

## Are Voters Equal under Proportional Representation?

Orit Kedar\*

okedar@mscc.huji.ac.il

Liran Harsgor\*

liran.harsgor@mail.huji.ac.il

Raz A. Sheinerman\*

raza.sheinerman@mail.huji.ac.il

### Abstract

How electorally equal are voters? Whose voice equals more than others'? And what districting schemes lead to greater equality? We develop and apply a new conceptual framework and measures for evaluating electoral systems. We focus on proportional representation with districts, the electoral system found in more than half of democratic states, and point at an almost entirely overlooked fact: electoral regimes vary substantially within countries with some voters casting their ballot in semi-majoritarian small districts while others in large and proportional ones. This within-country institutional variation, we contend, affects (in)equality of representation. Utilizing district-level data from twenty western parliamentary democracies, we find that supporters of right-wing parties and of large parties are overrepresented in parliament. Complementing our within-country with a cross-country analysis, we show that controlling for the average district, the share of small districts affects electoral inequality in the system. Overall, we show that the degree of inequality under districted PR is substantially more similar to that found under FPTP than is commonly thought.

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\* Department of Political Science, The Hebrew University of Jerusalem, Mt. Scopus, Jerusalem, 91905, Israel. Orit Kedar is an Associate Professor in the department of political science. Liran Harsgor is a PhD candidate in the department of political science. Raz A. Sheinerman is a PhD candidate in the department of political science. Kedar gratefully acknowledges support by the ERC and the Israel Science Foundation.

## 1. Introduction

From Greece to Norway, by far the most common electoral system in Europe (and beyond) is proportional representation (hereafter PR) with districts.<sup>1</sup> Interestingly, in almost all PR systems some districts have only few representatives, and others many, with the largest district having as many as twenty times more representatives than the smallest one. The Norwegian Storting (2009 elections), for example, has a district of as few as four representatives but also a district of seventeen, and nine other magnitudes in between those two. Spain's Congress of Deputies (2008) has a district of three representatives but also a district of thirty five. Districts of the Portuguese Assembly of the Republic (2009) range in their magnitude between two and forty-seven seats. This creates variation of electoral regimes *within* states: some voters have their vote count by majoritarian-like rules, while others by proportional.

This basic and often overlooked fact brings up an issue relevant for all democracies, but particularly potent where the rules of the game vary across voters: what if 'one person, one vote' holds but not all votes translate to the same fraction of a seat in the legislature? In this study we ask: are voters electorally equal under proportional representation, an unlikely suspect? If not, who equals more? And, what districting principles enhance electoral equality among voters? Surprisingly, in spite of voluminous literature on electoral systems and representation, these questions are left almost entirely unexplored.

In this study, we offer three contributions. First, we develop a new bottom-up conceptual framework that evaluates electoral systems focusing on representational equality among voters. Borrowing analytic tools from the study of income inequality and adapting them to the study of representation, this framework allows us to assess how egalitarian different electoral systems are, and unlike current measures of representation, also to characterize the position of different voters in them. Our assessment of representational inequality relies on a simple analysis that reveals who is under- (over-) represented in parliament, how many are under-represented, and by how much.

Our second contribution has to do with the notion of geographic representation under PR. Electoral districts are a key representational instrument that channels local interests. Voters supporting a given party often differ in their interests, we contend. Voters of a given party residing in industrial vs. agricultural areas might have different preferences about subsidies to different sections of the economy, northerners and southerners might vary in their interests of regional development, and the like. Parliamentarians, too, on their end, are not district-blind in how they allocate their efforts (we elaborate on this point below). We thus identify every vote not only by the party written on the ballot but also by the district in which it is cast.

While district-level representation is front and center in the study of FPTP systems, studies of representation under PR implicitly assume that votes are cast and seats are

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<sup>1</sup> In a survey we conducted, over fifty percent of democratic states in the world had districted PR as their electoral system.

allocated nationwide and so, as long as they are for the same party, a rural vote is assumed to be represented by an urban representative, a southern vote by a northerner representative, and so on. This, we argue, leads students of representation to overestimate the degree to which districted PR delivers representation. Once districts are taken into consideration, we find that districted PR is colored by bold majoritarian hues. We demonstrate that there is a systematic pattern to electoral inequality of voters.

Most importantly, we find that the variation in district magnitude often leads to a systematic bias of the parliamentary pie in favor of right-wing voters. Simply, the semi-majoritarian regime in the small districts gives an advantage to leading parties in these parts of the country whereas the more proportional regime in large districts does not result in similar bias. The small districts are usually small town, rural, or otherwise conservative areas, and thus conservative parties enjoy an advantage where they are in the lead while liberal parties, leading in cities, do not enjoy a similar advantage. Thus, voter support for right-wing parties is overconverted to parliamentary seats and that for left-leaning ones is underconverted.

