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Representation and district magnitude in plurality systems

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ABSTRACT

Despite the widely accepted theoretical prediction that high district magnitudes should yield less proportional results in plurality systems, empirical evidence is surprisingly mixed. We argue that these mixed results are ultimately due to a lack of clarity about the counterfactual being considered. We use a simple model to show that an increase in district magnitude reduces expected proportionality in a plurality system only if it is accompanied by a reduction in the number of districts. This conditional prediction helps to explain the diversity of existing findings and is consistent with our own analysis of both U.S. congressional delegations and local councils in Britain.

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1. Introduction

The relationship between district magnitude and representation is a conceptual cornerstone in the literature on electoral systems. District magnitude is considered to be one of the most important institutional determinants of proportionality (i.e. the relationship between seats and votes) in any democratic system (Rae, 1967; Sartori, 1986; Taagepera and Shugart, 1989). In both PR and plurality/majoritarian systems, the choice of district magnitude shapes the distribution of power between small and large parties. The common view in the literature is that in PR systems greater district magnitude increases proportionality, whereas the opposite is true in plurality systems (Benoit, 2001; Blais and Carty, 1987; Grofman, 2006; Lijphart, 1999; Taagepera and Shugart, 1989).

The prediction that higher district magnitude should produce less proportional outcomes in plurality systems has received surprisingly weak empirical support, however. Some studies find support for the common view (Blais and Carty, 1987; Calabrese, 2000; Golosov, 2003; Scarrow, 1999; Ware et al., 2001) whereas other studies find evidence of the opposite relationship (Benoit, 2001; Niemi et al., 1985; Niemi et al., 1991; Rallings et al., 1998).[1] If there is any part of political science in which we might expect to discover predictable, measurable relationships, it would seem to be the study of electoral systems (Taagepera, 2007). Yet when it comes to the relationship between district magnitude and proportionality in plurality systems, the diversity of empirical findings suggests either that regularities cannot be found or that the existing theoretical accounts are insufficient to uncover them.

The reason why these contradictory results have not yet attracted much attention is probably that larger-magnitude plurality systems are rare in national legislatures, where most research in electoral studies is focused.[2] Yet there are at least three reasons why it is worth resolving this confusion about larger-magnitude plurality elections. First, multimember plurality elections are in fact quite common,

[1] The related literature on the effect of district magnitude on gender and minority representation in plurality systems is also characterized by mixed empirical evidence (Colomer, 2007).

[2] Indeed, national-level plurality elections with district magnitudes larger than one are rare enough that political scientists have often used district magnitude as the *only* defining characteristic of electoral systems, conflating electoral formula with district magnitude (Cox, 1999).

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not just at the local level where they are very widely used (in e.g. the U.S., U.K., Canada, Russia, India, France, and Hungary) but in a sizable number of national legislatures as well (in e.g. Mexico, Kuwait, Lebanon, Egypt, Mauritius, Philippines, Bermuda and, historically, both the U.S. and U.K.).[3] Second, the confusion about how district magnitude in plurality systems relates to representativeness is relevant to policymakers, not just at the local level where multimember plurality elections are most common but also in recent debates about electoral reform at the national level. For example, with reference to the Egyptian electoral system introduced in 2011 (in which one-third of MPs are elected from two-member districts), one might ask whether the system would become more or less representative if district magnitude were reduced from two to one[4]; the literature currently does not appear to produce a clear answer. Finally, setting aside the practical importance of multimember elections, on a conceptual level it seems important to resolve an outstanding ambiguity about the relationship between such fundamental elements of electoral systems as district magnitude and representativeness.

In this paper, we try to resolve this confusion. We suggest that the reason for these surprisingly disparate empirical findings is an insufficient attention to what counterfactual scenario is being considered. The standard theoretical claim is based on a comparison between a scenario in which a system elects its representatives from many single-member districts and a scenario in which it elects its representatives from a single multimember district. In this comparison (as we confirm via a simple formal model), increasing district magnitude is likely to make election outcomes less proportional on average. One can also conceive of a simpler counterfactual comparison between a scenario in which a district elects m members and a scenario in which the same district elects $m+1$ members. In this comparison (as we again confirm via a simple formal model), increasing district magnitude should make election outcomes *more* proportional on average. The diversity of empirical results is explained by the fact that some analysis compares *systems* and thus approximates the first counterfactual comparison while other analysis compares *districts* and thus approximates the second counterfactual comparison. Apparently contradictory findings are thus seen to be consistent with a revised prediction that takes into account the level of analysis (i.e. what is being compared) and how these comparisons map onto counterfactuals.

After elaborating on the existing state of the literature in Section 2 and offering our diagnosis in Section 3, we present a simple model to formalize our argument in Section 4. We then proceed to illustrate our points with our own empirical analysis. We first examine congressional delegations from small U.S. states, which sometimes elected multiple members in a single state-wide district until the practice was eliminated in the 1960s (Calabrese, 2000). We then analyze a large panel dataset of local election results from Britain, where many local wards elect more than one member and district magnitudes are frequently altered due to population shifts. We provide results consistent with our analysis: in system-level analysis, higher district magnitude (i.e. lower district number) is associated with higher disproportionality; in district-level analysis, higher district magnitude is associated with lower disproportionality.

Not only does our theoretical and empirical work help to resolve the apparently contradictory findings of recent research on multimember plurality elections, it also makes clear the factors on which the district-level effects of district magnitude should depend. Adding seats to an existing district (i.e. increasing district magnitude at the district level) should lead to more proportional results by giving under-represented parties extra chances to win seats; this should especially occur in contexts where parties are competitive and voters respond to candidate-specific factors. In Section 6 we illustrate this point through analysis of British local elections, where we can carry out fixed-effects analysis in a large sample of elections to show how the effect of district magnitude depends on local factors.

