of votes in fewer candidates allows small parties to move their candidates faster up the list and claim a larger share of seats. To counteract these benefits larger parties need to allocate votes more efficiently among the party candidates. Secondly, we present a general model of seats and votes that takes into consideration the level of concentration of the candidates' vote as well as the relative contribution of the party to the coalition vote. Finally, we provide statistical estimates that demonstrate biases that benefit small parties that concentrate their vote on a few list candidates and penalize parties that cannot efficiently distribute their vote among candidates. The overall result will be a counter-majoritarian effect that maps onto the seat-vote data described in Fig. 3.

Step 1: The relationship between party size and the concentration of votes on top Candidates

For the remainder of the analysis we use a dataset that includes the allocation of seats and votes to Lower House candidates running in elections in Brazil from 1994 through 2010. The dataset includes 20,675 observations with variables measuring seats, votes, as well as party and candidate characteristics. The dataset includes the **total votes** by candidate, party, and coalition for each Lower House election. We also have information that describes the allocation of **seats by candidate**, **party, and coalition**, as well as the **effective district magnitude**. To measure the level of
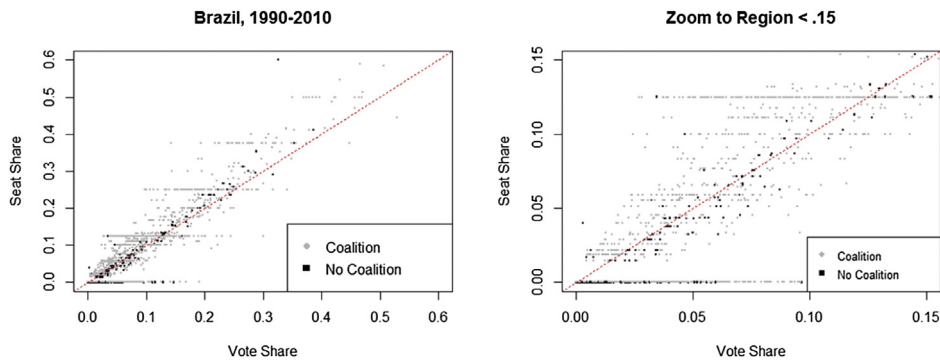
Fig. 3. Distribution of seats and votes in lower house by coalition, Brazil, 1994–2010.
Source: Data from the Tribunal Superior Eleitoral.

concentration of Party j vote on its top candidates we use the Herfindahl index, $C_j = \sum v_{cj}^2$, where v_{cj}^2 describes the share of votes won by candidate c from the total party vote V_j collected by Party j. As it may be readily noted, C_j is just the inverse of the effective number of candidates by Party j, taking a maximum value of 1 when all votes are concentrated in a single candidate and 0 if the vote was perfectly dispersed among a large number of candidates. In the data, the median level of concentration of votes in the top candidates is a meager ≈ 0.19 and the mean level of concentration is ≈ 0.28, skewed toward more dispersion of votes among candidates. The most concentrated parties, the top 90%, display values that range from ≈ 0.65 all the way to 1.

As it is possible to observe in Fig. 4, as the share of votes won by a party increases, the concentration of votes for the top candidate of the party declines.[4] When a party receives 10% of the vote in a coalition, the concentration of the vote on its top candidates is very significant, with the Herfindahl index approaching 0.7 and the effective number of candidates approximately 1.4. By contrast, when a party receives 90% of the coalition vote, the concentration of the vote on its top candidates is low, with the Herfindahl index approaching 0.27 and the effective number of candidates approximately 3.7.

The discontinuity between a party receiving almost 100% of the coalition vote and a party running a separate list (therefore controlling exactly 100% of the vote) is particularly revealing. When a party in a coalition approaches 100% of the vote, the Herfindahl index is 0.27, equivalent to a 3.7 effective number of candidates. By contrast, when a party runs outside of a coalition the Herfindahl index is 0.53 or a 1.8 effective number of candidates. That is, large parties that are in a coalition already spread their votes among a larger group of party candidates than those parties presenting separate lists. Such different strategies already indicate that large parties are aware of the costs of concentrating the party vote in few candidates when running in a coalition.

As we will show next, the fact that small parties concentrate their vote in a few candidates creates pro-small

party biases in the allocation of seats. These biases are attenuated when a big party optimally spreads its vote among multiple candidates, but is never completely eliminated.