These two contributions bring us to examine districting schemes across countries. If voters' interests are geographically embedded, and if representational inequality across voters stems from variation in district magnitude and hence electoral regimes within countries, one wonders what districting schemes support more or less equality. Our third contribution identifies how different districting schemes affect the level of representational inequality across countries. While the vast literature on electoral systems focuses on the magnitude of the average (or median) district, we call attention to the distribution of districts. We show that across countries, *irrespective of the average district*, the share of parliament elected via small districts, that is the share of voters casting their ballot in small districts, affects voter inequality. This finding has important implications for institutional design.

The paper proceeds as follows. The next section introduces our conceptualization of representational equality and lays out our analytic framework and hypotheses. The following section presents an empirical analysis of inequality, first identifying those who are over- and under- represented within countries, and then shifting to analyzing the overall level of inequality across countries. This analysis draws on districted PR systems and is complemented by PR in a national district and FPTP. The final section concludes.

## **2. A New Look at Representation: Unequal Voters?**

It is well established that democracies with an electoral system of proportional representation are characterized by better representation compared with majoritarian democracies. PR allows diverse voices and interests to be heard and considered in parliament, government and the policymaking process (e.g., Amorim Neto and Cox 1997, Clark and Golder 2006, Cox 1997, Duverger 1954, Lijphart 1999, Norris 2004, Rae 1967, Taagepera and Shugart 1989). It also enables better representation of minority groups

(Shugart 1994), women (Darcy et al. 1993, Norris 1985) and better ideological congruence between the government and voters in comparison to majoritarian systems (Huber & Powell 1994, Powell 2000).<sup>2</sup> Perhaps best established of all is that parliamentary seats under PR are allocated (more or less) proportionately to the votes obtained by the different parties (Gallagher 1991). And indeed, students of electoral politics offer different ways of accounting for the votes-seats gap (Grofman 1983, Rose 1984, Taagepera and Shugart 1989 (p. 105)).<sup>3</sup>

While these characteristics are informative at the system level, we seek to shed light on a more basic set of questions, ones that directly pertain to the individual voter. In spite of the voluminous literature on electoral systems and the evaluations of the quality of representation they provide on a variety of important aspects, a systematic bottom-up analysis of *equality across individual voters* (or groups of voters) is wanting. We ask three questions:

1. Are voters electorally equal under proportional representation?
2. If not, whose vote equals more and whose less?
3. What principles of districting facilitate equality across voters?

## 2.1 Conceptual framework

To address the questions above, we conceptualize the voter as embedded in two contexts: the district she resides in and the party she votes for. Figure 1 lays out our conceptual setup. Take two neighbors, say, Anne and Bob, who reside in the same district but cast their ballot for different parties first (see panel 1A). We wish to know if their votes are equally converted to seats or whether their district is such that the voice of one of them is amplified at the expense of the other. Moreover, are they equal to one another as much as Cindy and David who reside in a different district are, or are some districts characterized by greater equality compared to others? And if not, does one's vote equal more than the other's? Although our framework is constructed for the individual voter, we can group voters and more easily analyze representational inequality across them. We group the electorate to groups of voters categorized by the party they support and the district in which they reside, as is described in panel A. There is thus a group of voters such as Anne who reside in  $D^1$  and support  $P_1$ , a group such as Bob who reside in  $D^1$  and supports  $P_2$ , and so on.

Under PR in a single district Anne and Cindy are indistinguishable. And indeed, in the spirit of national-district PR, common measures of national-level representation assume away districts. Most studies of proportionality at the national level, for example, compare a party's national vote-share with parliamentary seat-share and aggregate those gaps across parties (see, e.g., Powell and Vanberg 2000, Carey and Hix 2011). Thus, Anne's vote is matched with the seat of the representative from Cindy's district and so the assumption is

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<sup>2</sup> Although see Golder and Stramski 2010.

<sup>3</sup> Grofman's (1983) systematically examines measures of bias and proportionality, Rose's (1984) Index of Proportionality uses absolute gaps, Taagepera and Shugart (1989, p.105) propose a measure of Deviation from PR, and Gallagher's (1991) Index of Disproportionality mentioned above uses squared gaps.

that co-partisans who reside in different districts share the same interests or at least that Anne's representative will promote Cindy's interests just as much as she will promote Anne's. Put differently, Anne's and Cindy's voices are averaged out. If the average of Anne and Cindy is represented as much as the average of Bob and David, a desired representational property is fulfilled, it is concluded. This offers an excellent summary measure under national-district PR. But where the electoral system is districted, Anne and Cindy have presumably differing interests.<sup>4</sup>