2. The existing confusion

The literature on representativeness and electoral systems since Rae (1967) has emphasized the role of district magnitude, which Rae defined as "the number of seats assigned to the district" (Lijphart, 1999; Sartori, 1986; Taagepera and Shugart, 1989; Rae, 1967; pp. 19–20). Because most countries elect their legislatures either using plurality in single-member districts or using PR in districts of larger (sometimes much larger) magnitudes, discussions of district magnitude and representativeness have mostly focused on the question of whether plurality or PR leads to more proportional outcomes and, within PR systems, how disproportionality varies with district magnitude. There is widespread agreement that electoral outcomes in PR systems are more proportional in larger districts; this emerges fairly mechanically from the operation of any proportional electoral formula. There is also widespread agreement that electoral outcomes tend to be more proportional in PR systems than in plurality systems, although the comparison depends largely on the distribution of preferences across districts (Gallagher, 1991; Powell and Vanberg, 2000). Focusing on systems using SMD plurality or PR, then, the overall pattern is that greater district magnitude makes results more proportional.

As several authors have pointed out, however (e.g. Blais and Carty, 1987; Taagepera and Shugart, 1989; Lijphart, 1999), this prediction does not seem to apply when we turn our attention to plurality systems with varying district magnitudes; instead, it seems that large-magnitude

[3] Allowing the number of representatives to vary across districts is attractive to electoral engineers because it makes it possible to achieve roughly equal representation across districts without redrawing district boundaries and thus disrupting the relationship between an integral community and its representatives. For an overview of the current and historical use of multimember plurality systems see Colomer (2007).

[4] The system used in the 2011 Egyptian parliamentary elections is unusual in that it applies a profession-based quota: if the leading vote-getter is a "professional", the second seat goes to the leading vote-getter among non-professional candidates (i.e. farmers or laborers). The rise of quotas of various kinds in election systems around the world (see e.g. Dahlerup, 2006) may lead to more such multi-member plurality systems being adopted.

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plurality elections would tend to hurt smaller parties and thus produce less proportional results. The logic is simple. Given a jurisdiction (e.g. a city or a country) with a legislature of n members and two competitive parties, we can imagine electing that legislature either by holding SMD elections in n districts or by holding an n-member election in a single jurisdiction-wide district. Given sufficiently party-oriented voters, the n-member election is likely to result in one of the parties winning all of the seats, leading to high disproportionality; the SMD approach is more likely to return members from both parties (assuming that the districts are drawn such that some favor one party and some favor the other) and thus produce lower disproportionality. This logic suggests that within plurality systems the relationship between district magnitude and disproportionality is the reverse of that within PR systems: higher district magnitude in plurality elections makes results *less* proportional.[5] This has indeed been the standard view among political scientists. As stated by Lijphart (1999, pg. 150), for example, "increasing district magnitude in plurality and majority systems entails greater disproportionality and greater advantages for large parties, whereas under PR it results in greater proportionality and more favorable conditions for small parties."[6]

Surprisingly, however, empirical studies assessing this prediction have produced mixed results. Several studies have indeed found that higher district magnitudes correspond to less proportional results in plurality systems. For example, Blais and Carty (1987)'s cross-country analysis finds that one-party majority government is more common in multimember plurality systems than in SMD systems; Calabrese (2000) finds a higher probability of single-party sweeps in U.S. congressional delegations elected from multimember districts than from SMDs; and Ware et al. (2001)'s study of British local elections concludes that "large district magnitude in plurality elections leads to higher levels of disproportionality" (pg. 209).[7] Several studies show the opposite, however. Niemi et al. (1985)'s analysis of U.S. state legislatures concludes that "contrary to expectations, multimember districting does not result in underrepresentation of the statewide minority party" (pp. 442–443). Niemi et al. (1991) comes to a similar conclusion, noting that the percentage of districts electing representatives from both parties is higher in larger magnitude districts (pg. 102). Based on data on Hungarian local elections, Benoit (2001) finds that disproportionality in plurality districts is lower when district magnitude is higher, which he notes is "directly opposite to prior theoretical expectations" (pg. 220). Rallings et al. (1998) similarly note that the representation of dominant parties is not as strong in multimember districts as in SMDs.

In short, when scholars of electoral systems have tried to incorporate multimember plurality systems into discussions of the relationship between district magnitude and representativeness, they have concluded that the theoretical relationship is the opposite of that in PR systems: plurality elections with larger district magnitudes are expected to produce less proportional results. Empirical studies have not consistently confirmed this prediction, however, and no explanation for the disparate findings has emerged.

3. Our argument

The source of the apparently contradictory empirical findings on district magnitude in plurality systems, in our view, is a lack of clarity about the relevant counterfactual and how it relates to the level of analysis. This lack of clarity is in turn related to a fundamental ambiguity in what is meant by "district magnitude" when discussing electoral systems. If we consider a single district, it is simple enough to say what we mean by district magnitude: it is "the number of seats assigned to the district" (Rae, 1967). Increasing or decreasing the district magnitude means adding or dropping seats. When we consider a *system* (i.e. a collection of districts), however, an increase in district magnitude could mean two things. Suppose there are two districts in the system, each electing one member. Based on the district-level definition just discussed, we could increase district magnitude in the system by adding a member to one or both of the districts. Alternatively, we could conceive of combining the two districts into one two-member district, thus preserving the total number of members elected while reducing the number of districts. Fig. 1 offers a schematic view of the distinction between these two counterfactuals. We will refer to an increase in the number of seats assigned to a given district as a "district-level" increase in district magnitude; we will refer to

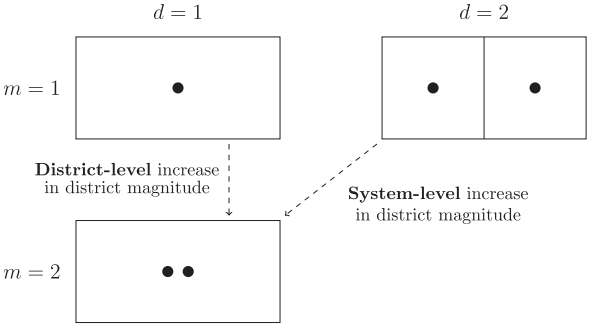

Fig. 1. Changes in district magnitude at the district level and system level. Note: Discussions of district magnitude often conflate changes to the district magnitude in a district (what we call "district-level" changes in district magnitude) and changes to both district number and district magnitude in a system, holding the total number of representatives fixed (what we call "system-level" changes in district magnitude). We represent the distinction between these counterfactuals here in schematic form for the simplest possible case: one or two districts electing a total of one or two representatives.

[5] The same logic led U.S. courts to come to the conclusion that at-large plurality elections result in an unconstitutional dilution of minority-group votes (Davidson and Korbel, 1981).