Step 2: The mechanical properties of open List PR electoral rules

In the last 30 years, advances in the estimation of seat-vote models have finally allowed us to measure with precision the mechanical properties of electoral rules. These models have become standard in the discipline, used to measure incumbency biases, partisan premiums, endogenous electoral reforms, and to map in greater detail how electoral rules transform votes into seats (Taagepera and Shugart, 1989; King, 1990; King and Browning, 1987; Linzer, 2012; Calvo, 2009). While these studies have successfully modeled the overall allocation of seats to votes among parties, considerably less research explores how preferential voting interacts with electoral rules to produce distinct allocations of seats.
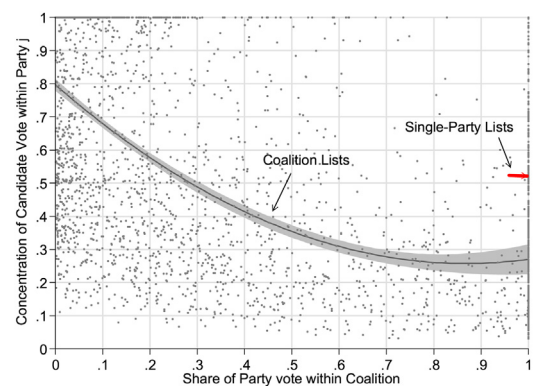
Note: Concentration of the votes in the top candidates of each party is measured using the Herfindahl index, $C_j = \sum_j v_{ij}^2$, with a maximum value of 1 if all party votes are concentrated in a single candidate and a value approaching 0 when votes are perfectly dispersed among a larger number of candidates. The share of party vote within coalition describes the share of votes held by party j out of all coalition k votes, v_j/v_k. Quadratic fit for coalitions (multiple parties in the list) that comprise 83% of sample. The concentration votes on the top candidates for single party lists (17% of the sample) are .53, described in Figure 4 with a red line. In single-party lists the share of Party vote is always 1 (100%).

Fig. 4. Explaining the concentration of votes in the top candidates of the list (*Y*-axis) by the share of coalition votes held by their party (*X*-axis), Legislative Elections to the Brazilian Chamber of Representatives, 1994–2010.

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[4] When parties present a separate list that includes only their own candidates (no coalition), then the share of party vote within the coalition is exactly 1.

Our model extends King (1990) to estimate a multinomial (conditional) logit specification that describes the allocation of seats to the House of Representatives in Brazil. In our model, the total number of seats S_{jkz} allocated to Party j in coalition k and State z are a function of three key parameters: firstly, the majoritarian parameter ρ_{jkz} which describes the translations of seats to overall vote shares. Secondly, a (ii) parameter δ_1 which describes the effect that a more concentrated (C_{jkz}) preferential vote has on the allocation of seats (as described in the previous section). Thirdly, a (iii) parameter δ_2 which describes the effect of a larger coalition vote share on the allocation of seats. We also control for the joint effect of a more concentrated vote and a larger share of coalition votes:

Equation (2).[5] We estimate three different specifications: a pooled model that includes all observations; a model restricted to medium to low magnitude districts (magnitudes ≤ 10); and a model that only includes high magnitude districts (magnitudes > 10). We expect pro-small partisan bias to be observable in all three models, with higher effective thresholds fostering broader coalition activity. Results from the three models are presented in Table 2, with parameters adjusting to our expectations.

Table 2 presents results for all three specifications with the three key parameters and their interactions (saturated model): Firstly, the allocation of seats is explained by the party vote. As in the standard models, a value of 1 describes a perfectly proportional allocation of seats. Values larger

$$S_{jkz} = \frac{e^{\delta_1 * C_{jkz} + \delta_2 * S_{kz} + \delta_3 * C_{jkz} * S_{kz} + \delta_4 * C_{jkz} * \log(v_{jkz}) + \delta_4 * S_{kz} * \log(v_{jkz}) + \rho_{jz} \log(v_{jkz})}}{\sum_{j=1}^{J} e^{\delta_1 * C_{jkz} + \delta_2 * S_{kz} + \delta_3 * C_{jkz} * S_{kz} + \delta_4 * C_{jkz} * \log(v_{jkz}) + \delta_4 * S_{kz} * \log(v_{jkz}) + \rho_{jz} \log(v_{jkz})}} \tag{1}$$

As in King (1990), ρ_{jz} describes the majoritarian bias in an electoral system, where $\rho_{jz} = 1$ when seats are perfectly proportional to votes; $\rho_{jz} > 1$ when rules reward winning parties (majoritarian or sub-proportional allocation of seats); and $\rho_{jz} < 1$ when rules benefit losing parties (a counter-majoritarian or super-proportional allocation of seats). Because Brazil uses a proportional representation formula in medium to large size districts, seat shares should be close to vote shares and, consequently, we expect that ρ_{jz} will be slightly larger than 1.

While the equation appears cumbersome, it includes only three independent variables: the log-odds ratio of the party share of votes, the level of concentration of votes among the party candidates, and the share of coalition votes held by party candidates. Using those three variables (and their interaction), we can describe all seat vote allocations observed in Brazil. Results from these specifications will show that when votes are fully dispersed among the candidates, small parties are penalized and large parties rewarded. By contrast, when votes are fully concentrated on the top candidates, small parties are rewarded and large parties penalized.

Step 3: estimating pro-small party biases in Brazilian elections

We estimate the model in Equation (1) on all National Legislative Elections in Brazil from 1994 through 2010. Our observations are at the party level, with an ordinal dependent variable that describes the total number of seats won by party i in election k. As described in the model, we explain the probability of being elected as a function of the party vote share (LN), the level of concentration of party vote on its top candidates (Herfindahl index), and the share of coalition votes held by the party.

We estimate Conditional Logit models via a Poisson approximation, with saturated specifications that include interaction between all three key variables as described in

than 1 describe majoritarian allocation of seats while values smaller than one describe a counter-majoritarian allocation of seats.

As shown in Table 2, the estimated coefficient for the party vote is slightly larger than one in models A and C, once we control for differences in the concentration of votes and the share of coalition votes. In consequence, as expected, the allocation of seats is roughly proportional for the full sample of allocations of seats when parties run outside coalitions. Majoritarian biases are more significant for lower magnitude districts (model B), with the majoritarian parameter, $\rho = 2.37$.

The strong majoritarian bias in small magnitudes districts makes the expected seat gains more sensitive to the coalition strategy adopted. Because an increase in the share of the party in a coalition decreases the probability of being elected, the best strategy for big parties is to run alone. If they decide to form a coalition the best choice is to reduce the share of votes inside of the coalition, i. e., to form coalitions with equals or to form big coalitions.[6]

For small parties in small magnitude districts the only strategy to increase the probability of being elected is to form coalitions and concentrate the votes in their top candidates. Because their share of coalition votes tends to be small and because, by definition, they have fewer votes, the impacts of the interactions are minimized and they have to rely exclusively on the degree of concentration to win seats. Concentration is not such a good strategy for big parties because of its interaction with votes. An increase in votes decreases the impact of concentration.

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[5] Model estimates should be interpreted as conditional logit estimates. We use a Poisson approximation to address the changing menu of parties across electoral districts. For a description of how to use a Poisson specification to estimate conditional logit models see Guimaraes (2004).

[6] While the mean number of parties in a coalition in districts with magnitudes below or equal to 10 is 5, the mean in districts with magnitudes over 30 is 2.

Table 2
Multinomial (Conditional) Logit Estimates of total Seats in Brazil: Legislative elections, 1994–2010.

|	Model A pooled data	Model B small magnitudes	Model C Large magnitudes
Party Vote (Majoritarian Parameter ρ)	1.24***	2.37***	1.188***
	(0.097)	(0.351)	(0.105)
Coalition Share (S)	−0.34	−1.990**	−0.299
	(0.334)	(0.887)	(0.377)
Concentration on Top Candidates (C)	2.076***	0.945	1.746**
	(0.543)	(1.107)	(0.751)
Party Vote(V)*Coalition Share (S)	−0.078	−0.972**	−0.066
	(0.136)	(0.426)	(0.156)
Party Vote(V)* Concentration (C)	0.465**	−0.336	0.381*
	(0.160)	(0.402)	(0.201)
Share (S)* Concentration (C)	−1.201*	−2.337*	−1.081
	(0.568)	(1.224)	(0.781)
District Magnitude-K	0.284***	0.547***	0.069***
	(0.055)	(0.104)	(0.005)
AIC	3091.0	1238.9	1839.5
N	2317	1158	1159

Note: Conditional Logit estimates from Equation (1), with standard Errors in Parenthesis. Saturated models with three-way interactions. Confidence interval for the interactions described in Fig. 5.

The picture is slightly different in large magnitude districts. Here the conversion of votes into seats is more proportional, the negative impact of the share of votes for the party in the probability of being elected is smaller, and the premium for concentrating the vote in the top candidates is bigger for all kinds of parties and not significantly affected by the interactions. However, as in small magnitude districts, the share of coalition votes for the party still has a negative impact and attenuates the effects of concentration of votes.

To provide a more intuitive description of the interactions between the share of coalition vote for a party and concentration of votes in the top candidates, Fig. 5 describes the conditional effect that the concentration of votes among the top candidates of a party has on the allocation of seats. The left plot in Fig. 5 describes the expected total number of seats allocated to a small party that collects just 20% of the coalition vote, S = 0.2. As the Left Plot in Fig. 5 shows, a small party with dispersed votes among its top candidates will collect around 0.5 seats in districts of low magnitude, K < 10. The allocation of seats increases monotonically with the increase in concentration.

On the other hand, a party that collects most coalition votes, S = 0.9, will not benefit, but instead lose seats when concentrating most votes on the top candidates. In the data, a share of the coalition votes of a party is strongly correlated with this its share of candidates, the negative interaction between concentration and coalition share revels the 'waste' of votes that a big party incurs by concentrating its votes. When a big party concentrates its votes in the top candidates, it will receive more votes than the necessary to elect these candidates. The excess of votes go to other parties inside the coalition.
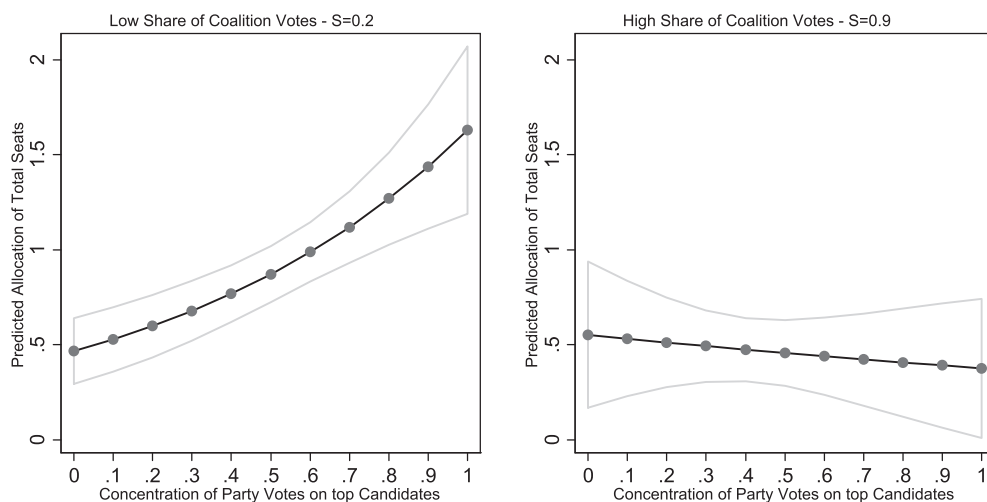
Note: Predicted probabilities from Model 2, Table 3.

Fig. 5. Predicted Allocation of Seats by Concentration of the vote on the Top Party Candidates, Low Share of Coalition Votes (left) and High Share of Coalition Votes (Right), Brazil, National Lower House, 1995–2010.

3. Concluding remarks

Electoral competition in Brazil is characterized by three inter-related phenomena: the widespread presence of coalition lists, high levels of party system fragmentation, and a consistent pro-small party bias in electoral rules. While the first two characteristics of the Brazilian electoral system have been widely described in existing scholarly work, little attention has been given to pervasive biases favoring small parties. In this article we provide a comprehensive argument that explains how open list proportional representation explains all three of these different phenomena. As we show, seat premiums favoring small parties are the result of a higher concentration of the vote in their top list candidates. By contrast, the concentration of votes on the top candidates of large parties reduces the number of seats allocated to those parties, and wasted votes end up subsidizing seats allocated to candidates of smaller parties.

While researchers have acknowledged that open-list PR rules facilitate the proliferation of parties, the mechanisms connecting these phenomena have not been formally described. Indeed, this article shows that we do not need to assume that weak party labels facilitate the proliferation of parties or that side payments to form majority coalitions subsidize small parties. Electoral rules consistently reward small party candidates to a larger degree than large party candidates. It is a dominant strategy for small parties to concentrate their vote and, as shown here, the mechanical rules will ensure better odds of being elected when large parties are unable to disperse their votes. Over time, observed party system fragmentation is the result of electoral rules that reward small parties that concentrate their vote in a few high yield candidates.

The proposed theory also explains the consistent trend towards higher effective numbers of parties observed since 1990. These results can neither be explained by majoritarian incentives in coalition activity nor by the candidate-centric incentives in open list PR. Instead, we show that the observed result is consistent with the small party biases that result from the mechanical properties of electoral rules.

The theory advanced in this article is also explains the wide variety of coalition types observed in Brazil. In effect, recruiting high yield candidates benefits all parties in the list, even if they benefit small parties to a larger degree than large parties. As all parties compete for high yield candidates, both large and small parties benefit from forming coalitions. However, differences in the level of concentration of a party vote explains the extra benefits to small parties that result from the choice of electoral rules.

There are currently a very large number of countries using open-list rules to elect national and state legislators. This article shows that the mechanics of preferential votes and electoral formulas need to be modeled together in order to account for how electoral rules shape party system behavior. As shown in this article, it is neither PR rules by themselves that increase the effective number of parties nor the fact that an open list is used, but the joint effects of open list and PR. Indeed, Magar et al. (1998) had already

shown that open-list binomial rules in Chile explained further ideological polarization and the concentration of the vote in two large coalitions in Chile after 1989. The case of Brazil also provides evidence that both the strategic incentive of PR rules and the expected allocation of seats to votes are very sensitive to open list incentives.

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