We take a different approach. Our setup allows us to take an explicit account of the fact that votes are cast and counted in and seats are allotted to districts. Just as in any given district some votes may be overconverted to seats and others underconverted, it is also the case that for *a given party*, electoral support originating from some districts may be overconverted and that from others underconverted. A party, say  $P_1$ , whom Anne and Cindy both support, may form policy that inevitably prioritizes interests in society. These interests, even if not regional per se, often correlate strongly with geography. A tax code that supports farmers more than industry will promote the interests of rural areas at the expense of industrial ones; a developmental plan that invests in infrastructure in the north indirectly transfers wealth from south to north; pork provision to Cindy's district rather than Anne's will have clear electoral consequences; and so on. In other words, forming policy, a party may de facto allocate resources across districts.

Studies of legislative behavior support the notion of geographically geared representation under PR. Bowler and Farrell (1993), for instance, show that members of the European Parliament elected via district-based systems are more tuned in to demands of voters in their districts than those elected via national-based systems. Stratmann and Baur (2002) find that members of the Bundestag serve on committees that increase their chances of being reelected. Those elected via districts are more likely to be members of parliamentary committees that enable them to serve geographically based interests by engaging in allocation of benefits to their district while those elected via the nationwide PR vote are more likely to be members of committees that promote non-geographic interests. More broadly, given that representatives of single-member districts cater to their local constituents, it is a stretch, we contend, to assume that representatives in two, three, five, or ten-member districts are district-blind in their efforts and direct their efforts universally.

Are all supporters equally represented by the party? A party may ask where its parliamentary seats come from and value its constituencies by the seats they provide. Thus, if votes are unequally converted to seats then benefits that are geographically allotted are unequally distributed among or enjoyed by voters. High conversion rate of votes to seats implies that the basket of benefits delivered to the district is enjoyed by relatively few voters. Conversely, if the marginal seat is attained by a large number of votes that are poorly converted to seats the benefits are divided among many. Thus, the relative representation of a vote is determined not only in comparison to supporters of other parties

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<sup>4</sup> Of course, when district-level representation is at stake, the district level figures are fed into the equation. Our point, however, that evaluation of national-level representation skips districts rather than building up representation from the district level, stands.

in a given district, but also in comparison to supporters of the same party residing in other districts. We turn now to systematically integrate the two contexts.

-- Figure 1 here --

## 2.2. Analyzing Representational Inequality

We borrow and adapt tools of analysis from the study of income inequality. In particular, we adapt the Lorenz curve of income inequality and Gini inequality index scores to the study of representation. To the best of our knowledge, this is the first time this approach is taken in the study of electoral politics.<sup>5</sup>

Assume a democracy with a PR electoral system of  $N$  districts ( $i=1,\dots,N$ ) in which voters cast  $V$  votes in total, electing representatives for an  $S$  seat parliament. Assume further that  $K$  parties ( $j=1,\dots,K$ ) compete in the elections.<sup>6</sup> Let  $(v_j^i, s_j^i)$  denote the number of votes and seats of party  $j$  in district  $i$ . For each group of voters in the table (Figure 1B) we calculate its vote-share  $v_j^i/V$  and seat-share  $s_j^i/S$  out of all votes cast and seats allocated. We then calculate for the group (and in fact, for every member of the group) the conversion ratio of votes to seats:  $CR_j^i = \frac{s_j^i/S}{v_j^i/V}$ . Voters who contributed a share of votes greater than the share of seats they received ( $CR < 1$ ) have their voice diminished while those whose seat-share is greater than their vote share have their voice amplified ( $CR > 1$ ). We line up the voters by ascending order of that ratio whereby every data point is a group of voters supporting party  $j$  in district  $i$ , and draw the representational inequality curve. The vote- (seat-) share of one group serves as a baseline for the next, such that on the horizontal axis is the cumulative vote-share and on the vertical axis the cumulative seat-share. For example, if of all  $NK$  groups of voters the two smallest conversion ratios are for supporters of  $P_1$  in  $D^3$  (the party won 15% of the votes and ten out of a hundred seats in parliament) and for  $P_2$  in  $D^1$  (the party won 8% of the votes and no seats), the coordinates of the two lowest points on the curve will be  $P_2D^1 = (0.08, 0.00)$ , and  $P_1D^3 = (0.23, 0.10)$  with conversion ratios of  $CR_2^1 = 0$  and  $CR_1^3 = 0.67$ , respectively. The slope of the curve leading to each data point thus stands for the conversion ratio of the relevant group of votes.

