Party-System Fragmentation: A New Look at an Old Question

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Abstract

Proportional representation with districts, the most prevalent electoral system in the democratic world, is often characterized by institutional heterogeneity. Within the same state, some voters cast their ballots in districts of a few representatives while others in districts of a few dozens. Yet in other states variation is much smaller. How does variation in the number of seats per district affect permissiveness of electoral systems and hence representation? The implicit assumption in the literature is that systems are similar if they are similar 'on average' (district). Drawing on a broad cross-section of democracies, we demonstrate that greater variation in district magnitude and in particular the presence of large districts lead to better conversion of heterogeneity in the electorate to that in parliament. Where districts are of similar magnitude conversion falls short compared to what current literature finds while in systems with large variation conversion is better than perceived.

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1. Introduction

Given the voice of the electorate, the electoral system – the mechanism aggregating voters' voices and converting them into seats in the legislature – is what determines the lay of the land in parliament. Plethora of voices in the electorate can be translated to many or few in parliament. The distortion in the conversion can be large or small (or close to nil, in theory), depending on the electoral system. In particular, it is the permissibility of the electoral system that shapes the parliamentary landscape. In this study, we analyze this translation, focusing on districted proportional representation, the most prevalent electoral system in the democratic world.

It is well established that district magnitude in a country – the number of seats per district – is key factor determining representation in general and the permissibility of electoral systems in particular. Proportional representation with districts, however, is often, indeed almost always, characterized by varying number of seats per district. Within the same state, some voters cast their ballots in districts of a few representatives while others in districts of a few dozens. Yet in other states variation is much smaller. Are two systems similar 'on average', one with large variation across districts and one with districts of similar magnitude, equally permissible? In spite of the voluminous literature on electoral systems, this question, to the best of our knowledge, is unexplored. Ignoring the issue of within-country variation in how votes are converted to seats, the implicit assumption is in fact that the two are identical. The question motivating this study is: how does variation in district magnitude affect permissiveness of electoral systems and hence representation?

When some districts are small others large, the legislature is elected via different models of democracy: some are more majoritarian-like while others are proportional representation in large multi-member districts. The distribution of districts in a country with large variation is often characterized by a long right tail: many districts represent rural areas and are thus small, and few represent large cities and are thus large. The large districts, by definition, consist of a substantial portion of the legislature. Ignoring this upper tail of the distribution of districts and focusing on central tendency alone may result in misspecification of relationships between electoral systems and various political outcomes.

Drawing on a large cross section of democracies that vary in their electoral systems, we find that where variation in magnitude is small larger districts than standard models assume are needed to achieve the same level of permissiveness. Where variation is particularly large permissiveness is less limiting than current models assume.

In our endeavour to unpack the effect of district magnitude on conversion of voices to seats we spend time on standard models that attribute the mediating effect to a central district (e.g., median district). Different studies use different approaches to characterizing an electoral system. We show that different approaches to categorizing the central district of a system lead to often dramatically different values and sometimes invalid classifications of systems, and importantly, the differences are contingent on the districting scheme itself. We take a step toward offering guidelines on the choice of central tendency measures.

The paper proceeds as follows. The next section briefly reviews the account of voices in the electorate and their conversion by the electoral system offered in the literature. The next section presents our argument about the effect of heterogeneity in district magnitude. The following section incorporates heterogeneity in district magnitude into analyses of parliamentary fragmentation. The following section unpacks the issue of heterogeneity in district magnitude. The following section empirically analyzes the effect of large districts on fragmentation of the party system in legislature. The final section concludes.

2. Voices in the electorate and their translation to parliament

Party systems in general and the number of parties in particular have been objects of extensive investigation by students of comparative politics. Although studies of the effective number of parties are driven by various questions and it is not possible to do them all justice here, one can identify two broad themes that receive particular attention. To the best of our knowledge, all analyses of the number of parties in legislature include on the right-hand side either an account of social heterogeneity that affects the effective number of parties in the electorate (e.g., ethno-linguistic fractionalization) or the latter itself, as well as an account of institutional mediation of the vote. Let us briefly review the treatment of the two components.

Social heterogeneity. Societal heterogeneity is the starting point for understanding fragmentation in parliament. Scholars take different approaches in addressing this issue, depending on their theoretical perspective and the region investigated (see Stoll 2008 for analytic and nuanced discussion). Among the different measures are ethno-linguistic fractionalization (e.g., Ordeshook and Shvetzova 1994, Benoit 2002), a combination of the number of ethnic groups or politically relevant ethnic groups and their geographical

concentration (Kostadinova 2002, Mozzafar et al. 2003),[1] and the number of issue dimensions (Taagapera 1999).

It is often the case that fragmentation in the electorate – affected by social heterogeneity – is in itself the focus of investigation. Depending on the theoretical focus, factors such as district magnitude (Singer and Stephenson 2009), decentralization of authorities in multi-level governance systems (Chhibber and Kollman 1998), presidential powers (Clark and Wittrock 2005, Hicken and Stoll 2011, 2013), regional cleavages (Peñas 2004), temporality (Jones 1997), and the proximity of presidential elections to legislative ones as well as the number of candidates competing (Amorim Neto and Cox 1997, Brambor Clark and Golder 2007, Clark and Golder 2006, Golder 2006, Hicken and Stoll 2011, Reich 2001, Stoll 2008. Also, see Moser and Scheiner 2004 for insightful discussion contamination in mixed party systems).

One additional theme that should be mentioned is spillover or contamination effect between elections for two institutions. This is particularly relevant for analyzing party systems in the electorate. The proximity of presidential elections to legislative ones (as well as the number of candidates competing) is found to affect the ENPV for legislature (Amorim Neto and Cox 1997, Brambor Clark and Golder 2007, Clark and Golder 2006, Golder 2006, Hicken and Stoll 2011, Reich 2001, Stoll 2008. Also, see Moser and Scheiner for insightful discussion contamination in mixed party systems).

Institutional mediation. How do political institutions mediate the transformation of party system in the electorate to that in legislature? Almost all studies analyzing party system in legislature include district magnitude on the right-hand side, and the vast majority of these include the magnitude of a central district (two exceptions are Monroe and Rose 2002 and Kedar et al. forthcoming).[2] In particular, the literature utilizes the magnitude of the median district (Carey and Hix 2011), the average district (Tavits 2008, Shugart et al. 2005), or the district electing the median legislator (Amorim Neto and Cox 1997). The greater the central tendency, the greater the permissibility of the electoral system. We unpack these measures below.

[1] See a thorough discussion of the two dimensions at Mozaffar et al. (2003, p. 384).

[2] Monroe and Rose (2002) explicitly incorporate the variance of the distribution of district magnitudes. In their innovative study, the authors contend that 'first-moment effects concern *how many* players are at the political table. The variance effect determines *which* players are at the table and what cards they hold' (p. 68, emphasis in the original). Kedar et al. (forthcoming) analyze the effect of the distribution of magnitudes on inequality in representation.

While the three statistics for central tendency measures are the most common account of institutional mediation of the vote, depending on the focus of the study, scholars offer additional ones that either measure central tendency or offer a summary characteristic of the system. Among these measures are the (usually averaged) effective magnitude (originally offered by Taagepera 1999), legal threshold (e.g., Carey and Hix 2011), effective threshold (e.g., Jones 1997, Peñas 2004), proportion of seats in legislature elected via upper tier (e.g., Amorim Neto and Cox 1997, Benoit 2002, Clark and Golder 2006, Stoll 2008), a set of dummy variables accounting for the type of electoral system (Carey and Hix 2011, Kostadinova 2002, Nishikawa and Herron 2004), and compulsory voting (Jensen and Spoon).

Finally, it should be noted that following Ordeshook and Shvetsova's (1994) pathbreaking article, the two key components – social heterogeneity and institutional mediation of the vote – are considered to have an interactive effect on fragmentation in the legislature (see also Amorim Neto and Cox (1997), Clark and Golder (2006), and Lowry et al (2010).

3. Institutional mediation of social heterogeneity

The number of seats allotted to a district, presumably the most important component defining an electoral system, is ubiquitous shorthand for institutional mediation not only in the study of party systems but also in comparative politics more broadly. Yet in most districted PR systems the number of seats per district varies substantially within the same country.

Districts in Sweden vary in magnitude between two and forty-two, in Spain the range is one to thirty-five, and in Brazil while the smallest district elects eight seats the largest one elects seventy. In fact, out of thirty-eight districted PR democratic states (those whose Polity IV score is greater than eight), only three have no variation in the magnitude of districts – Macedonia, Malta, and Chile.

3.1 Within-country variation in district magnitude

How varied are district magnitudes within countries? Figure 1 presents the median magnitude (on the horizontal axis) as well as its standard deviation (on the vertical axis) as well as their respective distributions. At the center of the figure is a scatterplot of the two. The figure includes all districted PR and mixed member majoritarian systems that score eight or higher on Polity IV with the exception of South Africa, a total of forty-four cases. We

omitted single-member districts, MMP, and national PR from the figure for presentational purposes.

As the figure shows, there is substantial variation not only in the central tendency but also in the degree of heterogeneity in district magnitude. Let us examine each moment separately first. The median district magnitude varies between one and 622 (Germany 2009) and is 30.9 on average. Among DPR's the median district magnitude varies between one (Panama) and 21 (Italy) and is 8.18 on average. Our cases vary in their average district magnitude (not reported here) as well. The average magnitude varies between one and 622 (Germany) and equals 31.9 on average. Among Districted PR's the average district magnitude varies between 1.21 (Panama) and 22.5 (Italy) and is 9.29 on average. The degree of heterogeneity in magnitude varies substantially as well. There are a few cases that have no variation in their magnitude. These are Chile (M=2), Malta ((M=5), and Macedonia (M=20). Among the rest, the standard deviation varies between 0.42 (Panama) and 16.24 (Brazil), and is 5.27 on average (with the exception of South Africa (57.66)).

Importantly, although the two dimensions co-vary, they cluster only loosely with a correlation of 0.32 (p-value =0.05). At the same time, not all combinations are equally likely. With the exception of Macedonia, large districts are usually accompanied by smaller ones and hence large districts along with little heterogeneity in magnitude is an uncommon combination. Similarly, consistent with the long left tail of the distribution of standard deviations, a combination of small median and large standard deviation is wanting.

What does a greater variation in magnitude within country look like? Next to the scatterplot we present four distributions of magnitudes of two pairs of countries that have almost identical median magnitude. Examine Malta and Portugal, with median districts of five and six seats, respectively, first. In the former all districts are of five representatives each, while Portugal, with an average magnitude of 10.45 has districts varying between two and forty-eight representatives, with a long right tail. Iceland and Brazil (with medians equalling 10.5 and 10, respectively) present an even more extreme difference. In the former districts vary between nine and twelve (average = 10.5) while in the latter the range is eight to seventy (average = 19). While the pattern might be particularly pronounced in these two examples, it is a general one. In 29 out of all 38 cases presented the average is greater than the median, suggesting a long right tail. Furthermore, the skewness is positive in 28 out of 38 cases, and negative in seven. While about half of the cases have a median district magnitude of five or smaller, about two-thirds of the cases have at least one district of twenty seats or greater. In some cases, such as Switzerland, Spain, Argentina, the

Dominican Republic, Portugal, and Brazil, the largest district is up to seven times bigger than the median one. Lastly, standard deviation in magnitude is positively correlated with the fraction of legislature elected via districts of at least fifteen seats (0.66, p-value<0.001) and at least twenty seats (0.58, p-value<0.001). The fraction of parliament elected in districts smaller than five seats is negatively associated with larger standard error, albeit the correlation is weaker (0.40, p-value=0.01). Other things equal, then, larger standard error in district magnitude within country implies that more representatives are elected via large districts.

-- Figure 1 --

The differences in within-country variation regardless of the median suggest that variation in magnitude ought to be taken seriously and in particular incorporated into analyses of institutional mediation of the vote. Because greater variation in district magnitude often implies a left hump and a long right tail (a few large districts in cities), large variation implies that a large portion of parliament is elected via few large districts. Thus, we expect that:

H1. the bigger the variation in magnitude the more permissible is the electoral system.

4. Empirical analysis: how districts mediate variety of voices in the electorate

4.1. Our data

We utilize data on election results and institutional structure from sixty-three democracies that vary in their electoral systems.[3] The majority of our cases employ districted PR, nine employ FPTP, six employ national-district PR, and ten cases employ mixed systems (seven of them MMM and three MMP). Geographically, twenty of our cases are Western European democracies, fourteen are Eastern European, twelve located in Latin America, and the rest are in North America, Africa, Asia, the Middle East, and Oceania. Our data sources on votes and seats are official records of election results usually published by National Elections Committees or the Ministry of the Interior. Institutional data regarding the electoral system was gathered for each case using various sources.

[3] We include cases that score at least eight on Polity IV scale. We also include Iceland and Malta with a population too small to be included in the Polity scale.

In our calculation of the effective number of parties in the electorate (ENPV) and that in legislature (ENPS) we included all competing parties and candidates. In cases where official records reported independents or others as a group we did as follows. For independents, we considered each attained seat as a separate independent and allotted each of them an identical fraction of votes out of all independent votes. For others (these competitors did not attain a seat or they would have been identified by name) we imputed a 0.2 percent of the total votes. Lastly, given the electoral system in Switzerland and Luxemburg in which the number of votes per voter vary across districts, we standardized the total votes per district according to the magnitude of that district.

4.2 The mediating effect of small and large districts

How does the districting scheme in a country mediate the conversion of party system fragmentation in the electorate to that in legislature? In line with previous work, we allow for key institutional components which have a potential limiting effect to interact with social heterogeneity as manifested in the electorate's votes (e.g., Clark and Golder 2006, Amorim Neto and Cox 1997). Also in line with previous work, we include a series of dummy variables to control for whether the electoral system is mixed-member proportional, mixed member majoritarian, fused vote, national-district PR, or FPTP system.[4] Our principal baseline model is thus:

(1) $ENPS_j = \alpha_0 + \alpha_1 ENPV_j + \alpha_2 MedD_j + \alpha_3 ENPV_j MedD_j + \sum_{i=4}^{K} \alpha_i z_{ij} + \upsilon_j$

where $ENPS_j$ is the effective number of parties in legislature in country *j*, $ENPV_j$ is the effective number of parties in the electorate, $MedD_j$ is magnitude of the median district in country *j*, z_j is a control variable for the electoral formula as specified above, and υ_j is a random error. Results of this analysis are reported in Table A1 in the on-line appendix. Figure 2(a) presents our key quantity of interest extracted from the raw results – the conversion of *ENPV* to *ENPS*:

$1(a)$: $\dfrac{\partial ENPS}{\partial ENPV} = \hat{\alpha}_1 + \hat{\alpha}_3 MedD_j$

and how this conversion depends on institutional factors. This conversion ('effect' of *ENPV* on *ENPS*) on the vertical axis is presented against the median district magnitude on the horizontal axis. At the bottom of the figure is a rug plot of districted PR's and MMM systems

[4] This specification of controls is quite similar, albeit not identical, to the one employed by Carey and Hix 2011). Among others, Carey and Hix also include a modified PR variable, which includes PR with median district magnitude smaller than nine seats.

included in our raw data, truncated at 3.1 for presentational purposes. Their logged medians vary between zero in Panama and most MMM systems (median of one) and 3.045 in Italy and South Africa (median of 21).

The Figure reveals several things. First, as expected, the effect is positive; *ENPV* is strongly, positively, and significantly correlated with *ENPS*. Other things equal, more parties in the electorate imply more parties in legislature. Second, the relationship increases with median district magnitude and approaches one from below as the median district gets larger. Thus, when district magnitude is small the electoral system has a limiting effect, and this effect fades out with district magnitude, making the system more permissible.

Based on our contention above we now shift to estimating the conversion of votes to seats as mediated via both central tendency and variation in district magnitude. The principal model we test in reference to the baseline model is thus:

$$(2)\ ENPS_j = \beta_0 + \beta_1 ENPV_j + \beta_2 MedD_j + \beta_3 ENPV_j MedD_j +$$

$$\beta_4 SD(D)_j + \beta_5 ENPV_j SD(D)_j + \sum_{i=6}^{K} \beta_i z_{ij} + u_j$$

where *SD(D)*$_j$ is the standard deviation of district magnitude and u_j is the random error. Results of this estimation are reported in Table A1 in the on-line appendix, and while we focus on substantive effects here, let us mention that the coefficients on *both* interaction effects – with the median and with the standard deviation – are statistically significant. Figure 4(b) presents the conversion of party system in the electorate to that in parliament as modified by institutional effects. On the vertical axis is thus:

$$(2a)\ \frac{\partial ENPS}{\partial ENPV} = \hat{\beta}_1 + \hat{\beta}_3 MedD_j + \hat{\beta}_5\, SD(D)_j.$$ [5]

On the horizontal axis is the magnitude of the median district. For parsimony, at this stage we set the heterogeneity in magnitude to two values. The dotted line stands for countries in which district magnitudes vary substantially (in particular, standard deviation of magnitudes

[5] The estimated standard errors of the two specified effects are thus:
$\left[var(\hat{\alpha}_1) + MedD_j{}^2 * var(\hat{\alpha}_3) + 2\, MedD_j * cov(\hat{\alpha}_1\hat{\alpha}_3)\right]^{1/2}$ for the baseline model, and
$\left[var(\hat{\beta}_1) + MedD_j{}^2 * var(\hat{\beta}_3) + SD(D)_j{}^2 * var(\hat{\beta}_5) + 2\, MedD_j * cov(\hat{\beta}_1\hat{\beta}_3) + 2SD(dm)_j * cov(\hat{\beta}_1\hat{\beta}_5) + 2MedD_j * SD(D)_j * cov(\hat{\beta}_3\hat{\beta}_5)\right]^{1/2}$ for our main model.

of the 90th percentile of our sixty-three cases), and the dashed line stands for cases with little within-case heterogeneity (standard deviation of magnitude of the 10th percentile).

Generally, as in the baseline model, the figure presents a positive relationship that increases with median magnitude. The two panels differ, however, in their prediction of how well votes translate into seats given magnitude. Take point A on the left panel, the baseline model, and consider two comparisons on the right panel. This point represents permissiveness level of 0.7. At this level, four effective parties at the electorate translate into 2.8 in the legislature. This conversion is achieved when the median district is of 3.7 seats (logged median is 1.3). The right panel presents two analogous points of the same permissibility: A' and B'. At point A' -- of countries with high variation in district magnitude – this same level of conversion is achieved via almost the same median district (3.3 or logged median of 1.2). In countries where districts vary to a lesser degree, however, a substantially larger median district is needed in order to achieve that same level of conversion (point B'). Where there is little heterogeneity in magnitude across districts, this level is achieved when the median district is no smaller than 15.2 (logged median is 2.7), over eleven seats larger than per the baseline model. Put differently, between A' and B', the greater variation in magnitudes counteracts the smaller median district and the same overall permissiveness is achieved.

Alternatively, consider point C' on the bottom line. This point is of the same median magnitude as A' (3.3), but unlike the dotted line, it represents countries in which districts are of similar magnitude. Compared to 0.7 at the baseline model, the permissibility achieved here is of 0.55. At this level, four effective parties in the electorate translate to 2.3 only in parliament.

Initial analysis, therefore, suggests that once variation in magnitude in taken into consideration, compared to standard models, in countries with low variation in magnitude larger districts are needed in order to achieve the same permissiveness. In countries with high variation, districts similar to and perhaps even smaller than standard models yield the same level of permissiveness.

- Figure 2 here -

Figure 3 presents a comprehensive picture of the relationship. The figure presents the median and standard deviation of magnitude on the horizontal and vertical axes, respectively. Scattered on this plain are the cases (for presentational considerations we omit the national-district PR's and FPTP. The shades in the body of the figure represent the predicted level of permissibility, $\frac{\partial ENPS}{\partial ENPV} = \hat{\beta}_1 + \hat{\beta}_3 MedD_j + \hat{\beta}_5 SD(D)_j$, as estimated from Equation 2, collapsed into 0.1 width intervals. The darker the shade the better the conversion of party system in the electorate to that in parliament. On the left panel is the estimated effect based on the baseline model (akin to Figure 4a). As can be seen, party system in the electorate is more accurately converted to that in parliament as the magnitude of the median district increases (denoted by a darker shade). As in current literature, and per Equation 1, this model is by design insensitive to variation in magnitude. Thus, Chile and Uruguay have about the same permissiveness (0.651 both), as do Malta and Portugal (0.720 and 0.740, respectively), and as do Iceland and Brazil (0.782 and 0.779, respectively).

The right panel presents the permissiveness based on the model estimated in Equation 2 (akin to Figure 4b). Here, an effect of the median district only would be reflected in horizontal gradation (per the left panel) while an effect of variation alone would be reflected in vertical gradation. The figure presents several interesting findings. First, permissiveness increases with median district magnitude, as the darker shades on the right side of the figure indicate. Second, permissiveness increases with variation in magnitude, as the darker shades on the upper part of the figure indicate. The conversion from the electorate to parliament depends on both the median and the within-country variation in district magnitude. Note, as an example, the permissiveness of countries that have similar district magnitude but differ in their variation. By the baseline model, Malta and Portugal have a similar predicted permissibility. In panel b, however, once heterogeneity is accounted for, party system in the electorate translates substantially better to that in parliament in Portugal than in Malta (0.797 and 0.614, respectively). Another example is Iceland and Brazil for which panel a predicts an almost identical conversion. Once variation is taken into account, however, conversion in Brazil is substantially superior to that in Iceland (0.902 and 0.687 respectively). Our first hypothesis, therefore, finds support in the data.

Thirdly, notice that given that both median district and variation are at work per the diagonal pattern of shades, de facto, a combination of low median and large variation is exchangeable with that of high median and low variation. Malta has a permissibility similar

to that of Lithuania (0.614 and 0.607, respectively), and Iceland to that of Uruguay (0.687 and 0.678, respectively).

Lastly, and related to previous points, notice that for countries with low variation – those on the bottom part of the figure -- the right panel predicts worse permissiveness compared with the left one. In other words, under these circumstances the standard model overestimates how well the party system in the electorate is converted to that in legislature given a given central tendency. For countries with high variation – those on the upper part of the figure – the right panel predicts better translation of votes to seats. In other words, when districts vary in their magnitude, the standard model underestimates the quality of conversion of votes to seats

- Figure 3 here -

4.3 Different paths to the same outcome?

Above, we demonstrated that diversity of voices in the electorate is better transformed into diversity of voices in parliament when either districts are larger in general (e.g., median district) or the distribution of districts has larger variation. In other words, there are different institutional designs by which the system can maintain a relatively large number of effective voices. Does the difference in how the overall level of diversity in representation is achieved affect which voices are represented? Particularly, does the high variance route lead to greater heterogeneity in how votes are converted to seats, benefitting larger parties at the expense of smaller ones? To examine this possibility, we conducted several sets of analyses focusing on overrepresentation of the largest one or two parties.

Our first set of analyses employed the ratio of seat-share to vote-share of the largest party as well as the ratio of the combined seats and votes of the largest two parties. A ratio greater than one implies that the largest parties are overrepresented in parliament given their vote-share, and smaller ones are likely underrepresented. To validate this measure, we examined it at the district level and found that, as expected, the ratio of seat-share to vote-share of the largest party exceeds one under small districts and gradually declines with district magnitude. We found no systematic effect of the standard deviation of district magnitude on the bias in favor of the largest party(ies), whether accompanying the median magnitude alone or with additional control variables (single-member district, mixed-member

majoritarian). We repeated this set of analyses but with the difference between seat- and vote-share rather than the ratio. Our results remained unchanged. Similarly, when only the subset of districted PR's was included in the analysis the results remained unchanged. We then replaced the standard deviation of magnitude with the lower and then upper tail of the distribution. Here, some of the analyses reached statistical significance, but these results were unstable.

Next, we employed Gallagher's index of disproportionality (1991) at the national level, accounting for the overall gaps between parties' vote- and seat- shares. We first estimated the effect of both median magnitude and standard deviation in magnitude on the degree of disproportionality, and found no systematic effect of the latter. Additionally, we separated our data according to the predicted value of the conversion estimated above, dividing it by 0.1-interval diagonals, and estimated the effect of Monroe and Rose's (2002) measure of $\sigma_{DM}/_{median_{DM}}$ on the predicted conversion. An increase in the explanatory variable is akin to an upward and leftward shift along the diagonal. A positive coefficient in this analysis would imply greater disproportionality at the top-left part of the diagonal compared to its bottom-right part. Here, too, in all diagonals the data showed no systematic relationship.

Overall, then, we found no systematic evidence that cases on the upper part of a diagonal (high variance, low median) involve greater inequality in the representation of different parties compared with cases on the lower part (low variance, high median). Both institutional configuration seem to lead to similar cross-party results.

5. Unpacking the effect of district heterogeneity

What about high-variation in districting leads to better conversion of votes to seats? Above, we point to the fact that high variation in magnitude is associated with the presence of large districts. The typical case of high variation in magnitude is one of many small districts (usually in small towns and rural areas) and a single or several large ones (usually big cities). In this section we unpack heterogeneity in district magnitude and its effect on electoral system permissibility.

5.1 How many seats? It depends how you count

As established above, the greater the number of seats elected by a central district (hereafter central tendency), the greater the permissiveness of the electoral system. But how does one measure district magnitude? There are two alternative approaches: one takes

districts as the unit of analysis and another takes legislators as the relevant unit. Importantly, the differences, sometimes vast, are not constant – they depend on the districting scheme itself. This issue is not merely a technical nuisance regarding measurement. It sheds light on the way in which the electoral system mediates the translation of votes to seats.

Let us draw on an illustration from a different field – education – that highlights the logic of each of the two approaches (inspired by Feld and Grofman (1977). Suppose that a college in which three classes are taught -- two with ten students each and one with a hundred – conducts an evaluation of teaching and learning. The median class has ten students while the median learning experience for students is studying in a class of a hundred. Similarly, while the average class size is forty (120/3), the average student learns in a class of eighty-five: there are a hundred students ("observations") learning in a class of a hundred and twenty learning in a class of ten ((100*100+20*10)/120). Whether one should count classes or students depends on the motivation of the study. If one is interested in construction of classrooms on campus classes and their sizes are an appropriate focus. If, on the other hand, the goal is learning about the experience of students, it is students that should be counted, not classes.

The electoral analogy is straight forward. The first approach takes districts as the relevant unit. Perhaps the simplest measure is the magnitude of the median district (MedD) – that district that half of the districts elect fewer representatives and half a greater number of representatives in comparison (e.g., Carey and Hix 2011). The main advantage of this measure is the ease of data collection and its computation. A close alternative is the average district magnitude (AvgD) defined as D/S where *D* is the number of districts and *S* is the number of seats in legislature (e.g., Tavits 2008, Shugart et al 2005). As is well known, the median is less sensitive to the extremes of the distribution (in this case, large districts are of particular relevance).

The second approach takes legislators as the unit of analysis. The information encapsulated in this approach is whether, generally, legislators come from small or large districts (Amorim Neto and Cox 1997). With this logic in mind, Amorim Neto and Cox propose the magnitude of the district electing the median legislator (MedL): the legislator who half of her colleagues are elected in smaller districts and half in larger ones. Lastly, although to the best of our knowledge not offered in the literature, we can focus on the magnitude in which the average legislator is elected (AvgL). This is defined as

$\sum_{i=1}^{D} m_i \frac{m_i}{S} = \frac{1}{S}\sum_{i=1}^{D} m_i^2$ where *m* is district magnitude, such that every magnitude is weighted by the number of legislators elected in this district (which equals *m* as well).

The political parallel of the example above is a country with three districts, two of which elect ten legislators each and the third elects a hundred (e.g., a large city). Should one count districts (classes) or legislators (students)? What is the central tendency in this country? Ten (MedD), forty (AvgD), eighty-five (AvgL), or a hundred (MedL)? Under what circumstances do the measures score similarly and when do they differ? And does it matter as long as a researcher is consistent across systems? Importantly, the two approaches yield the same values (per statistic) when all districts are of equal magnitude. Only then does the equal weight given to every observation (district) under the first approach well represents individual legislators under the second. We now switch to analysing the systematic differences between them.

5.2 Large and small districts

Consider a sequence of 101 electoral systems. Holding the legislature size fixed at 101 seats, we begin with a system in which all districts are of a single member. We then take seats allocated via single-member districts and gradually, one by one, reassign them to a single district which gets larger and larger. Thus, as we move from Country 1 to Country 101 the number of single-member districts declines and instead more seats are assigned via a single district of greater magnitude while the size of the legislature is unchanged. This is equivalent to gradually shifting the electoral system from one resembling the British FPTP system to one resembling the Dutch, national-district system.

Figure 4 presents the 101 countries on the vertical axis, along with the four central-tendency measures on the horizontal axis. Let us begin with the district approach. Beginning at the bottom of the figure, as we move up single-member districts outnumber the (single) multi-member district up to Country 99 (two single-member districts and one district of ninety-nine representatives). This holds even when as many as eighty or ninety percent of the legislators are elected via a large multi-member district. The magnitude of the average district is slightly more sensitive to extreme values, as expected (AvgD, marked by triangle). Still, it increases slowly: starting at one, it takes the value of two at the fifty-first country and 9.2 at the ninety-first, with the exceptions of the last very few systems this measure of central tendency is between ten and twenty-five times smaller than the district that elects the bulk of the legislators.

The two legislators' measures present a different pattern. Examine the magnitude of the district electing the 51st legislator first (MedL, marked by square). In the first fifty countries that legislator is elected via a single-member district and as of Country 51 in the single large district. Thus, the value of this indicator is unchanged (one) for the first fifty countries and in the remaining countries it takes the values of fifty-one to 101. Lastly, the magnitude of the district electing the average legislator (AvgL, marked by diamond) increases secularly. For example, in Country 33 (sixty-eight SMD's and a single district of thirty-three seats) it takes the value of 11.5, and in Country 66 (thirty-five SMD's and a single district of sixty-six seats) the value of 43.5.

That the four measures take different values is not a concern in itself – they each capture a different property of districting. What is potentially concerning, however, is that the differences between them are not constant, and in fact depend on the districting structure itself. In general, the legislator approach yields larger values compared with the districted approach. Additionally, the larger the range of districts (a bigger multi-member district next to plethora of single-member districts) the greater the gap between the district and the legislator approach. We now turn to empirically consider the two approaches.

-- Figure 4 here –

Figure 5 presents the thirty-eight districted PR included in Figure 1. To avoid a crowded picture, we present the *differences* between the two pairs of measures: the gap between magnitude of the median legislator and the median district (MedL-MedD, marked by circles) and the gap between the magnitude of the district electing the average legislator and that of the average district (AvgL-AvgD, marked by triangles). Each marker, then, denotes the difference between the two approaches, whether in terms of medians or means. Importantly, the countries are arranged in descending order of their standard deviation in district magnitudes, with Brazil at the top and Chile (with all districts of two representatives) at the bottom. Analysis of the four measures themselves (not reported here) indicates a pattern similar to (albeit somewhat more noisy than) that of the hypothetical 101 systems presented in Figure 4.

The figure reveals several interesting things. First, the gaps vary substantially across cases. While in some countries counting districts and counting legislators yield almost the

same answer, in others it makes a substantial difference up to over ten seats (e.g., Portugal and Uruguay). This is the case both in terms of both mean and in terms of median. Second, the gaps between the two approaches increase with variation in district magnitude. And given that variation in magnitude goes hand in hand with a long upper tail this same pattern holds when organizing the countries in descending order of their largest district (not presented here). In summary, as standard deviation in district magnitude increases central tendency gives us increasingly different results depending on the approach (district vs. legislator) and the measure (mean vs. median).

-- Figure 5 here –

We are now better positioned to analyze how variation in district magnitude affects the conversion of votes in the electorate to parliamentary seats. We pay special attention to variation in magnitude, and with it to the two approaches of accounting for central tendency. Overall, the analysis conducted here along with the information captured in Figure 1 leads us to our second hypothesis:

H2. The approach that takes legislators as the unit of analysis is better able to account for institutional mediation of voices in the electorate than that which takes districts as the relevant unit.

6. The effect of large districts

Above, we showed that the (often dramatic) differences between the two approaches to counting seats correlate with the districting structure itself. We also demonstrated that heterogeneity in district magnitude is often characterized by a long upper tail of a small number of large districts (cities). We shift now to showing how the different approaches lead us to different inferences about the effect of electoral systems. We repeat the estimation of Equations 1 vs. 2 employing various measures of spread that focus on the upper tail of the distribution – large districts. We also employ the different approaches to counting districts. Our analysis focuses on the conversion of fractionalization in the electorate to that in parliament (per Equations 1a and 2a), or put differently, the degree to which the electoral system allows multiple voices in the electorate to penetrate parliament.

Figure 6 presents the gap in the conversion of votes to seats between the baseline model and our main model. On the horizontal axis are the gaps between the two such that a positive difference implies that the baseline model overestimates the conversion compared with our model. For spread, we employed standard deviation and the proportion of parliament elected via large multi-member districts – twelve seats and greater up to twenty-one seats and greater (ten alterative cut-off points overall). We also employed the four alternative measures of magnitude mentioned above. For compactness, we present here the differences in conversion based on two of the four measures: magnitude of the median district (in gray, used in Carey and Hix 2011) and magnitude of the average legislator (in black). As we showed in Figure 4 above, these are the two measures that differ most, with the latter being sensitive to the upper tail and the former not. And we present three of the spread measures in the three panels of the figure: standard deviation, and cut-offs of twelve- and eighteen-member districts (results of all other cut-off points are similar to the two presented here). While the models are estimated on all cases in our dataset (See Appendix Tables A1 and A2), for ease of presentation we include here only cases employing districted PR. Finally, in each panel the cases are organized in descending order of the relevant spread measure.

Panel (a) presents the gap in conversion for cases with low and high variance in magnitude. The figure reveals several things. First, in most cases (and utilizing either measure) the baseline model overestimates the degree to which votes are converted to seats, leading to infer that the electoral system is more permissible than our model suggests. This is contingent, however, on heterogeneity in magnitude. For cases with little heterogeneity the bias is large, about 0.05 or greater for a third of the cases. For cases with large variation, however, the bias is reversed, and the baseline model underestimates the conversion of votes to seats.

Second, for almost all cases, the analysis utilizing the magnitude of the district electing the average legislator yields results that are more similar to those produced by the model that incorporates variation (shorter horizontal bars) while the magnitude of the median district yields results that are farther off from it (longer bars). This latter finding is consistent with our analysis of the different central tendency approaches and measures. Recall that the approach that counts legislators is more sensitive to the upper tail of the distribution than that that counts districts (classes).

Panels (b) and (c) present our analysis with specific spread measures that target the upper tail – the proportion of parliament elected in multi-member districts greater than a

particular threshold. We present here results of twelve- and eighteen-member districts, though our analysis hold for all cut-off districts of twelve to twenty-one representatives. The results are similar to those in Panel (a). In countries with a long or thick upper tail the baseline model underestimates the permissibility of the electoral system while in countries where a small proportion of legislators is elected via large districts the baseline model based on the central district overestimates the quality of conversion. Here, too, the results based on the median district show greater gaps between the models compared with those produced by the average legislator

To summarize, where large districts are present, the electoral system is more permissible than one would infer by the magnitude of a central district alone. Where districts are similar in magnitude, however, the electoral system is more limiting than one might infer by the magnitude of a central district. This is because there are no large districts that are 'doing the work' of incorporating diversity of voices in the electorate into parliament. Put differently, where all districts are of similar magnitude, larger districts than commonly assumed are needed to achieve permissibility. Where some are larger than others, however, even with a modestly large central district permissibility can be achieved.

- Figure 6 here -

7. Conclusion

Many democracies are characterized by an electoral system of varying district magnitude. Within the same country some districts elect a few representatives while others elect many with a gap between the two ends of up to twenty-fold and greater, yet other states are characterized by districts of similar magnitude. Students of electoral politics treat the two types as similar as long as they are similar on average. This study challenges this assumption, and particularly analyses the effect of heterogeneity in district magnitude on party-system permissibility.

We demonstrate that when variation in magnitude is low the effect of the electoral system is more limiting than often thought. Put differently, compared with current models, we find that larger districts are needed in order to reach the same level of permissiveness of the electoral system. When variation is particularly large, we find the opposite: electoral systems are more permissible than current models find. We particularly identify the effect

of a long right tail in the distribution of districts – countries with high variation in district magnitude are often countries with one or several large districts and many small ones. When the distribution of district magnitudes is stretched upward and a substantial part of the legislature is elected via large district(s) the relative weight of the small districts in shaping the legislature decreases and hence the electoral system is more penetrable to multiple parties.

Our analysis of central tendency takes a step toward offering guidelines to the choice of measure. We show that different measures take (sometimes dramatically) different values, and the gaps between measures depend on the districting scheme itself. For the research question at hand – institutional mediation of social heterogeneity – counting districts is likely to lead a researcher astray more so than counting legislators. For other research questions the opposite might be the case. While useful shorthands, central tendency measures come with a cost. They may mischaracterize a system, overlook differences across systems, and exaggerate a modest difference between systems.

This paper is among the first that incorporate variation in district magnitude into the study of electoral politics. While we do not prescribe one particular measure of the distribution, our results suggests that similarity 'on average' is often a perilous working assumption. Different properties of the distribution of districts in a system may have different effects on various political and economic outcomes. Further unpacking the weighty explanatory power that political scientists have attributed to district magnitude may enhance our understanding of electoral politics.

Appendix

Table A1. Institutional mediation of social heterogeneity (MedD)

	(1) Baseline model	(2) Model including SD(D)	(3) Model including %Leg from DM≥18	(4) Model including %Leg from DM≥12
ENPV	0.596***	0.489***	0.562***	0.551***
	(0.054)	(0.054)	(0.052)	(0.052)
MedD(Logged)	0.311***	0.317***	-0.156	-0.108
	(0.116)	(0.106)	(0.153)	(0.160)
ENPV x MedD	0.079***	0.077***	0.032	0.020
	(0.023)	(0.020)	(0.030)	(0.030)
SD(D)		-0.026		
		(0.016)		
ENPV x SD(D)		0.014***		
		(0.004)		
%≥18			-0.845	
			(0.643)	
ENPV x %≥18			0.297**	
			(0.124)	
%≥12				-1.049*
				(0.601)
ENPV x %≥12				0.312***
				(0.108)
SMD	0.630***	0.491***	-0.633***	-0.619***
	(0.206)	(0.183)	(0.194)	(0.190)
National PR	0.069	0.425	-0.130	0.075
	(0.284)	(0.272)	(0.284)	(0.260)
MMM	0.679***	0.700***	-0.838***	-0.762***
	(0.241)	(0.213)	(0.238)	(0.226)
MMP	0.095	0.273	0.019	0.155
	(0.301)	(0.273)	(0.295)	(0.276)
Fused Ballot	0.744*	0.612	0.831**	0.847**
	(0.393)	(0.424)	(0.381)	(0.366)
Constant	0.972***	1.234***	1.101***	1.130***
	(0.256)	(0.234)	(0.244)	(0.242)
Observations	63	63	63	63
R-squared	0.931	0.949	0.942	0.945

Note. Dependent variable: ENPS. Model (1) is the baseline model per Equation 1. It is used for generation of Figures 2a and 3a. Models (2-4) include alternative spread measures. Model 2 follows Equation 2 and is used for generation of Figures 2b and 3b. Models 3 and 4 are used for generation of Figures 6b and 6c. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A2. Institutional mediation of social heterogeneity (AvgL)

	(1) Baseline model	(2) Model including SD(D)	(3) Model including %Leg from DM≥18	(4) Model including %Leg from DM≥12
ENPV	0.526***	0.504***	0.625***	0.592***
	(0.073)	(0.069)	(0.078)	(0.069)
AvgL(Logged)	-0.270*	-0.287*	0.117	0.178
	(0.141)	(0.152)	(0.240)	(0.247)
ENP x VAvgL	0.081***	0.061**	-0.030	-0.027
	(0.024)	(0.025)	(0.047)	(0.040)
SD(D)		-0.014		
		(0.018)		
ENPV x SD(D)		0.011**		
		(0.005)		
%≥18			-1.723*	
			(0.864)	
ENPV x %≥18			0.491***	
			(0.183)	
%≥12				-1.831**
				(0.767)
ENPV x %≥12				0.446***
				(0.137)
SMD	-0.545**	-0.613**	-0.610**	-0.503*
	(0.269)	(0.262)	(0.280)	(0.272)
National PR	0.004	0.561	-0.098	0.020
	(0.294)	(0.346)	(0.282)	(0.277)
MMM	0.861***	0.830***	-0.825***	-0.757***
	(0.215)	(0.203)	(0.203)	(0.203)
MMP	0.027	0.411	0.085	0.084
	(0.338)	(0.357)	(0.320)	(0.330)
Fused Ballot	0.920**	0.746	0.859**	0.799**
	(0.409)	(0.455)	(0.387)	(0.376)
Constant	1.149***	1.300***	0.842**	0.862**
	(0.370)	(0.360)	(0.402)	(0.376)
Observations	63	63	63	63
R-squared	0.931	0.941	0.941	0.945

Note. Dependent variable: ENPS. Model (1) includes the baseline model similar to Equation 1 but with Average Legislator as the measure of magnitude. Model (2) includes the model similar to Equation 2 and is used to generate panel (a) in Figure 6. Columns (3) and (4) replicate Equation 2 with different spread measures - proportion of parliamentary seats elected in districts greater than eighteen seats (Figure 6 panel b), and proportion of parliamentary seats elected in districts greater than twelve seats (panel c).
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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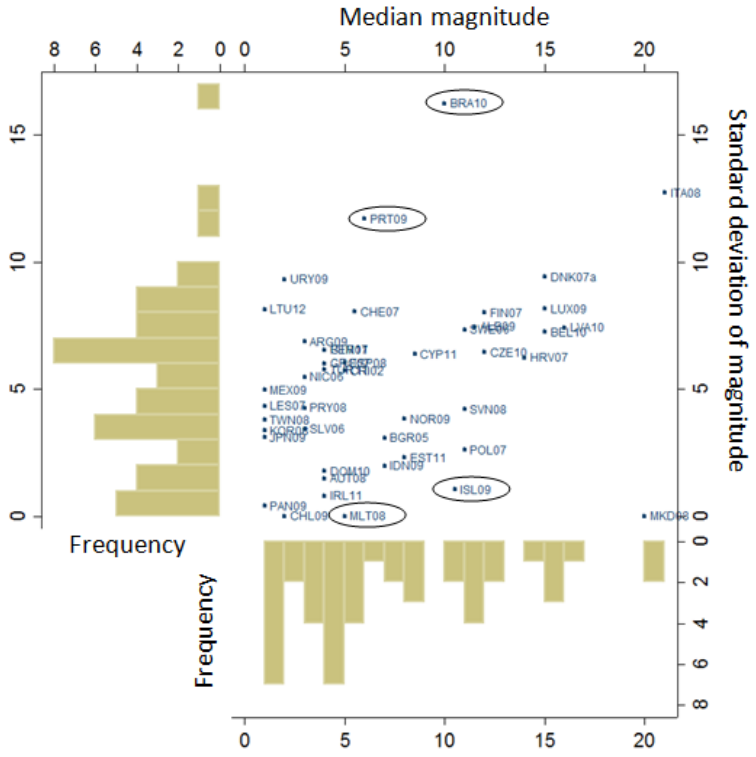
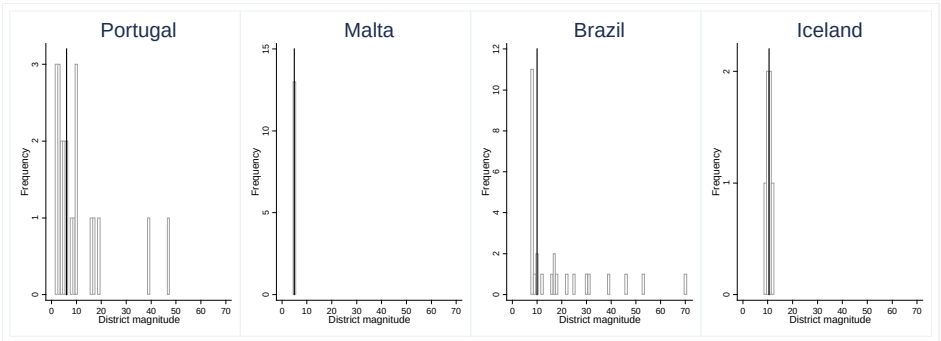
Figure 1. Electoral systems: within country variation



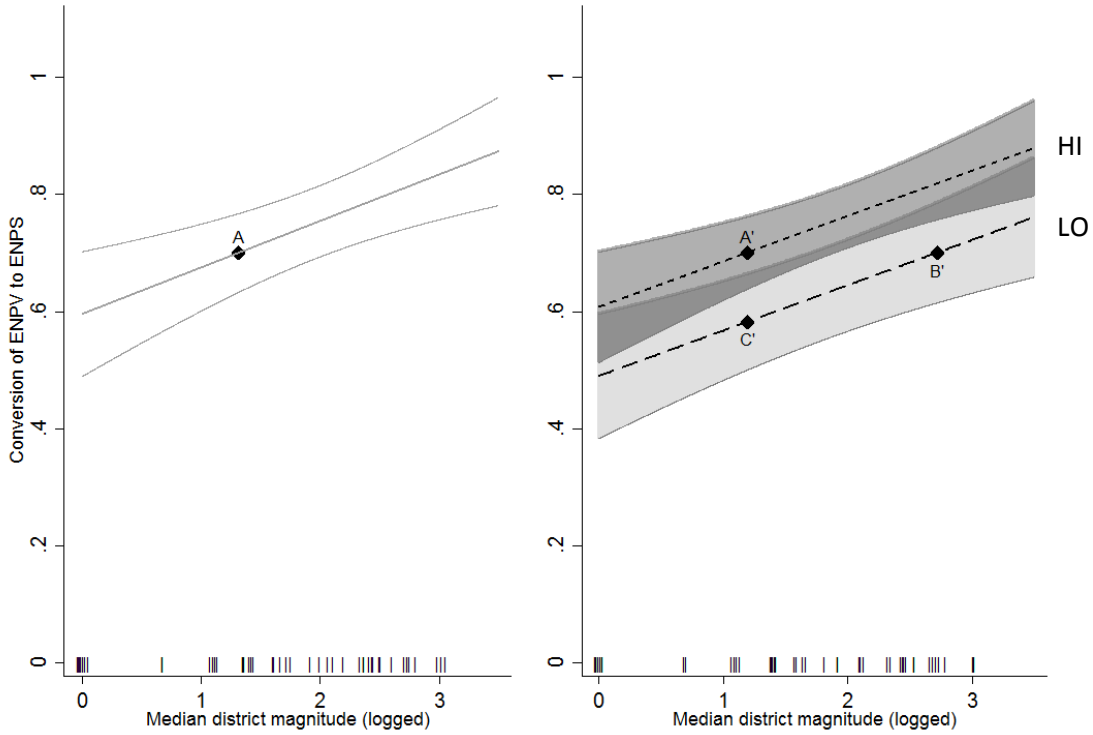
a



b

Note. Panel (a) presents a scatterplot of median district magnitude and standard deviation of magnitude in districted PR and MMM systems (with the exception of South Africa). Histograms of the two variables are at the bottom and left margin. Panel (b) presents histograms of district magnitudes in four districted PR systems. The black bold line marks the median district magnitude.

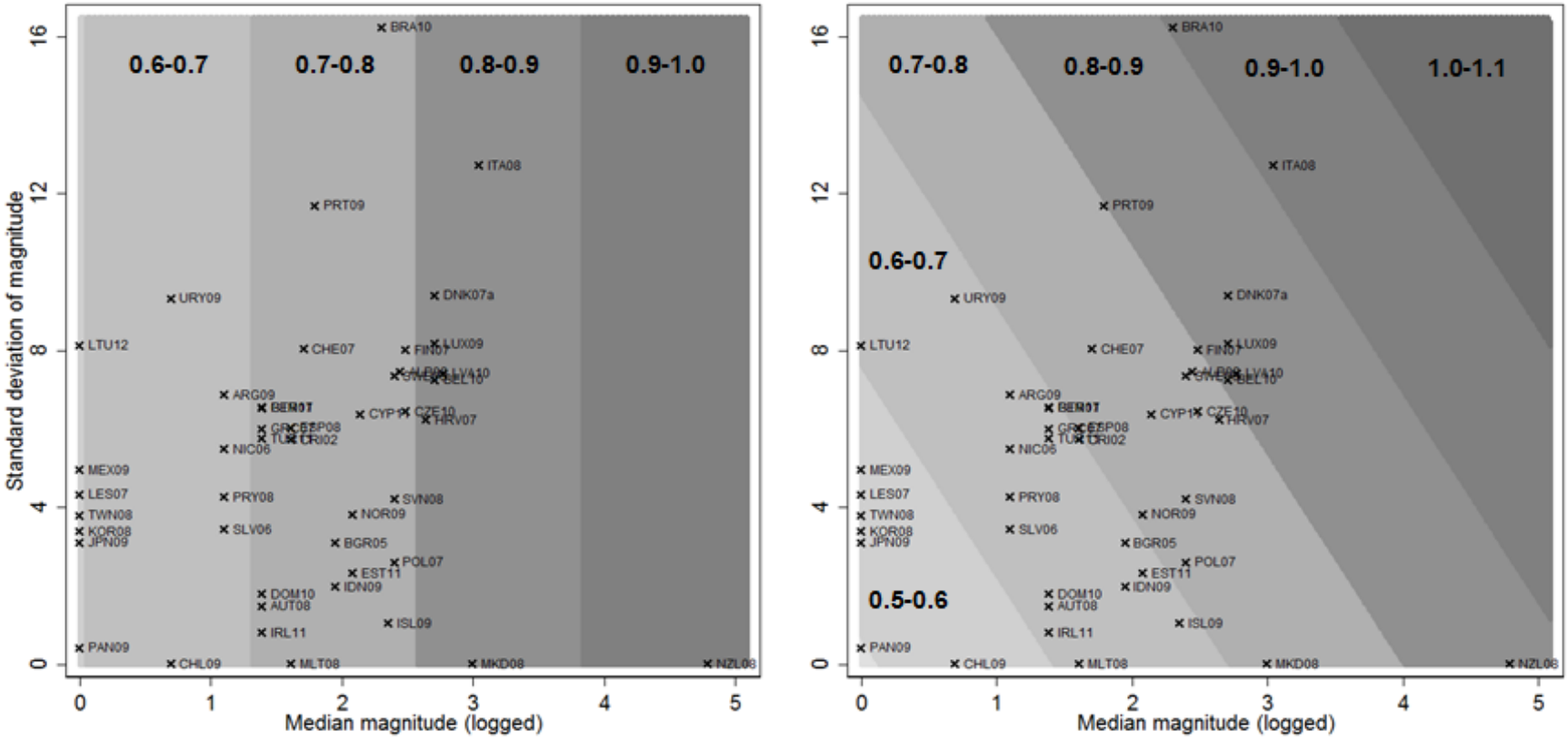
Figure 2. Effective number of parties: a two dimensional picture



a. Baseline model **b. Our model**

Note. Both panels present the conversion of ENPV to ENPS (on the vertical axis) as a function of median district magnitude (on the horizontal axis). Panel (a) presents the baseline model and Panel (b) includes SD(D) per Equations (1) an (2), respectively. In panel(b) the upper dashed line presents this effect for the 90th percentile of SD(D) and the lower dashed line – for the 10th percentile. Both lines are accompanied by 95% confidence intervals. The rug plot marks the distribution of median district magnitudes (logged) among districted PR and MMM cases, with the horizontal axis truncated at 3.1.

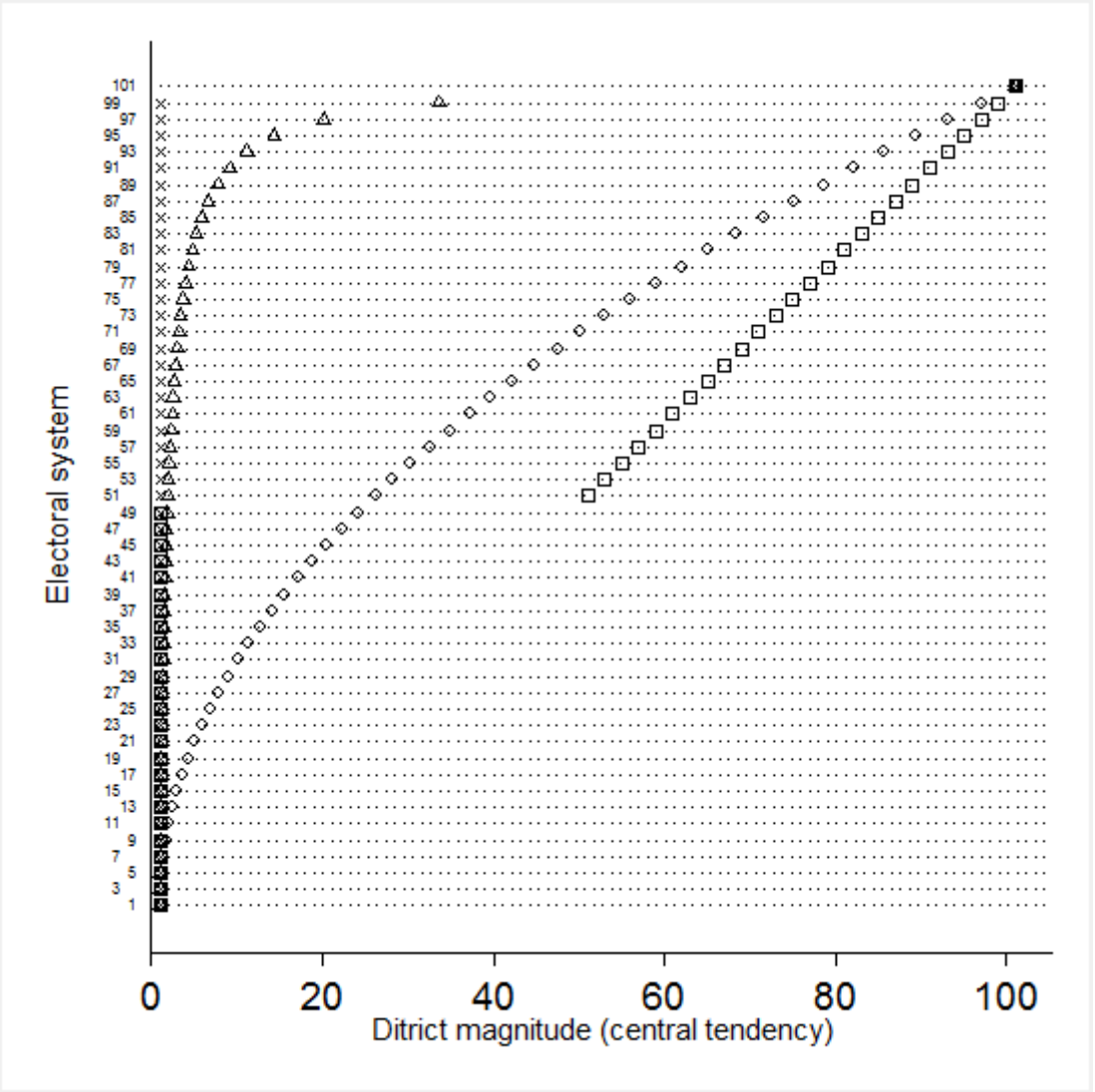
Figure 3. Effective number of parties: a three dimensional picture



a. Baseline model **b. Our model**

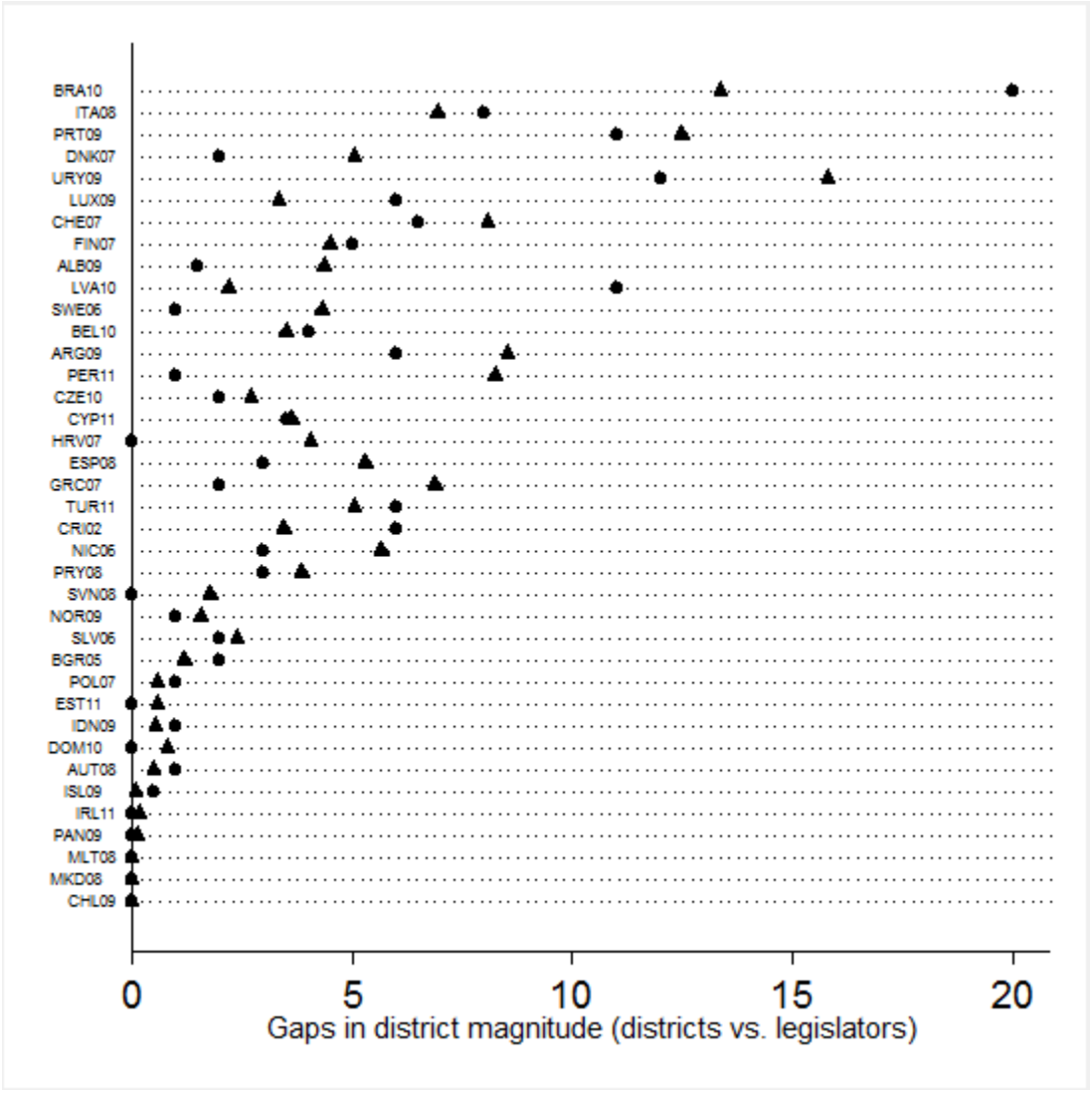
Note. Panels (a) and (b) present results of models estimated in Equations (1) and (2), respectively. The gray areas are the estimated conversion values of ENPV to ENPS, collapsed into 0.1-width intervals. Darker shade denotes better conversion. A scatter of cases includes districted PR, MMM and MMP systems, with the horizontal axis truncated at 5.1.

Figure 4. "UK to the Netherlands": central-tendency measures



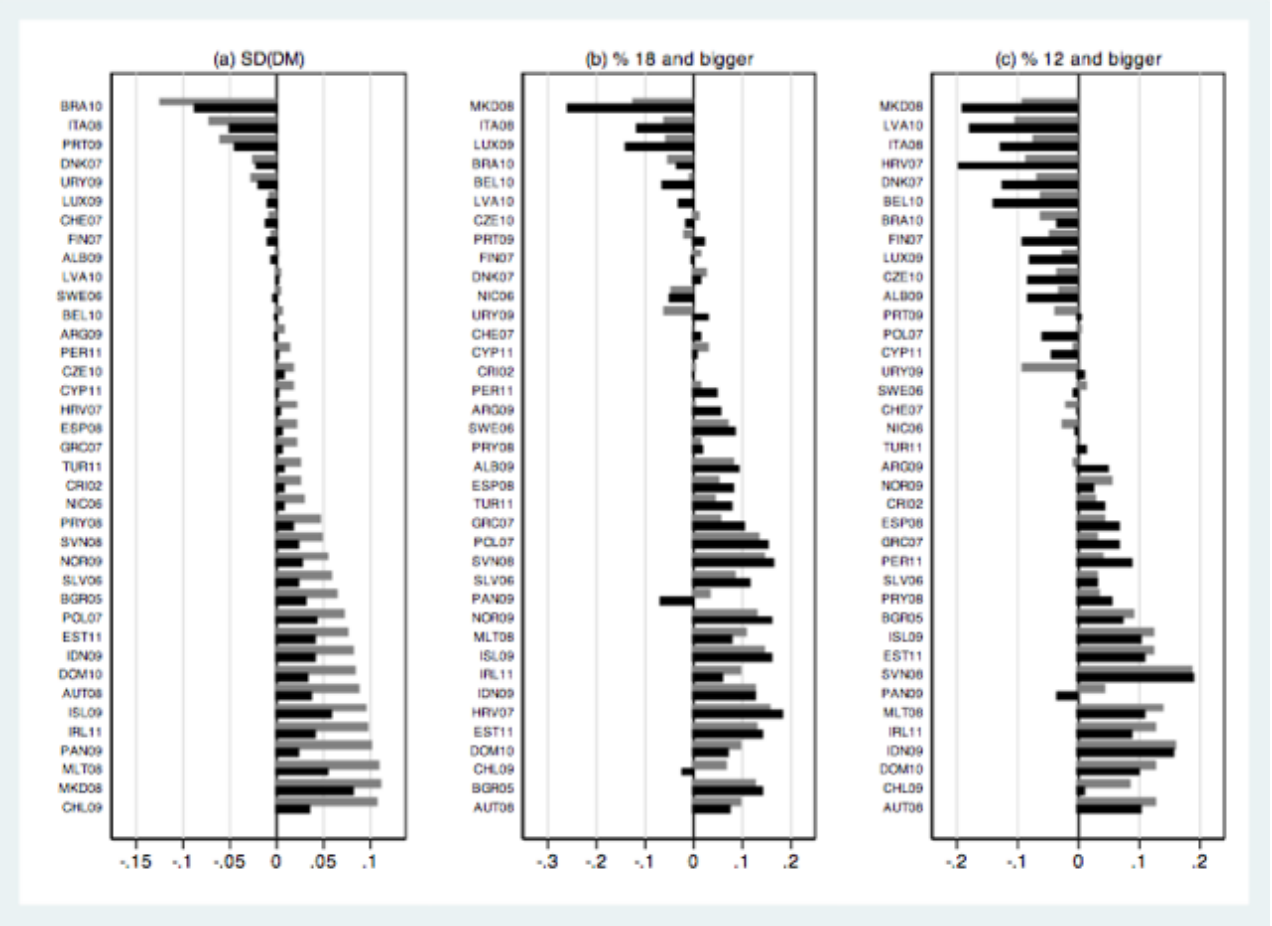
Note. On the vertical axis: 101 hypothetical electoral systems as described in section 5.2. Different shapes represent four central tendency measures of district magnitude. Taking districts as the relevant unit, x's denote median district magnitude, and triangles denote average magnitude. Taking legislators as the relevant unit, squares denote magnitude of the median legislator, and diamonds denote magnitude of average legislator.

Figure 5. District magnitude under PR: two approaches



Note. Circles denote the difference between magnitude of the median legislator and that of the median district. Triangles denote the difference between magnitude of the average legislator and that of the average district. The figure includes all districted PR systems. Countries are organized in descending order of SD(D).

Figure 6. A Comparison between models and approaches



Note. On the horizontal axis is the gap between the conversion of fragmentation in the electorate to that in parliament as calculated by Equation 1a (baseline model) and Equation 2a. Positive differences imply that the baseline model overpredicts conversion compared to our model. Black bars mark the difference utilizing magnitude of average legislator and gray bars utilize magnitude of the median district. Panels utilize different spread measures: standard deviation in magnitude (panel a), proportion of parliamentary seats elected in districts greater than eighteen seats (panel b), and proportion of parliamentary seats elected in districts greater than twelve seats (panel c). The models themselves (estimated on all cases included in the study) are presented in Tables A1 and A2 in the appendix. The figure presents cases of districted PR alone (with the exception of South Africa), where in each panel cases are organized in descending order of the respective spread measure.