[6] The same conclusion is found in electoral handbooks designed for practitioners, e.g. Reynolds et al. (2005) and Strauch and Pogorelis (2011), both of which state that in plurality systems "as district magnitude increases, proportionality is likely to decrease".

[7] Scarrow (1999) conducts a similar analysis of the probability of a party sweeping all the seats in a city council election based on election data on ten towns in Suffolk County, NY, finding that party sweeps are indeed more likely to occur in towns using multimember districts compared to single-member districts.

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an increase in the number of seats per district that coincides with a decrease in the number of districts as a "system-level" increase in district magnitude.

The logic that implies that higher district magnitude should increase disproportionality in plurality systems operates at the system level: the implied counterfactual comparison is typically between a single multimember district and several single-member districts (e.g. Taagepera and Shugart, 1989). In turn, the empirical findings consistent with that logic (Blais and Carty, 1987; Golosov, 2003; Scarrow, 1999; Ware et al., 2001; Calabrese, 2000) involve comparisons between *systems* with high district magnitudes (and thus few districts) and low district magnitudes (and thus many districts).[8] The empirical findings that contradict the standard prediction (Benoit, 2001; Niemi et al., 1985, 1991; Rallings et al., 1998; Scarrow, 1999), by contrast, involve comparisons between *districts* with high and low district magnitudes, where the implied counterfactual involves simply changing the number of seats in each district. At the district level, the logic is different: under reasonable assumptions (which we clarify below), adding extra seats weakly increases the chance that underrepresented parties will win seats and thus makes results more proportional on average.[9] The findings of empirical studies carried out at the district level are in fact consistent with that logic.

In summary, findings that contradict the widespread theoretical expectation of less proportional outcomes in large-district plurality elections are in fact consistent with a more nuanced prediction that carefully considers the counterfactual and how it relates to the level of analysis.

4. Formal analysis

In order to clarify our argument and highlight factors that affect the role of district magnitude in plurality systems, we study a model of the simplest possible electoral system, in which (as in Fig. 1) one or two districts elect a total of one or two representatives. We assume throughout the formal analysis that just two parties, x and y, compete for seats. Disproportionality is measured as the absolute difference between party x's seat share s and vote share v:

$$D = |s - v|. \tag{1}$$

In the case of just two parties, all of the most commonly-used measures of disproportionality – the least-squares index, the Loosemore-Hanby index, and the Rae index, all described by Gallagher (1991) – reduce to this measure. We also assume that the distribution of party x's vote share (and, by extension, party y's vote share) does not depend on district magnitude. That is, for any interval $\underline{v}, \overline{v}$ the probability that v will fall in that interval is the same regardless of district magnitude m or the number of districts d.[10]

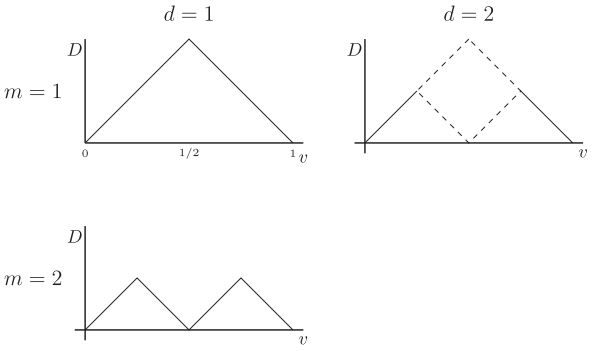

Fig. 2. Disproportionality (D) as a function of vote share (v): Proportional representation Note: In a single SMD (top left), disproportionality is v when $v < 1/2$ and $1 - v$ otherwise. Dividing the district into two SMDs (top right) makes it *possible* that each party wins a seat for $v \in [1/4,3/4]$; electing the two members from a single district (bottom left) makes it *certain* that each party will win a seat for $v \in [1/4,3/4]$. Disproportionality when each party wins a seat is $1/2 - v$ for $v < 1/2$ and $v - 1/2$ for $v \geq 1/2$.

4.1. Proportional representation

Although this paper focuses on plurality contests, political scientists discussing the role of district magnitude in plurality systems have generally drawn comparisons to proportional representation systems. To make clear how our contribution relates to existing work we begin with our own analysis of PR in the simplified setting just introduced.

Disproportionality as a function of party x's vote share v is depicted for all three electoral arrangements in Fig. 2. With $m = 1$ and $d = 1$ (top left), party x wins the seat if $v \geq 0.5$ and loses it otherwise[11]; disproportionality D is thus v for $v < 1/2$ and $1 - v$ for $v \geq 1/2$. With $m = 1$ and $d = 2$ (top right), party x wins both seats if $v \geq 3/4$, loses both seats if $v < 1/4$, and wins either one or two seats otherwise, depending on how its support is divided between the two districts. (We assume that the two districts are equal in size.) Disproportionality with $m = 1$ and $d = 2$ is thus weakly lower at each value of v than with $m = 1$ and $d = 1$: it is the same if the dominant party wins both seats and lower if the parties split the seats. With $m = 2$ and $d = 1$ (bottom left), party x wins both seats if $v \geq 3/4$, loses both seats if $v < 1/4$, and is certain to win exactly one of the two seats otherwise.[12] Disproportionality at each value of v is thus weakly lower with $m = 1$ and $d = 2$ than with either $m = 1$ and $d = 2$ or with $m = 1$ and $d = 1$. Given the assumption that the distribution of v does not depend on district magnitude, we can conclude that expected

[8] System-level studies generally do not explicitly control for the total number of seats, but a negative relationship between district magnitude and the number of districts in the system will hold as long as the legislatures being considered are approximately the same size.

[9] Rallings et al. (1998) make this point in discussing multimember elections at the local level in the U.K.: "if sufficient voters engaged in 'split-ticket' voting then a more proportional outcome could, theoretically, be obtained" (pg. 113).

[10] The advantage of this assumption, as will become clear below, is that we can easily move from statements that we make about the effect of district magnitude on disproportionality *conditional on* v to statements about the effect of district magnitude on *expected* disproportionality.

[11] For simplicity, we assume throughout that party x wins ties.

[12] We assume the Sainte-Laguë method is used; using d'Hondt would yield similar but slightly more complicated results.

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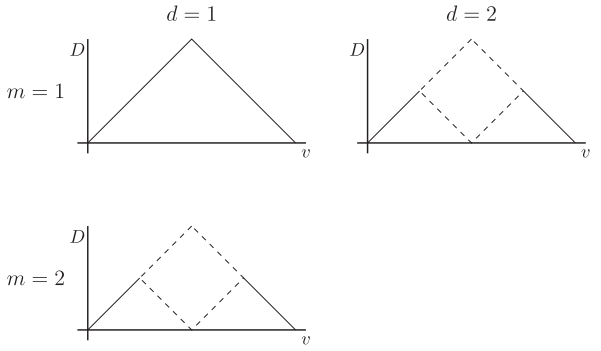

Fig. 3. Disproportionality (D) as a function of vote share (v): Plurality rule. Note: In a single SMD (top left) and two SMDs (top right), plurality elections and PR elections are equivalent. (The PR versions are described in the Note to Fig. 2). When two members are elected in a single plurality contest (bottom left), a split result is possible for $v \in [1/4,3/4]$; as discussed in the text, there are several reasons to think that a split result is more likely in two SMDs than in one two-member district.

disproportionality is weakly decreasing in district magnitude both at the district level and the system level.[13]

4.2. Plurality rule

To relate disproportionality to district magnitude in multimember plurality contests, we must make the following additional assumptions:

Assumption 1. Given m seats to be contested in a district, each party fields m candidates.

Assumption 2. Each voter casts one vote for each seat to be contested.

Under these assumptions, disproportionality as a function of v is depicted for all three electoral arrangements in Fig. 3. With $m = 1$ and $d = 1$ (top left) and $m = 1$ and $d = 2$ (top right), the analysis is the same as under PR: increasing the number of districts weakly decreases electoral disproportionality; the extent of the effect of depends on the degree of preference heterogeneity between the two districts. With $m = 2$ and $d = 1$ (bottom left), given Assumptions 1 and 2 we know that the possible outcomes are the same as when there are two separate districts: party x wins both seats if $v \geq 3/4$, loses both seats if $v < 1/4$, and wins either one or two seats otherwise, depending on how its support is divided between its two candidates. Under the assumption that the distribution of v does not depend on district magnitude, we can conclude that, in plurality as in PR, expected disproportionality is weakly decreasing in district magnitude at the district level: for any overall vote share, disproportionality is the same or lower if there are two seats than if there are one.

It is important to note, however, that the mechanism through which greater district magnitude reduces disproportionality in a plurality system is slightly different than in PR. In a PR system, higher district magnitude in a district reduces disproportionality through the mechanical operation of the electoral formula; it depends solely on the vote shares received by the parties. In a plurality system, the effect depends not just on overall party vote shares but also on the extent to which candidates from the same party receive disparate vote shares. As a formalization of this idea, consider a two-member district in which party x's vote share exceeds that of party y by a, with $a > 0$ indicating x's overall popularity advantage; suppose also that the difference between the vote share of the two candidates from party x is δ_x and the difference between the vote share of the two candidates from party y is δ_y. For the stronger candidate from party y to win a seat it must be the case that $\delta_x + \delta_y > 2a$, i.e. that there is enough difference between the performance of the stronger and weaker candidates of each party to overcome the difference between the parties' overall performance.[14] Thus, we would expect an increase in district magnitude to reduce disproportionality especially when parties are more closely balanced (small a) and when the candidates from one party receive more disparate support (large δ_y and δ_x), for example because voters know more about or care more about the individual attributes of candidates as opposed to their party labels.[15]

Having established that adding a seat to a single district and splitting a single district in two both weakly reduce disproportionality for a given overall vote share v, we now turn to the system-level comparison between a single two-member district and two SMDs. This system-level comparison requires us to speculate about which situation is more likely to result in the seats being split between the two parties, for a given overall vote share v. As a theoretical matter, we can make no prediction without making further assumptions about voter behavior and the distribution of voter preferences across districts. In the standard system-level comparison (e.g. Taagepera and Shugart, 1989), the claim is that splits are less likely in multimember plurality elections; the underlying assumptions seem to be that voters tend to vote along party lines, which gives little chance for minority party candidates to win in multimember districts, and that voter preferences vary substantially across districts, which implies that smaller parties have better chances to win seats in at least some single-member districts than they would have in a single unified district. One can imagine a situation in which the prediction would be reversed: it could be, for example, that voters would prefer to have a split council and are better able to coordinate to produce this result in a single two-member district than in two SMDs. On balance, however, it seems that the more reasonable supposition to make is that a split result is more likely when there are two SMDs, for at least three main reasons:

[13] If in addition there is a positive probability of $v \in [1/4,3/4]$, then expected disproportionality is *strictly* decreasing in district magnitude at the district level.

[14] To see this, note that the vote share of the stronger candidate from party y is $1/2 - a/2 + \delta_y/2 > 1/2 + a/2 - \delta_x/2$. Simplifying we get the condition $\delta_x + \delta_y > 2a$.

[15] Increasing district magnitude would thus be especially likely to reduce electoral disproportionality in a situation where personal acquaintance with the candidate influences voters, producing a "friends and neighbors" effect (Key, 1949; Johnston, 1974).

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(a) The electorates in separate districts may have distinct preferences, such that party *x* does systematically better in one district than in the other. (Put differently, the parties may have geographically concentrated support, such that the smaller party is likely to win a seat when districts are drawn such that its supporters constitute a majority in one district.[16])

(b) Different shocks (for example from local conditions or candidate-specific factors) may occur in separate districts.

(c) Voters may pay more attention to the candidate (as compared to the party) when there is only one candidate from each party on the slate.

Whether and to what degree an increase in district magnitude at the system level increases disproportionality clearly depends on the likelihood of split councils being elected from multimember districts. As noted above, this in turn depends on competitiveness in those districts as well as the extent to which candidates from the same party in a multimember election receive disparate results.

4.3. Summing up

Using the simplest possible model of an electoral system, the formal analysis has clarified the relationship between district magnitude and disproportionality under PR and plurality rule. The broad conclusions about the direction of the effect of increasing the number of members per district in each system are encapsulated in Table 1.

Contrary to the commonly-made claim that the relationship between district magnitude and disproportionality is negative under PR and positive under plurality, our analysis has shown that it depends on what kind of change in district magnitude one is considering. If one is considering an increase in district magnitude that holds fixed the arrangement of districts, the relationship between district magnitude and disproportionality is the same under PR and plurality: electing more members should lead to less disproportionality in each district. If one is considering an increase in district magnitude that holds fixed the total number of seats, i.e. an increase in district magnitude that is accompanied by a reduction in the number of districts, the relationship between district magnitude and disproportionality is different under PR and plurality: holding elections in fewer districts, each with larger magnitude, should lead to less disproportionality in PR but more in plurality. The system-level prediction is clearer in PR than in plurality and (as we will discuss further below) clearer in the simple comparison on which we have focused than in more general comparisons among electoral systems; the goal in analyzing these simple cases is to conceptually clarify the different factors that might matter and how they interact differently in different types of counterfactual comparisons.

[16] The fact that parties with geographically concentrated support are likely to do well with low district magnitudes is related to the main finding of Ziegfeld (2012), which is that small parties with geographically concentrated support do about as well with low district magnitudes as they do with high district magnitudes under PR. Such parties would do poorly in plurality systems with high district magnitudes, however (although again it depends on how district boundaries are drawn).

Table 1
Effect of district magnitude on disproportionality in PR and plurality systems.

	District-level	System-level
PR	–	–
Plurality	–	(+)

Note: At the district level, increasing district magnitude weakly reduces disproportionality in both plurality and PR systems under the assumptions made in the analysis above. At the system level (i.e. holding fixed the total number of seats), increasing district magnitude weakly reduces disproportionality in PR but is likely to increase it in plurality systems.

Within plurality systems, the formal analysis has yielded the following predictions about the relationship between district magnitude and disproportionality:

- At the *district* level, increasing district magnitude weakly reduces expected disproportionality by making it possible for more than one party to win seats. This effect is likely to be especially strong when parties are more evenly matched and candidates from the same party have more disparate results, for example because voters respond more to candidate-specific factors.
- At the *system* level (holding the total number of representatives fixed), increasing district magnitude (and thus reducing the number of districts) is likely to increase disproportionality. The increase will be larger when voter preferences are spatially clustered (i.e. when parties have geographically concentrated support) and when, at the district-level, one party tends to win all of the seats (e.g. because voters concentrate on party labels and/or are inattentive to candidates' individual qualities).

We now turn to empirical analysis in which we test these predictions.

5. Empirical analysis: U.S. congressional delegations

To illustrate how disproportionality depends on district magnitude and district number in plurality systems, we begin with the case of delegations to the U.S. Congress. In the last few decades, members of the House of Representatives have exclusively been elected from single-member districts. Until the late 1960's, however, many smaller states elected their representatives in multimember "general ticket" elections – contests in which two and occasionally more members were elected in a single statewide district (Calabrese, 2000). In this section we use variation in district magnitude and district number in the House delegations of small states to test some of the predictions of the formal analysis above.

Table 2 lists all of the configurations used in states with two or fewer representatives in the period between 1876 and 2010. A total of twenty-one states elected two or fewer members to the House at some point between 1876 and 2010; as indicated in Table 2, seven of those states at some point elected two members in a general-ticket, multimember election. Of those, six states appear in all three

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Table 2
District magnitude and district number in one- and two-member House delegations, 1876–2010.

	$d = 1$	$d = 2$
m=1	$N = 358$, $\overline{D} = 40.1$ AK (1958–2010), AZ (1911–1940), CO (1876–1890), DE 1876–2010), HI (1959–1960), ID (1890–1910), MT (1889–1910, 1992–2010), ND (1889–1900, 1972–2010), NE (1876–1880), NM (1912–1940), NV (1876–1980), OR (1877–1890), SD (1982–2010), UT (1895–1910), VT (1932–2010), WA (1889–1890) WY (1890–2010)	$N = 386$, $\overline{D} = 28.1$ AZ (1948–1960), CO (1892–1900), FL (1876–1900), HI (1970–2010), ID (1920–2010), ME (1962–2010), MT (1918–1990), ND (1962–1970), NH (1882–2010), NM (1968–1980), NV (1982–2000), OR (1892–1910), RI (1876–2010), SD (1932–1980), UT (1912–1980), VT (1882–1930)
m=2	N=61, $\overline{D} = 34.0$ AZ (1942–1946), HI (1962–1968), ID (1912–1916) SD (1889–1910), ND (1902–1910, 1932–1960), NM (1911, 1942–1966), MT (1912–1916), WA (1892–1900)	

Note: The table lists states and time periods in which a House delegation was elected with a given combination of district magnitude (m) and district number (d). N refers to the number of elections and $\overline{D}$ reports the average disproportionality in those election results.

boxes of Table 2. For example, Idaho elected one member from 1888 to 1910 ($d = 1$, $m = 1$); after the 1910 census, which gave Idaho a second seat, Idaho elected its two members on a statewide general ticket in 1912, 1914, and 1916 ($d = 1$, $m = 2$); finally in 1918 the state was divided into two single-member districts ($d = 2$, $m = 1$), the arrangement that has persisted until the present. At the top of each cell of Table 2 we report the number of elections observed in each cell of the table, along with the average disproportionality in those elections. The raw averages fit the predictions of the analysis above: disproportionality is highest in a single SMD; adding a member is associated with a drop in disproportionality from about 40 to about 34; dividing the state into two districts (and thus reducing district magnitude, holding the number of seats fixed) is associated with a further drop from about 34 to about 28.

In Fig. 4 we report the results of regressions in which we carry out the same comparison controlling for state-specific factors and period effects; all of the results are consistent with the predictions. Each dot represents a point estimate from a regression with disproportionality as the dependent variable and delegation types (e.g. two members in one district) on the RHS; 0.95 confidence intervals are depicted by gray lines. Results from three regressions are reported. In the first regression, reported via square points, the only RHS variables are the delegation types (and the point estimates are thus the same as the raw averages reported in Table 2); in the second, reported via triangular points, state dummies are added; in the third, reported by circular points, state and decade dummies are added. The addition of controls does not affect the basic pattern: disproportionality in small House delegations is highest when there is just one member, it drops when a second member is added on a general ticket, and it is even lower when the two members are elected in separate districts. (An F-test indicates that the three differences are significant at the 0.01 level or lower for all specifications.) This pattern is precisely what we would expect based on the formal analysis above: at the district level, expected disproportionality and district magnitude are negatively related; at the system level (where district magnitude is related to the number of districts), expected disproportionality and district magnitude are positively related.

We note that even in this simple analysis there are important factors that differ from the formal model above and that should be highlighted. When a system has two districts in our model, these districts are assumed to be of equal size, such that the system-level vote share is the average of the two district vote shares and thus overall electoral disproportionality is a simple function of district-level disproportionality. In practice, electoral districts are often malapportioned (Erikson, 1972; Samuels and Snyder,

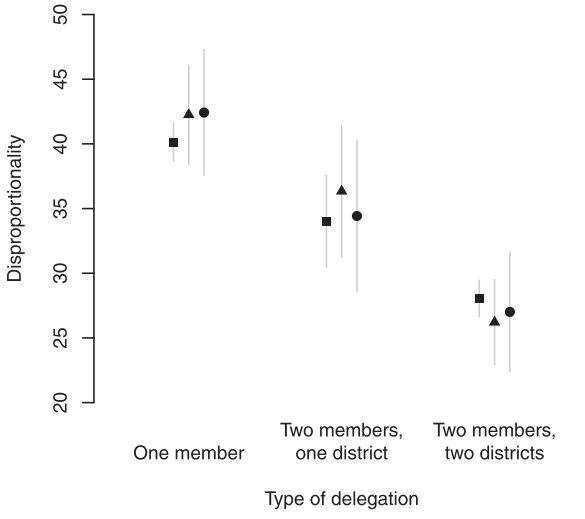

Fig. 4. Disproportionality in small states' House delegations as a function of delegation type, 1876–2010. Note: Point estimates and 0.95 confidence intervals are plotted for three regressions of disproportionality on delegation type: a simple regression with only the three delegation types (square points), the same regression adding dummies for each state (triangular points), and the same regression adding both state and decade dummies (round points). The sample is limited to state-years in which the state elected two or fewer representatives to the House. (See Table 2 for the complete list.) As noted in the text, all differences among the three types of delegations are significant at the 0.01 level or lower.

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2001), which adds an additional wrinkle. Without malapportionment, any redrawing of the boundary between two districts that strengthens a party in one of those districts must weaken it by an equal amount in the other.[17] With malapportionment, boundaries can be redrawn in a way that strengthens a party in one district while barely affecting it in another.[18] Malapportionment could thus in principle be used in a small state to help a dominant party win both seats by extending the party's dominance in one district while not sacrificing much in the other. To the extent that malapportionment accounts for the lower disproportionality in two-district House delegations, however, it is by disproportionately strengthening less dominant parties. Put differently, if malapportionment helps explain our findings on small House delegations, it is through the same mechanism we have emphasized in our formal analysis: by increasing the preference heterogeneity between the electorates electing the two members, which makes the outcomes of a party's candidates more disparate and increases the chances that a split delegation will be elected.

6. Empirical analysis: British local councils

In this section we turn to local councils in Britain, where we find both wider variation in district magnitude and a much larger number of observations than in U.S. congressional elections.[19]

British local authorities (district councils, county councils, and unitary authorities[20]), which collectively account for approximately 25% of public sector spending, are elected in plurality elections from districts known as "wards". The number of councilors elected from each ward is determined by local boundary commissions, which seek to achieve equal representation across wards while maintaining ward boundaries that are easily identifiable and respect local ties. In periodic reviews, boundary commissions attempt to equalize representation by altering the number of councilors allocated to each ward and, less often, redrawing boundaries to equalize representation.[21]

Table 3
Frequency of British ward-elections by District Magnitudes 1945–2003.

	$M=1$	$M=2$	$M=3$	$M=4$	$M=5$	$M\geq 6$	Total
1945–1959	13,344	1524	1793	114	76	350	17,302
1960s	12,212	1081	1710	209	39	63	15,330
1970s	23,941	6504	8971	1038	370	327	41,273
1980s	23,814	5707	7359	97	19	5	37,002
1990–2003	28,951	10,376	10,991	91	18	0	50,427
Total	102,262	25,192	30,824	1549	522	745	161,334

Because of the large number of local wards and the frequency with which the district magnitude of a given ward is changed, British local elections provide an unusual opportunity to study the effect of district magnitude on electoral disproportionality at the district level: using fixed-effects analysis, we are able to look at variation within a ward and see how disproportionality varied as the district magnitude changed over time. In contrast to the previous section, in this section we focus entirely on district-level variation in district magnitude. We do this because the theoretical predictions about system-level changes in district magnitude, which are in any case somewhat ambiguous even in simple cases like the ones examined above, are particularly unclear in comparisons where, as in British local councils, system-level changes in district magnitude are essentially always accompanied by a redrawing of district boundaries that adds further complexity to the analysis. In a comparison of a single multi-member district with multiple SMDs (like the one on which our model focuses above, or the one in our analysis of small U.S. congressional delegations, or the one behind the standard theoretical claims about district magnitude in plurality systems such as in Taagepera and Shugart (1989)), an increase in district magnitude at the system level can only involve *removing* district boundaries (and thus eliminating preference heterogeneity across districts). In a more general case where e.g. four three-member districts are redrawn to create six two-member districts, the ambiguity in the basic comparison is augmented due to the fact that the new boundaries may result in more or less preference heterogeneity across districts than the old boundaries. In focusing on district-level effects, we make use of the unusual number of district-level changes in district magnitude in this dataset while also devoting attention to the main theoretical contribution of this paper, which is to emphasize that, contrary to claims in the empirical literature, at the district level an increase in district magnitude should actually reduce electoral disproportionality on average.

Table 3 shows, by decade, the frequency of elections in wards of each district magnitude from one to six or more. Over the whole period, around 40% of ward elections involved a district magnitude of two or more; the overwhelming majority of these were in districts of two or three seats. (In the 1970s the proportion of ward elections involving four or more seats peaked at 4%; in recent decades the proportion has been below half a percent.) In some of the multimember wards all of the members are elected in a single contest, while in others the members are chosen in "staggered elections", in which the seats are filled in different years and members from the same ward thus serve overlapping terms. Our analysis initially focuses on the non-staggered elections; later, we look for differences

[17] To illustrate: If an electorate with an overall expected vote share for party of x of $1/2+\beta$ is to be divided into two equal-sized districts, the overall expected vote share of those two districts will be $1/2+\beta+b$ and $1/2+\beta-b$; the only role of gerrymandering can be to increase b and thus make the districts less similar.

[18] At an extreme, starting from two identical districts one can move all of the voters but one from one district to the other, such that the party is certain to win in the one-voter district and essentially just as likely to win in the other as it was in each of the original districts.

[19] The empirical analysis of British local elections is based on data from Rallings et al. (2006).

[20] In many places, local government responsibilities are handled by two tiers of councils: district councils (responsible primarily for housing and waste collection) and, at a geographically broader level, county councils (responsible primarily for education, transportation, and social services). In other places, all of these responsibilities are handled by a single unitary authority.

[21] The reviews of electoral wards for local authorities are carried out by different local government boundary commissions in England, Scotland and Wales. However, the basic institutional setup of a politically independent commission who attempt to equalize representation by altering the number of councilors allocated to each ward, is the same. For more information on the Local Government Boundary Commission for England, Scotland and Wales see http://www.lgbce.org.uk/, http://www.lgbc-scotland.gov.uk/, http://www.lgbc-wales.gov.uk/, respectively.

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Table 4
Effect of district magnitude on disproportionality at the district level in British local elections.

	(1)	(2)	(3)	(4)
District magnitude	−2.799*** (0.0668)	−3.385*** (0.201)	−3.270*** (0.207)	
$M = 2$				−5.306*** (0.342)
$M = 3$				−5.940*** (0.441)
$M = 4$				−9.984*** (1.495)
$M \geq 5$				−8.077*** (2.167)
Constant	37.36*** (0.129)	38.28*** (0.316)	35.74*** (0.646)	33.14*** (0.538)
District FE		✓	✓	✓
Year dummies			✓	✓
R-sq.	0.041	0.005	0.047	0.048
R-sq. Adj.	0.041	0.005	0.047	0.048
N	129,310	129310	129310	129310

Note: Standard errors are clustered at the district level. All models are estimated using OLS. The unit of analysis is district-years. The year dummy for 1945 is the excluded category. † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

in the effect of district magnitude between wards that have simultaneous and staggered elections.

In Table 4 we present district-level analysis of the relationship between district magnitude and electoral disproportionality. Because British local elections are multiparty contests, we must use a more general measure of disproportionality than we employed above; we use the least-squares index endorsed by Gallagher (1991) and measured on a 0-100 scale.[22] In column 1 we simply regress disproportionality on district magnitude, adding ward fixed effects in column 2 and year fixed effects in column 3. Consistent with the formal analysis above, the estimates indicate that adding an extra seat reduces disproportionality – the average drop is about three points, or almost 10%. The analysis in column 4 suggests that there are diminishing returns to increasing district magnitude: adding a second seat decreases expected disproportionality by over 15% while the third seat further decreases disproportionality by only about 3%.[23]

The formal analysis above indicated that increasing district magnitude should reduce disproportionality more when candidates from the same party enjoy more disparate electoral success. In Table 5 we test that prediction. First, we compare the effect of district magnitude on disproportionality in smaller electorates (where it is more likely that citizens would know the candidates personally) with the same effect in larger electorates where citizens would be more likely to vote based on party cues. In columns 1–3 of Table 5 we interact district magnitude with the size of the ward's electorate; the positive and significant interaction term indicates that increasing district magnitude reduces disproportionality more in wards with fewer voters. (As before, columns 2 and 3 add district and year fixed effects.) The regressions tend to support the prediction that district magnitude reduces disproportionality more in settings in which candidate-specific factors are more significant.

Our second approach in Table 5 is to include in the dataset not just wards that elect all of their council representatives at once (on which we have focused to this point) but also those wards in which each member is elected in a different year (i.e. via staggered elections).[24] We would expect an increase in district magnitude to reduce disproportionality more in wards that hold staggered elections because the conditions under which each member is elected in these wards are more distinct (different set of current events, slightly different electorates, different campaigns) than in wards where all of the members are elected at once. The regressions in columns 4–6 confirm just that: controlling for district fixed-effects, the interaction term indicates that the effect of district magnitude on disproportionality is almost 50% larger in wards with staggered elections as in wards that elect all of their members at the same time. Together, the regressions in Table 5 support the prediction that district magnitude reduces disproportionality more in settings in which the performance of one candidate from a party is less highly correlated with the performance of another candidate from that party.

The formal analysis above indicated that the effect of district magnitude on disproportionality would also depend on how competitive the parties are in a district: holding fixed the importance of candidate-specific factors, increasing district magnitude in a district where one party is highly dominant should have less of an effect on disproportionality than increasing district magnitude in a district where the parties are closely competitive. In Table 6 we test this prediction using elections to the lowest level of local government (the district council level). Our approach is to regress disproportionality in a given ward on a measure of the competitiveness of county elections in that ward.[25] In columns 1–3 our measure of competitiveness is the margin of victory (in terms of vote share) between the two top parties in the most recent county council elections, and in columns 4–6 we use the normalized Herfindahl index from those same elections.[26] Both sets of results indicate that district magnitude does in fact reduce disproportionality more in competitive places. The regression in column 3, for example, tells us that adding a seat reduces disproportionality by over

[22] The Gallagher index is defined: $\text{LSq} = \sqrt{1/2\sum_{i=1}^{n}(V_i - S_i)^2}$, where V_i and S_i are party i's percent of the votes and seats, respectively.

[23] All regressions presented in the paper include district magnitude as a linear term, *M*. All of our results are robust to the use of transformations of *M* including log (*M*) and M^2. However, since the R-squared only increases marginally in the non-linear models, we focus on the linear formulation for the ease of interpretation.

[24] To calculate disproportionality in these wards, we aggregate the results for one cycle of elections; that is, for a three-member ward, we group together three elections to calculate vote shares and seat shares (and the implied disproportionality) for the cycle.

[25] By measuring a ward's competitiveness based on election results at a higher level of government, we attempt to avoid the pitfall of measuring both the dependent variable and the independent variable using the same voting outcomes.

[26] The Herfindahl index is defined: $H = \sum_{i=1}^{N} s_i^2$, where i is the vote share of party i in the district. The Herfindahl index is normalized so it ranges from 0 to 1 regardless of the number of parties: $H_{\text{norm}} = H - 1/H/1 - -1/H$.

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Table 5
Effect of district magnitude and the importance of candidate-specific factors on disproportionality in British local elections.

	(1)	(2)	(3)	(4)	(5)	(6)
District magnitude	−20.30*** (1.077)	−16.19*** (2.657)	−14.24*** (2.685)	−2.799*** (0.0668)	−3.321*** (0.200)	−3.259*** (0.204)
District magnitude × Log (electorate)	1.935*** (0.122)	1.439*** (0.294)	1.216*** (0.297)			
Log (electorate)	2.164*** (0.177)	0.781 (0.557)	1.422* (0.567)			
District magnitude × Staggered elections				1.698*** (0.265)	−1.917*** (0.411)	−1.820*** (0.419)
Staggered elections				−5.794*** (0.737)	3.622** (1.159)	3.212** (1.168)
Constant	20.62*** (1.543)	32.48*** (4.871)	25.01*** (5.042)	37.36*** (0.129)	38.28*** (0.334)	39.12*** (0.745)
District FE		✓	✓		✓	✓
Year dummies			✓			✓
R-sq.	0.122	0.006	0.050	0.047	0.006	0.045
R-sq. Adj.	0.122	0.006	0.049	0.047	0.006	0.045
N	121,546	121546	121546	140,941	140941	140941

Note: Standard errors are clustered at the district level. All models are estimated using OLS. The unit of analysis is district-years. The year dummy for 1945 is the excluded category. † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 6
Effect of district magnitude and competitiveness on disproportionality.

	(1)	(2)	(3)	(4)	(5)	(6)
District magnitude	−2.538*** (0.386)	−5.570*** (1.143)	−6.299*** (1.114)	−5.129*** (1.120)	−5.129*** (1.120)	−5.869*** (1.100)
District magnitude × Margin of victory (two largest parties)	1.533 (1.065)	2.969* (1.332)	3.542** (1.301)			
Margin of victory (two largest parties)	−11.38*** (2.699)	−14.56*** (3.658)	−15.00*** (3.605)			
District magnitude × Normalized Herfindale index				2.614 (2.222)		3.937† (2.143)
Normalized Herfindale index				−20.34*** (6.077)	−20.34*** (6.077)	−20.23*** (5.925)
Constant	35.96*** (0.974)	42.99*** (2.714)	40.95*** (2.887)	41.93*** (2.643)	41.93*** (2.643)	39.92*** (2.858)
District FE		✓	✓		✓	✓
Year dummies			✓			✓
R-sq.	0.036	0.015	0.091	0.016	0.016	0.089
R-sq. Adj.	0.035	0.015	0.087	0.016	0.016	0.086
N	7562	7562	7562	7466	7466	7466

Note: All models are estimated using OLS. The unit of analysis is district-years. The regressions are based on elections for bottom tier councils, and the competitiveness variable is constructed using the results from the previous election to the top tier council in the same district. Standard errors are clustered at the level of the top tier (i.e. county) ward. The year dummy for 1973 is the excluded category. † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

6 points in a ward in which the two top parties are evenly competitive at the county district level and by around 5 points in a ward in which the two top parties were separated by 1/3 in vote share at the county level. The results are strongest when fixed effects are included.

We note that over 7% of candidates in the dataset are listed as "Independent". In the analysis shown so far we have calculated disproportionality based on the assumption that these candidates belong to a distinct party. All of our results are, however, robust to alternative ways of treating independent candidates, including dropping them entirely, treating each independent candidate as if he or she belonged to a different party, and treating all independent candidates if they were Conservatives.[27]

7. Conclusion

The most extensively studied plurality electoral systems are those in which each district elects one representative, but there are in fact many systems (especially at the local level) that combine plurality with higher district magnitudes. The consensus view is that higher district magnitudes yield less proportional results in plurality systems, but empirical papers examining this relationship have produced contradictory results. We address this confusion by emphasizing the importance of specifying counterfactuals in both theoretical and empirical work employing district magnitude. Existing empirical work comparing plurality systems supports the standard prediction, while other work comparing districts supports the intuitive observation that increasing the number of seats in a district leads to more proportional results by increasing the opportunities for under-represented parties to win seats. Our contribution in this paper has been to emphasize that the relationship between district magnitude and proportionality in plurality systems depends on the counterfactual one has in mind, to show how counterfactuals map onto the level of analysis (district vs. system) used in empirical studies, to formalize these insights in a simple model that yields additional predictions, and to illustrate all of our points in analysis of U.S. congressional elections and British local elections.

Our focus has been on the representation of political parties, which has been the primary preoccupation of the

[27] Our results are similarly robust to dropping all cases where not all parties field as many candidates as there are seats.

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electoral studies literature in political science. Our analysis does have implications for the large literature on representation of racial and other types of minorities, however (see Trounstine (2010) for references and a review). In cases where parties are effectively defined along racial or ethnic lines, of course, the model used above can be applied directly. In cases where a racial group constitutes a minority of all parties but predominantly belongs to one party, an additional dimension will be required: we must consider not only how district magnitude affects whether the racial group's main party will win seats, but also how it affects the propensity of that party to put forward members of the racial group as candidates. We leave to future work the task of fleshing out this analysis and applying it to the task of improving our understanding of how representation works in multimember plurality systems.

Similarly, by focusing on electoral proportionality we have given little attention to possibly important partisan implications of our findings. One such implication is what Monroe and Rose (2002) identified as the "variance effect" – the tendency for variation in district magnitude across districts to systematically favor certain partisan interests (usually, parties with strong rural support that disproportionately benefit from higher district magnitude in urban districts). Although the exclusive focus of Monroe and Rose (2002) is on PR systems, our district-level analysis (both theoretical and empirical) indicates that the same effect may be discernible in multimember plurality systems. It may be, to use our British example, that the Conservatives are systematically advantaged in local politics by the tendency of district magnitudes to be higher in wards with higher population density. We hope that by clarifying the relationship between district magnitude and representation we have made possible future studies of this and other implications of electoral design in plurality systems.

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