Panel C presents a hypothetical curve of representational inequality among voters. We marked our four voters from Figure 1A (initialed) on the curve. Regardless of rates of support for the different parties in different parts of the country, the forty-five degree line denotes perfect equality in the conversion of votes to seats. The figure reveals several interesting quantities. Note first the features of the curve that indicate under- and over-

<sup>5</sup> The only reference to Gini-like measure of representation we are aware of is in Taagepera and Shugart's *Seats and Votes* (1989). In their book, the authors offer an exceptionally systematic and thorough analysis of electoral systems. They note that 'an alternative [to the measure of deviation from PR which they use] is the Gini index of inequality, which has theoretical advantages but is more complex to calculate' (p. 204). They add that 'the Gini index is the most widespread index of inequality, and it does satisfy Dalton's principle [of transfers]. The Gini index is useful for many purposes other than electoral studies (where it has been little used)' (p.263).

<sup>6</sup> National-district PR is a specific case where  $N=1$ .

representation of individuals within a country. First, in this example, as the figure indicates five percent of the votes were not converted to seats. Also, note that voters such as Anne and Bob, with a slope smaller than one are underrepresented, while Cindy and David are overrepresented. Third, the shape of the curve is indicative of the type of misrepresentation in the country. With the belly dipping in about 0.53, fifty-three percent of the votes in the country are underrepresented while the remaining forty-seven percent are overrepresented in parliament. The more rightward the belly reaches its maximum dip (“high belly”), the greater the proportion of voters whose voice is diminished in parliament. Fourth, an examination of the actual parties/districts at different places along the curve can reveal which voters (characterized by both district and party) are systematically under-leveraged to seats and which voices get over-leveraged.

Additionally, a summary figure for the country as a whole, we calculate the Representational Inequality index (RI), which equals the area between the forty-five degree line of perfect equality and the curve divided by 0.5. This summary index, we show below, is correlated with standard measure of vote-seat disproportionality. Graphically, other things equal, a curve denoting greater inequality will be closer to the bottom-right corner compared with a curve of little inequality that will be closer to the forty-five degree line. Varying in size between zero and one, the more unequal is the transformation of votes to seats across groups of voters, the greater the RI index of the country as a whole.

This setup allows us to identify winners and losers, those persons who get de facto more or less than one vote. It also allows us to evaluate representational equality overall for every election – a quantity that is calculated bottom-up. Notice that the analysis we propose is informed by district-level discrepancies. If supporters of a party are overrepresented in district  $l$  and underrepresented in district  $m$ , unlike standard indicators of representation calculated at the national level, this discrepancy will be reflected in the analysis. And although the famous joke claims that if one's head is in the freezer and feet are in the oven all is well on average, representation is not an 'on average' quantity. If Anne lives in the center and Cindy in the periphery, one's vote is unlikely to compensate for the other's.

### **2.3 Predicting voter inequality: hypotheses**

We are now able to derive hypotheses about the pattern of representation both within and across countries. We begin with the former. Our first question was: are voters equal under proportional representation? Since it is representatives who embody the representation of voters, some discrepancies between the distribution of votes and that of representatives in a district is inevitable. A vote distribution of, say, 35-65 in a two-member district will have to result in a dissimilar distribution of the two representatives. In a district of ten representatives, however, the distortion will be smaller. Our first hypothesis, therefore, is:

H1. Voters residing in small districts are characterized by greater inequality compared to those residing in large districts.

If indeed votes are not equally converted to seats, we turn to our second question. We ask whose votes are overconverted to seats and whose are underconverted. Simply put, is Anne's vote worth more than that of Bob's or Cindy's? And if so, is there a systematic pattern to whose votes are amplified and whose is diminished? By definition, under FPTP the majority (or plurality) party takes it all. One might wonder what the systematic pattern of equality is like under proportional representation, and in particular under the commonly found districted version of PR. We think that there is a good reason to expect seat premium for parties that obtain a large share of the votes under districted PR as well. After all, the limiting effect of small district magnitude does not entirely disappear when shifting from a single- to a two- or three-member district and so forth. It is gradually reduced. This implies that supporters of small parties are disadvantaged in having their voice heard in parliament, and especially so if they reside in small districts. Our second hypothesis is therefore:

- H2. Voters of large parties are characterized by conversion ratio greater than that of voters of small parties. And,  
H2(a). The effect is stronger for those residing in small districts compared with their counterparts residing in large-magnitude districts.

This mechanical effect has an important substantive parallel. Since we expect that large parties enjoy a seat premium under districted systems and particularly under small districts, by mapping the majority and minority parties in different magnitude districts we can substantively identify winners and losers. Electoral districts are normally an institutional boundary of a community. Communities in small towns, rural areas and the periphery are usually small while cities usually have large districts. This is the case in the vast majority of west European countries. Lisbon and Porto have by far larger magnitudes than all other districts in Portugal (forty-seven and thirty-nine, respectively, while the median district magnitude equals six), Stockholms län and Stockholms kommun have greater magnitudes than all other districts in Sweden (forty-two and twenty-eight, while the median is nine), and so on. But there is an additional important difference correlating with district magnitude: cities tend to be more liberal than rural areas and small towns. Conservative parties tend to be a majority (or plurality) in those districts where the rules of the game benefit the largest competitor (small districts), while liberal parties tend to be a majority (or plurality) in districts where the rules of the game are relatively proportional (large districts). Hence, our third hypothesis is:

- H3. The smaller the district the more overrepresented are supporters of right-leaning parties.

An exception to this pattern is small but geographically concentrated parties. Calvo (2009) convincingly shows that the geographic dispersion of voter support affects the ability of small parties to compete and in particular to withstand competition from new parties. Calvo, as well as Ziegfeld (2013) demonstrate that small and geographically concentrated



parties are better able to secure some seats compared to their geographically dispersed counterparts.

Before we continue, two particularly insightful recent works examine the relationship between geography and the electoral success of particular interests and merit our attention. The arguments are both nuanced, and we offer only a crude version here. Rodden (2010) analyzes the electoral success of the left and right parties under single-member districts. He shows that due to legacy of the industrial revolution supporters of left-leaning parties tend to reside in cities and supporters of right-wing parties reside outside of them. Districts where the former enjoy a majority have a wide margin compared to the latter and so the vote for left parties is less efficiently turned into seats than the vote for right parties. At the core of the comparison Rodden makes, therefore, is the skewness of the distribution of votes in left-majority districts vs. that in right-majority districts, both under the same institution of single-member district.

Monroe and Rose (2002) offer an account of representation of urban vs. rural interests due to what they term 'the variance effect' – the fact that districted PR often has large variation in the magnitude of districts. They show that urban interests are more greatly represented than rural ones, that there is higher parliamentary fragmentation of urban parties compared with rural ones, and that there is systematic disadvantage of the largest urban party.

Note that our argument differs from Rodden's in that his argument relies on a correlation between ideological tendency and margin of victory when the rules of the game are kept constant. We, on the other hand, examine districts of different magnitude and argue that the correlation between who wins where and the rules of the game in that district creates the electoral bias. Our argument, in combination with the rest of the analysis of voter inequality we offer, complements Monroe and Rose's in that we offer a general framework for examining voter inequality. The right-wing bias we identify is a specific case of which the magnitude of the district and hence the rules of the game co-varies with voter preferences.

Does the districting structure affect the level of inequality? One of the most established stylized facts in the study of electoral systems is that the greater the district magnitude, the more proportional is the system (see, e.g., Lijphart 1984 and, Taagepera and Shugart 1989). Specifically, the relationship established is between a central-tendency measure of district magnitude and the degree of proportionality in the country. Central tendency is measured in three common ways: average district magnitude in the country (e.g., Taagepera and Enschede 2006, Edwards and Thames 2007), median district magnitude (e.g., Carey and Hix 2011), and the magnitude of the median legislator (Amorim Neto and Cox 1997, Gabel and Scheve 2007).<sup>7</sup> Our theorizing, however, suggests that perhaps something else in addition to average (or median) district is at work. If indeed voters who

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<sup>7</sup> The median legislator is defined by the magnitude of the district in which she is elected: this is the legislator who half of her colleagues are elected in smaller districts.

live in small districts are more unequal, and if indeed supporters of large and of right-leaning parties are overrepresented in small districts more than in large ones, then the share of parliament elected via small districts should matter irrespective of the average (or median) district. This allows us to shift from winners and losers within a country to cross-country analysis of the general level of representational inequality. In particular:

H4. The greater is the share of parliament elected via small districts the greater is voter inequality in the country, controlling for central-tendency district magnitude.

If supported empirically, this conjecture has key implications not only for our understanding of parliamentary representation of different groups but also for the design of electoral systems.

This set of hypotheses allows us to examine inequality patterns across supporters of different parties residing in different districts as well as general level of representational inequality across countries. We turn now to empirically evaluate them.

### **3. Empirical analysis**

#### **3.1 Case selection and data**

To examine equality in representation and test our hypotheses, we utilize district-level data from twenty western parliamentary democracies. These include a wide range of electoral systems: four cases of FPTP, thirteen cases of districted proportional representation, and three cases of national-district PR. Sixteen of our cases are western European democracies. To these, we added four cases. Israel and Canada are important additions on the extremes – national-district PR, and FPTP, respectively. And New Zealand 1993 and New Zealand 1996 is a case of an electoral system change (FPTP to PR) within a country which gives us empirical traction on institutional variation within a single country. Our thirteen districted PR systems vary both in their average and median districts and in the variation of their district magnitudes. With the exception of Italy (22.5), average district magnitude varies between 3.86 (Ireland) and 15 (Luxembourg) and is 9.4 on average. This within-country range is as small as two in Ireland where districts are of magnitudes 3-5 and as large as forty-five in Portugal, where district magnitudes vary between two and forty-seven. The distribution in most countries tends to be right tailed, with many districts of small magnitude and a few districts of large magnitude. The few large districts, usually representing cities, consist of a significant fraction of national parliaments.

Two parliamentary western European democracies are excluded from our analysis: Austria and Switzerland. Austria has the final allocations of a large fraction of parliamentary seats take place above the district level. As an example, in the 2008 elections only 71 of 183 seats were allocated at the first stage (district level) and the remaining seats were allocated in later stages at the provincial and national level. This makes any attempt to empirically analyze representation based on allocation of seats at the district level futile. With the number of votes per voter varying across districts in Switzerland, an analysis of conversion

ratios across districts yields distorted results. Appendix A presents a full list of countries in our analysis, as well as information about their districting structure.

Overall, our data consists of 220 parties (146 of which attained seats in parliaments) in 1366 districts (305 in districted PR systems). We included in our database all competing parties but grouped voters of extremely small parties and individual candidates if they failed to reach 0.2 percent of the national vote. Our data sources are official online records of election results usually published by the committee of national elections or the ministry of the interior in the relevant country.

### **3.2 Voter inequality: a general picture**

Before we systematically analyze individual over- and under-representation within countries, Figure 2 presents the general picture of representational inequality in twenty democracies. These are the empirical realizations of the hypothetical graph in Figure 1C with every point on each curve representing voters who support a particular party residing in a particular district (e.g., Anne, and NK points altogether per country which make an inequality curve). The countries are organized by ascending order of average district magnitude, beginning with FPTP (the first three cases), moving onto districted PR in the following thirteen cases, and ending with national-district PR in the last four cases.

The first three cases display particularly high inequality with an RI index of close to 0.6 and over fifty percent of the votes that are not converted to seats in parliament (the horizontal part of the curve at zero). For comparison, in the UK where fifty-three percent of the votes cast in constituencies are not represented, a calculation of party votes (and seats) ignoring districts as is commonly done produces a much smaller figure of 6.94% of unrepresented voters. The smallest inequality is observed in the four national-district PR cases at the bottom row. There, only a relatively small fraction of the votes is not converted to seats and the RI index is between 0.02-0.08. Notice in particular the dramatic difference between New Zealand 1993 and 1996.

The thirteen districted PR systems are characterized by greater voter inequality than one might expect. In fact, they are as much as half way between the PR in a single national district and the FPTP systems. Importantly, voter inequality is not only about those votes that are not converted to seats in the district. The shape of the curvature is informative. Recall that all voters to the left of the  $CR=1$  point (where the curve dips the most) stand for underrepresented voters. Note that in some countries (e.g., Denmark) the curve dips the most on the left while in others (e.g., Norway), it dips on the right -- not only does the overall degree of misrepresentation vary by country, but so does the proportion of the underrepresented ones.

Before we move on, an important wrinkle needs to be ironed. Three of our districted PR cases have compensatory seats designed to mitigate distortions in representation resulting from district-level allocation of seats. Norway and Sweden have 'at large' seats tagged onto each district. These seats are allotted to parties by national vote-

shares and are added to every geographically defined district after district-level gaps between votes and seats are calculated. Put differently, every district has a few (or one) seats that are allotted by a calculation different from that of the rest of the seats in the district. Our data include these seats as part of the district, and hence any such mechanism aimed to mitigate distortion in representation is taken into account by our analysis. Unlike these two cases, in Denmark, a compensatory district of forty seats exists *separately* from the geographically defined districts. Similar to the other cases, however, this district does not result from a separate set of votes but rather from the ‘regular’ votes cast in the districts. In this case, our analysis does not include that additional district (in fact, we cannot include them, as they do not result from separate votes) and potentially somewhat overestimates distortion in representation.

A bird’s-eye view, then, indicates that there is substantial variation in voter inequality within countries as well as variation in the general level of inequality across countries. The latter, it seems, is not only about the magnitude of the average district. We next turn to within-country analysis, followed by the cross-country comparison in section 3.4.

-- Figure 2 here --

### 3.3 Are voters equal? Who equals more?

We first wish to unpack the general picture to examine voter equality within countries in several ways. Our first hypothesis is that voters residing in small districts are characterized by greater inequality compared to those residing in large districts. To test this hypothesis we ran a model at the party/district level within each of the districted-PR cases in which we estimated the effect of (logged) district magnitude on the degree to which the conversion ratio is different from one.<sup>8</sup> Absent from this and the following two analyses is Malta which has no variation on district magnitude. Since the dependent variable is measured as distance from conversion ratio of one, the more unequal are voters the greater it is, and thus we expect to find a negative coefficient on the effect of district magnitude.

Table 1 presents these results. As the table demonstrates, in almost all cases we find a systematic negative relationship between district magnitude and the degree to which conversion ratios in it are different from one: large districts have conversion ratios closer to one compared with small districts. In Iceland the results are in the expected direction but fail to reach standard levels of statistical significance (perhaps related to the limited variation in district magnitude). A pooled model (with country fixed-effects) reports similar results. These findings suggest that voters under districted PR are not equal. Equality among voters depends on the magnitude of the district where they cast their ballot: the voices of those residing in small districts are substantially either magnified or diminished while the voice of those residing in larger ones are more evenly expressed in parliament.

-- Table 1 here --

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<sup>8</sup> The dependent variable is  $\text{abs}(1-\text{CR})$ .

Whose voice is amplified and whose is diminished? Our second hypothesis is that voters of electorally large parties have their votes converted to seats better than voters of small parties, and that the effect is stronger where district magnitude is small. In other words, the larger the vote-share of a party the larger the conversion ratio of the votes it attained, and more so in small districts. To test this hypothesis we estimated an interacted regression model at the district/party level in which we estimated the effect of party vote-share in the district on conversion ratio and let that effect be modified by district magnitude:

$$CR_j^i = b_0 + b_1 \ln(dm^i) + b_2 partyVS_j^i + b_3 \ln(dm^i) * partyVS_j^i$$

If our hypothesis finds support in the data the effect of party vote-share should be positive and decline with district magnitude.

We ran the analysis on twelve of the thirteen districted PR cases (excluding Malta). Figure 3 presents the results of our analysis, case by case, as well as pooled. Next to each case the range of district magnitudes is reported. On the vertical axis is the effect of vote-share on the conversion ratio (note the horizontal line in zero, marking no effect) and on the horizontal axis is logged district magnitude (see Brambor et al. 2006). The estimates themselves are reported in appendix table B1. The results support our prediction. First, in all countries the effect is positive. Voters who support large parties have their voice amplified in parliament compared to those who support small parties. Second, in all countries but Belgium, Finland, and Ireland the effect declines with district magnitude. Although the former two are curious, the results for Ireland are hardly surprising given the small variation in district magnitude there. In Ireland, supporters of large parties enjoy an advantage in all districts.<sup>9</sup> The pooled analysis (with country fixed effect and clustered standard errors) is consistent with our expectation as well.

-- Figure 3 here --

As mentioned above, in most of our cases large districts are often an electoral reflection of urban communities while small districts are those of rural and peripheral areas and small towns. Given that the former are more liberal than the latter on average and given the greater inequality found in small districts, we hypothesize that supporters of right-leaning parties are overrepresented in small districts compared to those supporting left-leaning parties.

We utilize Benoit and Laver's (2006) expert survey of party placements conducted in forty-seven countries during the period of 2002-2004. The survey includes data on party placement on various policy dimensions, though for our purposes the general left-right dimension is the most relevant one. The placements are coded on a twenty-point scale such that high values denote a right-wing position. Since the election cycles we analyze are not within that time window but one or two cycles later, depending on the country (indeed, even if we were to pick the cycles according to the survey, not all countries held elections during the relevant time frame) we assume that there are no major leapfrogging that change

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<sup>9</sup> The votes under STV are first rank.

the order of parties on the left-right continuum in the relevant period. In terms of matching between the coverage of the parties in the expert survey and the parties in the relevant cycle, in six of the cases all parliamentary parties of the relevant cycle are coded in the expert survey and in additional five almost all are covered.<sup>10</sup> The only country for which we have core parties missing a placement coding is Italy which is thus removed from this analysis.

To test our hypothesis, we estimate an interactive model in each of the eleven countries such that:

$$CR_j^i = b_0 + b_1 \ln(dm^i) + b_2 partyLR_j + b_3 \ln(dm^i) * partyLR_j$$

We also estimate a pooled model for all eleven countries. Our key quantity of interest is the degree to which the conversion ratio of votes to seats depends on the party being a left- or right-leaning and how this effect varies with district magnitude.

Figure 4 presents the results of this analysis in each of the eleven countries that vary in their district magnitude (the estimates themselves are reported in appendix table B2). On the vertical axis is the effect of the party's ideological placement on the party's conversion rate of votes to seats (in the district) and on the horizontal axis is the (logged) district magnitude. An effect line above zero implies that right-leaning parties better convert votes to seats than left-leaning parties do. A positive yet decreasing effect line that approaches zero from above implies that as the district magnitude increases, right-wing voters lose their relative advantage of having their voice amplified compared to their left-wing counterparts.

The findings support our predictions. First, as the figure shows, in all cases except Iceland and Finland the estimated effect line is above zero on the left part of the scale: in small districts right-wing parties convert voter support to seats better than left-wing parties do. In Iceland the smallest district as big as eight representatives and the range of district magnitudes is minimal (eight to ten with the mass on nine). It is thus no surprise that Iceland demonstrates no systematic effect.

Second, note that the effect is decreasing in all countries where we have a substantial range of district magnitudes with the exception of Belgium. In those countries where we find a particularly large range of districts with some very small and others very large ones (e.g., Greece, Portugal, Spain, Sweden) the estimation is more precise and so the effect on the left (in the small districts) is statistically significant, while in others the confidence interval includes zero. In all countries where the line decreases, however, the ideological effect becomes no different from zero once the district is large enough. In Spain, for instance, this takes place for district magnitude larger than eleven. In Sweden seven-member districts is where supporters of the right lose their overrepresentation.<sup>11</sup> Results of

<sup>10</sup> In Belgium, Greece and Spain less than four percent of the total parliamentary seats are missing a placement coding, in Iceland one parliamentary party with 5.6% of the seats is missing a coding, and in Ireland, due to a large share of independents, 11.5% of the seats are missing a coding and are thus removed from the analysis.

<sup>11</sup> These assertions are based on the point in Figure 3 where the lower-bound confidence interval intersects zero.

the pooled model, too, are consistent with our prediction. In other words, right-leaning parties lose their advantage when districts are characterized by greater equality of votes-to-seats conversion, and this characteristic of the large districts implies that left-leaning parties do not gain a representational advantage that offsets the advantage of right-leaning parties in small districts.

In two of our countries, Belgium and Ireland, our findings are curious. Belgium is curious to us as the entire effect is no different from zero in spite of the wide range of district magnitudes. In Ireland, both cities and rural areas are divided to small districts with hardly any variation in magnitude (three to five members each). Thus, the correlation between the rules of the game (district magnitude) and the winning ideology (majority or plurality) in the district found in other cases is not relevant. This is a case where Rodden's argument about single-member districts can be extended: if indeed the left wins the district it wins by large margin and the right by small margin, we end up with the pattern found in our figure -- right-leaning parties better convert votes to seats compared to their left counterparts.

In sum, conservative voters are often a majority (or plurality) in those districts where the rules of the game give the largest parties a seat premium while liberal voters are often a majority (plurality) where the rules of the game convert votes to seats relatively equally. Thus, misrepresentation in small districts work in favor of conservative voters (and parties) while there is little 'compensation' for liberal city dwellers in large districts. The mere correlation between the size of electoral communities (and hence the degree to which the rules of the game in them are proportional) and their political preference tilts the playing ground.

-- Figure 4 here --

### **3.4 How districting schemes affects inequality: a comparison across states**

We showed above that within countries small districts are characterized by greater voter inequality compared with large districts and that in them supporters of large and right-leaning parties are overrepresented. These insights call for cross-country analysis of the effect of districting schemes on the overall level of voter inequality. As we show in Figure 2 above, that systems of single-member districts are characterized by particularly high inequality and those of very large districts (in fact, a national district) by high level of equality is only part of the story. There is a substantial degree of variation in inequality found among districted PR cases, and importantly, inequality does not simply decrease with average district magnitude.

To analyze this variation in the overall level of inequality across countries, we first examine the districting structure in our districted PR cases.<sup>12</sup> Figure 5 presents histograms of district magnitude in twelve countries. Given our findings about the high levels of inequality across voters found in small districts, we pay special attention to the proportion

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<sup>12</sup> Malta, where all districts are of magnitude five, is missing from this part of the analysis.

of voters casting their ballot in small districts. The dashed line marks the proportion casting their ballot in districts smaller than five. Most distributions are right-tailed with the average being greater than the median (not reported here) and some also have a considerable amount of small districts. Spain, Portugal, Sweden, and Greece are perhaps the best examples. With an average district magnitude of 6.73 and a median of 5, Spain has districts of magnitude 35 (Madrid) and 31 (Barcelona). At the same time, as many as eighteen percent representatives in the 350-seat Congress of Deputies are elected via districts whose magnitude is smaller than five. Yet not all distributions are right-tailed, as one can see in Ireland or Denmark, among other cases. The districting structure, then, substantially varies across states.

-- Figure 5 here --

To evaluate the effect of the districting structure on inequality, we shift to analyzing our summary RI index. In particular, