The effect of variance in district magnitude on party system inflation

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ARTICLE INFO

Keywords:
District magnitude
Variance effect
Party system inflation
Strategic coordination

ABSTRACT

We argue that variance in district magnitude affects party system inflation by shaping the process of within- and cross-district coordination. First, at the stage of within-district coordination, electoral systems with large magnitude variance generate different party systems across districts, with larger districts having more fragmented party systems with a greater number of parties. Second, at the stage of cross-district coordination, district party systems dissimilar to each other make it more difficult for elites from different districts to engage in the projection of district parties onto national-level parties. This in turn leads to the inflation of the number of parties at the national level. Through numerical simulations and an observational study, we demonstrate that variance in district magnitude is positively associated with party system inflation.

Party system inflation refers to the extent to which the number of parties at the national level is higher than the average number of parties at the district level (Cox, 1999; Kasuya and Moenius, 2008; Moenius and Kasuya, 2004). When electoral support is homogeneous throughout a country, the same parties will be able to realistically compete for seats in all, or most, districts in the country. In such a case, party system inflation tends to be lower because the party system in each district resembles the party system of the entire country. By contrast, when support for different parties is unequally distributed across districts, there is high variation in party systems across districts, which leads to a large discrepancy in the number of parties at the national level and the average number of parties at the district level, i.e., party system inflation.

In practice, the inflation of a party system is determined by a two-step process through which citizens’ preferences are converted to the formation of national-level parties: within- and cross-district coordination (Cox, 1999; Ferree et al., 2014). In the first step, within-district coordination among voters and district elites affects the party system in each district. District magnitude is one of the most important determinants of within-district coordination and the number of district parties (Cox, 1997; Duverger, 1954; Potter, 2014; Singer and Stephenson, 2009). In the second step, cross-district coordination, or strategic interaction among elites from different districts, conditions how district party systems are projected onto the party system at the national level (Chhibber and Kollman, 2009; Hicken, 2009). In short, the combination of within- and cross-district coordination determines party system inflation at the national level.2

While we know much about the effect of electoral institutions on within-district coordination among district-level actors (Singer and Stephenson, 2009), what is largely missing in the literature is an investigation of how electoral institutions affect the incentives of cross-district coordination. In fact, the existing studies on cross-district coordination often focus on the role of non-electoral institutions, such as federalism, bicameralism, and presidentialism (Chhibber and Kollman, 2009; Hicken, 2009). As a result, we lack a theory about how electoral institutions influence the merging of district party systems to national-level party systems. This paper fills this gap by arguing that electoral systems shape not only within-district but also cross-district coordination. However, the feature of electoral institutions that affects the latter is different from the one influencing the former. While district

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1 Some authors provide a complex conceptualization of party nationalization. On one side, Morgenstern and Swindle (2005) and Morgenstern et al. (2009) suggest a two-dimensional conceptualization of party system nationalization: static—the extent to which a party’s level of support at any point in time is homogeneous across districts—and dynamic—the extent to which a party’s support levels increase or decrease in unison across districts over time. On the other side, Kasuya and Moenius (2008) provide a two-dimensional conceptual map of party nationalization consisting of two factors: inflation—the extent to which the average size of the district-level party system is inflated to the national level—and dispersion—the extent to which each district’s party system contributes to the size of the national-level party system varies across districts (Kasuya and Moenius, 2008, 127). Since the arguments regarding the nature of party competition are tied to party competition at a single point in time and have a more direct connection to the aggregation in the number of parties, we focus on the static and inflation concepts of party system nationalization, for which we simply use the term party system inflation.

2 This argument strictly follows the theoretical framework proposed by Cox (1999), Ferree et al. (2014), and Moenius and Kasuya (2004), which states that elites at the district level organize parties in each district first and then combine some of these district parties into large national parties. Other scholars try to understand party system formation using an alternative approach starting from the national level and working down to the district level (see, e.g., Shugart and Taagepera, 2017).
magnitude is the primary factor shaping within-district coordination (Cox, 1997; Duverger, 1954), variance in district magnitude conditions cross-district coordination. Electoral systems in different countries have different variances in district magnitude depending on how legislative seats are allocated to each district (Kedar et al., 2016; Monroe and Rose, 2002; Taagepera, 2007). For example, countries with a nation-wide district, like Israel and the Netherlands, do not have variation in district magnitude simply because electoral competition is held under the single district. Similarly, there is no variation in district magnitude in countries with single member district plurality (SMDP) systems, where every district has one legislative seat, as is the case in India and the United States. By contrast, other countries exhibit great variation in the size of districts. Under proportional representation (PR) systems, the most commonly used system in Europe, some districts have only a few seats while others have a large number of seats. In these countries, there is wide variation in the ways in which seats are distributed to each district, leading to different variance in district magnitude. For instance, in Portugal (2009), the size of a district ranges from 2 to 47, whereas in Norway (2009), it ranges only from 4 to 17. As a result, the former has larger magnitude variance than that of the latter.

We argue that variance in district magnitude affects the inflation of the party system through two mechanisms that condition the process of within- and cross-district coordination. First, at the stage of within-district coordination, large variance in district magnitude generates considerable variation in coordination incentives in each district. Voters and district elites in smaller (larger) districts have stronger (weaker) incentives to engage in district-level coordination. Such variation in coordination incentives results in the formation of different party systems across districts, with larger districts having more fragmented party systems with a greater number of parties.

Second, at the stage of cross-district coordination, different party systems created at the first stage make coordination beyond district boundaries more difficult. Party systems in larger districts are more likely to contain parties that would not gain seats if their districts were smaller. Since voter support for these parties is confined to certain permissive districts, these parties have little incentive to participate in cross-district coordination. The presence of parties that are not competitive in all districts hinders the effort of cross-district coordination, thereby making the projection of district parties onto national-level parties less effective. What results from this process is poor linkage between district and national party systems (Cox, 1999) and inflation of the latter.

To test this argument, we rely on two strategies. First, we conduct a simulation exercise to illustrate the effect of variance in district magnitude on party system inflation in a fully controlled environment. The simulation results show a strong positive association between magnitude variance and party system inflation (i.e., poor cross-district linkage). Second, we control our empirical examination by testing our hypothesis with observational data from 36 elections. The empirical results confirm our theoretical argument, revealing the same pattern as the simulations. Compared to countries with lower variance in district magnitude, countries with higher variance in district magnitude are more likely to have greater party system inflation at the national level vis-à-vis the average number of parties at the district level.

The rest of this paper proceeds as follows. The following two sections discuss the existing literature on coordination mechanisms and party system inflation and present our theoretical expectation. The third section describes our empirical strategies. The fourth section tests our argument with simulated data in a fully controlled environment. The fifth section is the empirical part of the study, where we present our findings based on real-world data from 36 elections. The final section concludes the argument.

1. Theoretical background

Party system inflation is a function of two distinct mechanisms: within- and cross-district coordination among electoral competitors and voters (Cox, 1999; Ferree et al., 2014). The number of political parties within a district is determined by the mechanical effect of electoral systems to translate votes into seats and the psychological incentives among district elites and voters to coordinate through strategic entry and voting (Cox, 1997; Duverger, 1954). Rich literature on comparative electoral studies shows that district magnitude and social heterogeneity jointly affect the level of within-district coordination and the number of parties per district (Potter, 2014; Singer and Stephenson, 2009; Rashkova, 2014). Restrictive electoral systems with low district magnitude, such as SMDP, decrease the number of parties by encouraging strategic coordination among local actors. By contrast, more permissive PR systems with large district magnitude increase the number of parties if social heterogeneity generates pressure to form additional parties.

Although many studies use this within-district logic to explain the number of parties at the national level (e.g., Clark and Golder, 2006; Lublin, 2017; Mozaffar et al., 2003; Neto and Cox, 1997; Ordeshok and Shvetsova, 1994; Stoll, 2008), such an extension should be made with some caution. Strictly speaking, the propositions of Duverger (1954) and Cox (1997) apply only to electoral competition at the district level. This means that testing the relationship between average district magnitude and the number of parties at the national level is not necessarily an accurate representation of the original arguments. In terms of the number of parties and party system inflation at the national level, it is not sufficient to rely on the logic of within-district coordination. Rather, we also need to take into account the second dimension of strategic coordination that occurs between districts (Ferree et al., 2014; Moenius and Kasuya, 2004).

Cross-district coordination is a process in which actors from different districts coordinate with each other (Chhibber and Kollman, 1998, 2009; Hicken, 2009). It affects how party systems in different districts are aggregated into the single party system at the national level (Ferree et al., 2014). Success or failure of cross-district coordination eventually influences how district-level party systems are projected onto the national party system, thereby determining the inflation of the latter. Successful cross-district coordination means a strong link between district and national party systems (low inflation), whereas failure to coordinate results in poor linkage (high inflation; Cox, 1999).

Various factors can affect cross-district coordination and party system inflation. For example, social heterogeneity (or preference di- similarity) across districts influences how much political actors from different districts are willing to coordinate with each other beyond district borders (Caramani, 2004; Golosov, 2016). Cross-district dis- similarity hinders coordination among elites from different districts, making it difficult to create national-level parties (Crisp et al., 2013). In a similar vein, democratic experience is also a determinant of cross-district coordination (Moser and Scheiner, 2012; also Tavits and Annu, 2006). When parties do not have strong ties with voters due to a lack of democratic experience, it becomes markedly more difficult for elites from different locations to find incentives to coordinate beyond their own districts.

Further, Cox (1997) notes the importance of concurrence between presidential and legislative elections. When elections for the two branches coincide, political actors from different districts have greater incentives to work together to elect the president whom they favor (Hicken and Stoll, 2011). Other studies suggest that the extent to which the power of the central government is concentrated has important implications for cross-district coordination (Chhibber and Murali, 2006; Chhibber and Kollman, 1998, 2009). In fact, federalism and fiscal decentralization, by empowering subnational actors, undermine aggregation incentives, resulting in party system inflation. Similarly, Hicken (2009) contends that the horizontal concentration of power can shape district elites’ incentives to engage in cross-district coordination.
When the power of the central government is horizontally dispersed through bicameralism, party disunity, and reserved domains, the inflation of party systems tends to be greater.

Although these studies identify a wide range of factors that affect cross-district coordination, very little is known about the role of electoral systems in shaping this process. The lack of attention given to electoral systems is surprising given the fact that scholars fully acknowledge the role of electoral systems, i.e., district magnitude, in determining electoral coordination within districts. In the next section, we advance a theory of why a particular aspect of electoral systems, variance in district magnitude, should affect cross-district coordination and party system inflation.

2. The variance effect

Although it has received little attention, variance in district magnitude is an important aspect of electoral systems with large cross-national variation (Taagepera, 2007). A few studies demonstrate that variance in district magnitude has important political ramifications (Kedar et al., 2016; Monroe and Rose, 2002). For instance, Monroe and Rose (2002) claim that variance in district magnitude accounts for the unequal representation of geographical interests between urban and rural areas. Since rural districts tend to have smaller district magnitude than that of urban districts, the interests of the former are more easily translated into effective parliamentary representation than those of the latter. When the magnitude variance increases, rural interests are more likely to be represented than are urban interests. Similarly, Kedar et al. (2016) show that large variance in district size leads to over-representation of right-leaning parties that represent rural interests.

We argue that variance in district magnitude also affects the inflation of national-level party systems through the combination of two mechanisms. First, at the stage of within-district coordination, the variable district size creates different party systems across districts. Second, at the stage of cross-district coordination, the different party systems generated in the first step weaken the aggregation effort of elites from different districts. As a result of these two processes, the larger variance in district magnitude inflates the number of parties at the national level vis-à-vis that of parties at the district level. We now discuss each of these mechanisms in detail.

The first mechanism is related to within-district coordination. As Kedar et al. (2016) and Monroe and Rose (2002) argue, when district size varies, electoral competition occurs under very different institutional environments. Since the permissiveness of electoral rules varies across districts, the incentives of district-level actors to engage in within-district coordination differ considerably by district. For example, in districts with smaller magnitudes, electoral competition may approximate the majoritarian system, and the necessity of strategic coordination among district elites and voters is heightened. By contrast, in other larger-magnitude districts, elites and voters may be faced with less pressure to participate in strategic coordination.

The consequence is that very different party systems are generated across districts. On the one hand, in districts with smaller magnitudes, strong coordination incentives suppress the number of parties. On the other hand, in districts with larger magnitudes, the relative absence of coordination pressure amplifies parties. As a result, the number of parties differs by district, with smaller districts having less-fractionalized party systems. Unsurprisingly, this tendency becomes even stronger as the difference in district magnitude across districts increases: the larger the magnitude variance is, the more different the party systems across districts.

At this point, the variance effect we depict can be thought of as a simple extension of the mechanical effect of district magnitude on the number of parties. To the extent that within-district coordination follows the “M + 1” rule, the number of parties in each district should converge on the district size plus one, and this number should increase as a function of district size (Cox, 1997; Duverger, 1954). As a result, varying magnitude mechanically creates different party systems across districts.

Moving to the second mechanism, variance in district magnitude causes party system inflation by hindering effective cross-district coordination among district elites. District-level party systems that are dissimilar to each other imply that the number and type of parties vary considerably across districts. One consequence of such discrepancy is that district elites are likely to have very different aggregation incentives. Some district elites may have strong incentives to aggregate district-level parties into national-level parties. By contrast, other district elites may lack similar incentives, which weakens the projection of district party systems onto the national party system.

We argue that electoral systems with larger variance in district magnitude are more likely to contain the latter type of district elites. In particular, the key actors are those elites from larger districts who gain representation only because of the high permissiveness of their districts. The fact that they would not obtain any seat if the district size were smaller suggests that the voter support they obtain is likely to be confined to a particular location. Since they serve narrow interests that are present in only specific permissive districts, they are likely to exhibit weak incentives to form national-level parties. At the same time, their distinctive interests also make elites from other districts unwilling to cooperate. Consequently, these “extra” actors from relatively large districts deter the aggregation efforts of other district elites, which results in inflation of the effective number of parties at the national level.3

Since this point is subtle, a stylized example may help to clarify our argument. Suppose that there are two countries, I and II, composed of two districts with identical demographic characteristics—that is, one district is a reflection of the other in a mirror. Additionally, assume that in country I, the two districts have the same district size of 9, as shown in the upper panel of Fig. 1. By contrast, in country II, the two districts have different sizes, one is 11 and the other is 7, as shown in the bottom panel of Fig. 1. Hence, the critical difference between the two hypothetical countries is that one has no variation in district magnitude, whereas the other does.

To begin with country I, given that we assume that the two districts are identical in any single dimension, the party systems of the two districts will be exactly the same. Parties A to H will emerge in district 1a, and parties A′ to J′ will emerge in district 1b, where parties A and A′ represent the same interests in districts 1a and 1b, respectively. In terms of cross-district coordination, these district-level parties will have little difficulty in aggregating themselves into national-level parties because each party in each district finds a party in another district that has corresponding interests. That is, at a minimum, party A has an incentive to merge with party A′, party B has an incentive to merge with party B′, and so forth. As a result, the national-level party system of country I will effectively reflect the aggregation efforts of all the district-level parties, which mitigates party system inflation.

By contrast, in the case of country II, the situation is slightly different because of the varying size of its districts. Although the demographic characteristics of the two districts are still identical, the two party systems will be different because one district is more permissive than the other. While district 2a, with magnitude 11, will generate parties A to I, district 2b, with magnitude 7, will have parties A′ to H′. Parties I, J, K, and L in district 2a would not emerge without the variance of the other in a mirror. Additionally, assume that in country I, the two districts have the same district size of 9, as shown in the upper panel of Fig. 1. By contrast, in country II, the two districts have different sizes, one is 11 and the other is 7, as shown in the bottom panel of Fig. 1. Hence, the critical difference between the two hypothetical countries is that one has no variation in district magnitude, whereas the other does.

As in the case of country I, it is not difficult for parties A to H in country II to participate in cross-district coordination because they find corresponding parties A′ to H′, which share the same interests, in the

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3 These parties can be conceived as “non-viable parties” to use Guiojoan’s (2016) terminology. They are non-viable in the sense that they are not competitive except in larger and more permissive districts.
3. Research design

To test our hypothesized relationship between variance in district magnitude and party system inflation, we employ two different strategies: a set of numerical simulations and a cross-national study using observational data. In this section, we detail our operationalization strategy for our variables of interest that are common to both the simulation exercise and the actual electoral data analysis.

Numerical simulations are useful to understand the causal mechanism in two situations: (1) when uncertainty in the outcome derives from sparse data; and (2) when causality is difficult to assess because the units of interest cannot be manipulated (Hedström and Ylikoski, 2010). Simulations are well-suited to assess our theoretical expectation because district magnitude cannot be subject to exogenous manipulation and the sample for analysis is naturally limited by the current number of democratic countries and elections in the world. Moreover, numerical simulations ensure that all contingencies and combinations of parameters are covered in our empirical evaluation, even if they may be apparently unlikely situations. We rely on a set of numerical simulations to generate hundreds of hypothetical countries with varying key electoral system features and social heterogeneity to see how changing each of these components affects the inflation of parties at the national level. This process enables us to test our hypothesized relationship in a perfectly controlled environment.

Additionally, we check our basic results from the simulations against a more traditional observational study using data from 36 elections in advanced democracies. This analysis confirms that our theoretical expectation is observed not only in simulated cases but also in real-world data. In this analysis, we test whether variance in district magnitude has an effect on the inflation of the number of parties after adjusting for potential confounders.

3.1. Dependent and explanatory variables

Party system inflation is measured as the extent to which the number of parties at one level of aggregation (nation) differs from the number of parties at another level of aggregation (district). Three measures are widely used in research on party system inflation. First, Chhibber and Kollman (1998, 2009) offer a simple measure that very closely follows the intuition behind the concept of inflation. In their view, the inflation of the national party system should be measured with respect to districts by taking the difference between the effective number of parties at the national level and the average of the effective number of parties at the district level.

The second and third measures are merely arithmetic extensions of this initial intuitive measure. On the one hand, Cox (1999) extends Chhibber and Kollman’s measure by converting it into an index that takes into account the relative increase in the number of parties at one level with regards to the number of parties at a lower level. On the other hand, Moenius and Kasuya (2004) argue that Cox’s index lacks the properties associated with an inflation index that incorporates the properties of an inflation rate. Thus, they suggest their own inflation index. Regardless of the measure, they capture the same theoretical construct and are empirically highly correlated.

In this paper, we use all three measures of party system inflation: Chhibber and Kollman’s (CK; 1998; 2009) deviation index, Cox’s (1999) inflation index, and Moenius and Kasuya’s (MK; 2004) inflation index. The CK index can be simply understood as a measure of how many more parties are represented at the national stage than are represented in the average district. We find this measure to be straightforward and readily interpretable compared to the other two, which involve rescaling by the effective number of parties at either the national or district level. Thus, while we provide the results from the observational data for all three measures, our simulation analysis is based on the CK index for the sake of conciseness. Further, in the following simulation section, we calculate party system inflation in terms of the number (proportion) of seats obtained by parties, whereas in the empirical section, we measure party system inflation in terms of both the number of seats and vote share.

Our key explanatory variable is within-country variation in district magnitude. We calculate the magnitude variance ($\sigma^2$) as follows:

$$\sigma^2 = \frac{\sum (M_i - \bar{M})^2}{N}$$

where $\sigma^2$ is the variance of country election $j$; $M$ is the magnitude in district $i$ within country election $j$; $\bar{M}$ is the average district magnitude in country election $j$; and $N$ is the number of districts in country election $j$.

In the following sections, we first conduct a set of numerical simulations and show that regardless of the different assumptions about the distribution of voter preferences, larger variance in district magnitude is related to higher inflation rates.
magnitude leads to higher inflation of party systems. Then, we proceed to an empirical analysis of 36 elections and show that the same relationship holds in the real-world examples.

4. Numerical simulations

We generate hundreds of hypothetical electoral systems with different variances in district magnitude and simulate how the election results would look under alternative scenarios. The advantage of this approach is that it allows us to isolate the mechanical effect of the magnitude variance. Our simulations therefore illustrate how the magnitude variance mechanically affects party system inflation if we ignore other factors, such as the strategic behavior of individual actors. This is particularly useful for our purpose because it is difficult to detect the mechanical effect of electoral systems alone based on observational data (Hedström and Ylikoski, 2010).

The first step of our simulations is to create hypothetical electoral systems with different variances in district magnitude. We assume a hypothetical country with 500 legislative seats with 100 districts. Next, we randomly generate 100 numbers that sum to 500. Each of these numbers represents the magnitude of each district. We repeat this process 501 times to obtain 501 different combinations of 100 numbers. Since the different combinations of numbers have different variances, they represent electoral systems with different magnitudes of variance. In these hypothetical electoral systems, the mean variance in district magnitude is 34.96, the minimum is 0 (i.e., every district has 5 seats), and the maximum is 71.52.

After creating the 501 electoral systems with different variances in district magnitude, the next step is to determine the hypothetical distribution of voter preferences in each of the 100 districts. As described in greater detail below, we use three scenarios of voter preference distribution to show that, regardless of underlying assumptions about the distribution of voter preferences, a larger magnitude variance results in greater party system inflation.

The three scenarios have several common features. First, in all cases, we have 500 legislative seats with 100 districts, hence our electoral systems always have a mean district magnitude of 5. Second, we assume that in all the scenarios, there are 15 parties in the country. However, as described below, only some of the parties are competitive (i.e., gaining support) in a given district. Third, the hypothetical country uses a closed-list PR system with the d'Hondt formula, which is the most commonly used form of seat allocation under PR systems.

Finally, for the sake of simplicity, we assume that the number of voters is constant across districts and that they vote sincerely. That is, regardless of district size, voters in our simulation do not engage in strategic coordination.9

Having introduced the basic setup, we proceed to numerical simulations under three alternative voter preference distributions.

4.1. Scenario 1: homogeneous preferences across districts

We begin with a simple assumption that there is no variation in voter preferences across districts. All 100 districts have exactly the same distribution of party support, meaning that the vote share of each party is constant across districts regardless of district size.10 Therefore, the distribution of voter support at the district level is the same as that at the national level. The first scenario is summarized in the first column of Table 1. For each of the 501 electoral systems created above, we calculate the seat share of the 15 parties by district and compute party system inflation at the national level based on the CK index.11

The results of the simulation with the 501 systems are presented in Fig. 2. Each point denotes the CK deviation index for a given value of the magnitude variance. The red line shows a loess curve, and the shaded area represents the 95% confidence interval. The relationship between variance in district magnitude and party system inflation follows a steadily positive shape. The association rate between the two is steeper at lower values of the magnitude variance and slightly flattens as the variance in district magnitude increases.12 We also regress the CK index on the variance in district magnitude. The results reported in Table A1 of the appendix suggest that the positive effect of magnitude variance on party system inflation is statistically discernible from 0 (models 1–3).13

Note: The table summarizes the three simulation scenarios. In the last row, systems mean electoral systems with different variances in district magnitude, and countries mean 100 × 15 matrices with different distributions of voters’ preferences.

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9 Voters’ strategic coordination is certainly a major force affecting party systems at the district level in real-world situations. Most likely, voters’ strategic coordination and psychological effects exacerbate the electoral system’s mechanical effects. Although it is not clear whether variance in district magnitude directly influences the coordination incentives among voters due to their limited abilities (see, e.g., Taagepera, 2007), we believe that such an effect would anticipate mechanical effects. Hence, our results are conservative estimates of the upper bound of the variance effect.

10 Specifically, the vote share of each party is fixed to: party A = 25%; party B = 23%; party C = 18%; party D = 9%; party E = 7%; party F = 4%; party G = 3%; party H = 3%; party I = 2%; party J = 1.5%; party K = 1.2%; party L = 1.1%; party M = 0.1%; party N = 0.07%; and party O = 0.05%.

11 We use the seat share of each party because the vote share of each party is constant across districts in this scenario.

12 The results of the simulations are strikingly similar when we use Cox’s index or the MK inflation index.

13 More specifically, we employ log-log models in the regressions with simulated data to maximize the fit of the data.
4.2. Scenario 2: heterogeneous preferences across districts

In the second scenario, we relax one of our assumptions and allow voter preferences to vary across districts by taking the following two steps. First, we randomly assign the vote share of the 15 parties in our 100 districts and create a $100 \times 15$ matrix in which the element in row $m$ and column $n$ represents the vote share of party $n$ in district $m$. In this step, we construct three types of districts. In some districts, one party gains more than a majority of the district votes, and the rest of the votes are cast roughly equally for the remaining 14 parties (one-party-dominant districts). In other districts, two or three main parties obtain approximately 30–40 percent of the district votes, and the other 12 to 13 parties split the remaining votes (few-parties-dominant districts). In the remaining districts, all the parties are equally competitive, and none of them has a clearly dominant position (multiparty districts). As a result, the 100 districts exhibit very different patterns of party support.

Second, we randomize the row order of the $100 \times 15$ matrix above and create 300 different matrices. By randomly changing the order of the rows, we change the distribution of voter support in the $m$th district across matrices. For example, the distributions of voter support in the first row (district) look different in matrices 1, 2, 3, and so forth. However, since we change only the row order, the column sum of voter support (i.e., overall support level) of each party is not affected. That is, the overall vote share of party A at the national level is constant across matrices. We call these 300 matrices “countries.” The second scenario is summarized in the second column of Table 1.

Using the 300 countries and the 501 electoral systems, we simulate party system inflation in $501 \times 300$ hypothetical elections. Because of the row randomization described above, in some hypothetical elections, larger magnitude is allocated to less competitive districts, whereas in other hypothetical elections, larger magnitude is assigned to less competitive districts. This ensures some variation in the translation of votes to seats. In Fig. 3, the results of the simulation confirm our argument. Even after taking into account the heterogeneity in voter preferences across districts, the effect of the magnitude variance on party system inflation remains positive. Table A1 of the appendix also suggests that this effect is significantly different from 0 (models 4–6).

4.3. Scenario 3: varying cross-district similarity in preference distribution

Similar to the second scenario, in the third scenario, we assume that the distribution of voter preferences differs by district. In this scenario, we further incorporate the assumption that the extent to which such distribution varies across districts (i.e., cross-district similarity in the preference distribution) can also differ. Recall that in the second scenario, we randomized only the row order of the $100 \times 15$ matrix to create the 300 different “countries.” Therefore, if we calculate cross-district variation in the distribution of voter preferences, it is constant across all 300 countries. In contrast, in the current scenario, we vary this quantity. In this way, we change the extent to which our 100 districts resemble each other in terms of the distribution of voter preferences.

Intuitively, this scenario aims to account for the possibility that the extent to which the distribution of voter preferences is similar across districts may either facilitate or hinder cross-district coordination (Crisp et al., 2013). For example, if every district in a multiethnic country has

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14 Another way to conceive this difference is that in the second scenario, the column sum of voter support for each party is the same across matrices (countries). By contrast, in the current scenario, it varies by matrix.
the same ethnic composition, there may not be much difference in the ways in which voter preferences are distributed across districts. By contrast, if each district exhibits very different ethnic composition, the distribution of voter support considerably varies by district. It is possible that cross-district coordination may be easier in the former than in the latter case because of the cross-district similarity in the ways in which voter preferences are distributed.

We take the following approach to vary the cross-district similarity in the preference distribution. First, recall that in the second scenario, we generated three types of districts: one-party-dominant districts, few-parties-dominant districts, and multiparty districts. We randomly change the proportion of these types of districts in the 100 districts. For instance, in an extreme case, all 100 districts are composed of one-party-dominant districts. In this case, the cross-district similarity in preference distribution is high. By contrast, in another extreme case, each type of district makes up a third of the 100 districts. In this case, the cross-district similarity in the preference distribution is low. By repeating this process, we create 300 countries with varying cross-district similarity in voter preferences. The third scenario is summarized in the last column of Table 1.

We again simulate party system inflation in $501 \times 300$ hypothetical elections. The results are presented in Fig. 4. Although the observations are more scattered than those in the previous simulation scenarios, the fitted loess curve still suggests that the relationship between the magnitude variance and the CK deviation index is positive. Regressions in Table A1 of the appendix also confirm that this effect is statistically significant at the 99% confidence level (models 7–9).

In summary, the numerical simulations confirm our theoretical expectation under controlled environments. Under closed-list PR with the d’Hondt formula, an increase in the district magnitude variance results in party system inflation. This is true regardless of differences in the assumptions about the distributions of voter preferences across districts. The next question is whether the same pattern exists in real-world elections.

5. Observational analysis

Our analysis is based on data used in Crisp et al. (2013), which include 36 general elections held in 20 countries across Australia, North America, Western Europe, and Eastern Europe between the years of 1996 and 2005.¹⁵ To the best of our knowledge, this dataset is the only one that includes a reliable measure of cross-district similarity in the distribution of voter preferences. As we showed in simulation 3 and discuss below, preference similarity across districts has an important consequence on cross-district coordination and party system formation. Hence, we need to control for this factor to isolate the effect of the magnitude variance.

We supplement data on district-level vote and seat share for each party from various resources.¹⁶ Although the number of observations

Fig. 3. Heterogeneous preferences (scenario 2).


may not be large, our cases show significant variation in all of our measures of interest, including the nature of the party system, district magnitude variance, average district size, and social heterogeneity in the country. Therefore, the observations allow us to leverage the widest possible range of the variance in district magnitude in modern, developed democracies controlling for many factors that are theoretically relevant.

5.1. Control variables

Whereas the simulation exercise did not require confounders due to the experimental nature of the data generation process, we need to control for confounding factors when using observational data. Thus, we provide a rationale for the inclusion of each of the control variables in our observational analysis, including within-country heterogeneity of preferences, federalism and fiscal decentralization, average district magnitude, assembly size, and democratic experience.

Most countries present a two-dimensional structure of political conflict that consists of an economic dimension and a cultural dimension. While a common practice is to simply control for a measure of ethnic, religious, or linguistic fractionalization—the second dimension—we also need to adjust the effect of variation in within-country diversity in the economic dimension of political conflict, which is the primary dimension of conflict in many countries. Although cross-district socioeconomic differences are rarely measured in the literature, Crisp et al. (2013) provide a proxy measure. They use survey data from the Comparative Study of Electoral Systems (CSES) to construct a measure of cross-district constituency similarity as a composite index of demographic characteristics regularly linked to political preferences: age, income quintiles, education level, employment status, urbanness of the place of residence, and union participation of survey respondents. These factors capture the variation in district preferences in a country’s main socioeconomic cleavage. Although the measure from Crisp et al. (2013) refers only to the distribution of preferences among the supporters of the party in the government, it is informative about the cross-district heterogeneity of preferences within a single country in this economic dimension given that the governing party generally competes in this first dimension.

To adjust for the second or cultural dimension of political conflict, we control for a country’s ethnic fractionalization. Social heterogeneity has generally been regarded as a major determinant of the number of parties at the district and national levels (Clark and Golder, 2006; Lublin, 2017; Neto and Cox, 1997; Potter, 2014; Singer and Stephenson, 2009). To measure this effect, we rely on the fractionalization measure of Alesina et al. (2003).17

Another important set of controls is related to the territorial distribution of power within a country. The rationale behind this argument is that decentralization provides stronger incentives for parties and candidates to compete locally as it increases the resources under the control of regional and local governments. Although there is some empirical evidence to support this hypothesis (Brancati, 2008; Harbers, 2010), there are also several empirical studies that find a null effect (Bochsler, 2010b; Hopkin, 2009; Lago-Peñas and Lago-Peñas, 2011). Regardless, and even though the direction of the effect is not clear, we

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17 The correlation between ethnic fractionalization and district preference heterogeneity is low ($r = 0.21$). This is consistent with the argument that they capture different dimensions of cross-district heterogeneity.
Table 2
The effects of district magnitude variance on party system inflation.

<table>
<thead>
<tr>
<th>Key Independent Variable</th>
<th>Parties' vote-share</th>
<th>Parties' seat-share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CK (log)</td>
<td>Cox (log)</td>
</tr>
<tr>
<td></td>
<td>CK (log)</td>
<td>Cox (log)</td>
</tr>
<tr>
<td>Variance in District Magnitude (log)</td>
<td>0.10** (0.05)</td>
<td>0.09** (0.04)</td>
</tr>
<tr>
<td></td>
<td>0.09** (0.04)</td>
<td>0.09** (0.04)</td>
</tr>
<tr>
<td></td>
<td>0.07* (0.04)</td>
<td>0.07* (0.04)</td>
</tr>
<tr>
<td></td>
<td>0.11* (0.05)</td>
<td>0.11* (0.05)</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnic Fractionalization</td>
<td>3.34*** (1.14)</td>
<td>2.51** (0.92)</td>
</tr>
<tr>
<td></td>
<td>(0.98)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>District Heterogeneity</td>
<td>2.61* (1.36)</td>
<td>2.53** (1.10)</td>
</tr>
<tr>
<td></td>
<td>(1.17)</td>
<td>(1.17)</td>
</tr>
<tr>
<td>Fiscal Decentralization</td>
<td>0.003 (0.02)</td>
<td>0.01 (0.02)</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Federal System</td>
<td>0.003 (0.02)</td>
<td>0.15 (0.04)</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Average District Magnitude</td>
<td>0.02 (0.04)</td>
<td>0.04 (0.04)</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Assembly Size ('00)</td>
<td>0.07 (0.09)</td>
<td>0.07 (0.07)</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Democratic Experience ('U)</td>
<td>0.13 (0.08)</td>
<td>0.07 (0.07)</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Constant</td>
<td>2.64*** (0.93)</td>
<td>0.82 (0.75)</td>
</tr>
<tr>
<td></td>
<td>(0.83)</td>
<td>(0.83)</td>
</tr>
</tbody>
</table>

Observations | 36 | 36 | 36 | 36 | 36 | 36
Adjusted R² | 0.57 | 0.64 | 0.66 | 0.51 | 0.61 | 0.61
Residual Std. Error (df = 27) | 0.78 | 0.63 | 0.70 | 0.67 | 0.57 | 0.85

Note: "p<0.1; "**p<0.05; "***p<0.01. Abbreviations of the dependent variables: CK = Chhibber and Kollman (1998, 2009); MK = Moenius and Kasuya (2004). Dependent variables are converted into logarithmic scales to improve goodness of fit. We add a 0.1 to the CK inflation index and 3 to the Cox and MK inflation measures to ensure that all values take strictly positive values before the logarithmic transformation. Assembly size and democratic experience are divided by 100 and 10, respectively, to ensure that coefficient values do not take values that are too small.

5.2. Empirical results

Table 2 displays the results from a set of ordinary least squares. Models 1 and 4 show the effects of the key independent variable and the control variables on the inflation of party systems, which is measured by the CK deviation index based on the vote shares or seat shares of parties, respectively. Models 2 and 5 repeat the same exercises using Cox’s measure, and Models 3 and 6 use the MK measure of party system inflation. Since the statistical significance and magnitude of the effects remain unaltered regardless of whether we use vote share or seat share and whether we rely on the CK, Cox, or MK indices, we focus on the first model in the following discussion.

Consistent with our theoretical expectation and the simulation-based findings, the effect of variance in district magnitude is positive and significant, both statistically and substantively. According to Model 1, the country whose magnitude variance is the highest in the sample—Portugal with variance of 141—has an expected CK deviation index value of 0.76, which is substantially greater than the expected deviation index value of 0.30 for countries such as Canada, the United Kingdom, and the United States that show no variation in district magnitude, ceteris paribus (see the top-left panel of Fig. 5). In other words, our model predicts that variance in district magnitude alone is responsible for a 150% increase in party system inflation after adjusting for the major determinants of party system inflation.

In regard to the control variables, we should highlight the importance of the heterogeneity of preferences along both an economic and an ethnic dimension. On the one hand, our measure of district

18 The correlation between fiscal decentralization and the dummy for a country’s federal system is high (r = 0.6).

19 According to Model 1, a country with an average magnitude variance has a CK index value of 0.53.
heterogeneity along the economic dimension is positive and statistically
significant. On the other hand, ethnic fractionalization, which captures
the diversity of preferences along other relevant social cleavages, such
as linguistic, ethnic, or religious divisions, is also positive and statisti-
cally significant. As suggested in our numerical simulations, both
coefficients confirm the importance of adjusting our results for the di-
ersity of preferences across districts. Once we adjust the models for the
diversity of preferences, other institutional features, such as decen-
trization, federal system, average district magnitude, and assembly
size, do not play a significant role in party system inflation.20

5.3. Comparing the variance effect across data sources

The results from the two data sources, the numerical simulation and
the observational data, can be directly compared. Fig. 6 reports the
coefficient estimates of the magnitude variance from each data source
and across the three different measures (based on Table 2 and Table A1
of the appendix). All models implement log-log specifications in which
the log of a measure of party system inflation is regressed on the log of
the variance in district magnitude. For each of the three outcomes, the
left-most is the result of the observational analysis. The simulated data are divided into three
scenarios that represent distinct conditions. Scenario 1: Homogeneous preferences across districts. Scen-
ario 2: Heterogeneous preferences across districts. Scenario 3: Varying cross-district similarity in the
distribution of preferences.

20 These results are not necessarily at odds with the prior literature because it shows
the relevance of these variables in predicting the effective number of national parties,
rather than party system inflation.
most-likely case to test the mechanical effect of electoral institutions and therefore might represent an upper bound of the effect of magnitude variance. Thus, an explanation for the difference between the real-world data and the simulated data in this scenario might stem from the fact that preferences in the real world are rarely homogeneous.

Scenarios 2 and 3 from our numerical simulation assume heterogeneous preferences across districts and thus generate more realistic conditions under which we can compare the coefficients from the models with real-world data. The results from the observational data indicate a variance effect of 0.10; a one percent increase in the variance in district magnitude leads to an expected increase in party system inflation (using the CK measure) of approximately 0.10. This effect is strikingly similar to the effects derived from the simulations, which estimate a variance effect of 0.9 and 0.7 in scenarios 2 and 3, respectively.

6. Conclusion

Variance in district magnitude affects party system inflation by shaping the process of within- and cross-district coordination. At the district level, district magnitude determines the number of parties (Cox, 1997; Duverger, 1954). This means that if electoral systems allocate different numbers of legislative seats to different districts, there should be substantial variation in district party systems across districts (Monroe and Rose, 2002; Taagepera, 2007). The co-existence of different party systems makes it more difficult for elites from different districts to coordinate at the stage of cross-district coordination. Here, key actors are party elites who obtain seats only because their districts are larger and more permissive than other districts. Since their support is restricted to only specific districts, they are likely to have limited incentive to engage in the projection of district party systems to the national party systems. The end result of this process is the inflation of the latter.

Consistent with this argument, we establish a strong positive association between district magnitude variance and party system inflation. First, using purely hypothetical elections under a variety of scenarios, we simulate how party systems would change if electoral systems with different magnitude variances were used. The results consistently show that variance in district magnitude increases party system inflation. Importantly, the variance effect holds regardless of different assumptions about the distribution of voter preferences. Second, our empirical analysis of the 36 elections confirms that magnitude variance has a significant and substantive effect on the inflation of party systems in real-world cases. Interestingly, the simulation and observational exercises yield very similar effect sizes.

Our contributions are twofold. First, our findings suggest that the impact of electoral systems on party system may go beyond their role in shaping the incentives of within-district coordination. Although scholars fully acknowledge that electoral institutions condition within-district coordination (Singer and Stephenson, 2009), little is known about how they influence cross-district coordination. In fact, existing studies on cross-district coordination largely focus on the role of non-electoral institutions, leaving the effect of electoral systems underexplored (e.g., Chhibber and Kollman, 2009; Hicken, 2009). We fill this gap by showing that electoral systems are important for not only within-district but also cross-district coordination.

However, for the latter, what matters is not necessarily district magnitude but its variance. Therefore, different aspects of electoral system design become relevant when we focus on different stages of party system formation. This point highlights the importance of a well-known cautionary tale that the logic of district party system formation (Cox, 1997; Duverger, 1954) should not be simply extended to that of national-level party system formation. As Ferree et al. (2014) emphasize, we should have analytically separate perspectives on the two types of processes. By so doing, we can arrive at better theoretical predictions about the role of electoral systems.

Second, our findings also provide a novel insight into the effect of district magnitude variance. Although some scholars recognize that it is an important feature of electoral system design, only a few studies explore its political ramifications (Kedar et al., 2016; Monroe and Rose, 2002). We demonstrate that district magnitude variance has an important effect on the formation of party systems. Hence, how many legislative seats are assigned to each district and how the overall balance of the seat allocation is maintained have a greater political implication than previously believed.

Our findings directly speak to another well-established effect of district magnitude variance: increasing urban-rural representation inequality (Kedar et al., 2016; Monroe and Rose, 2002). Our argument suggests that parties that receive representation in smaller districts, which tend to be rural areas, should have a greater advantage in projecting themselves onto national-level parties than parties that obtain seats only in larger urban districts. In other words, large variance in district magnitude can preclude the latter type of parties, which are “viable” only in certain districts, from forming parties with a broad national basis. This may, in turn, have a negative consequence on their access to the government as well as their influence on policy outputs. In this way, our theory offers an alternative explanation for why the urban-rural representation gap can increase under electoral systems with large variance in district magnitude from the perspective of cross-district coordination.

Precisely because theoretical and empirical investigation on the impact of district magnitude variance is sparse, existing debates about electoral system design pay insufficient attention to the question about the effective distribution of legislative seats across districts (Kedar et al., 2016). Yet, our study shows that it can be an important instrument to structure party systems, thereby determining the channels of voter interests into policy-making. We recommend future researchers and reformers to take into account the role of district magnitude variance more carefully and explicitly.

Acknowledgements

Both authors contributed equally and are listed in alphabetical order. We thank Dominic Jarkey and William Simioncove for their assistance in early stages of this project. We also thank Brian Crisp, Guillermo Rosas, and the participants of Democracy, Responsiveness, and Accountability seminar at Washington University in St. Louis for their valuable comments on earlier versions of the paper.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.electstud.2018.04.016.

References

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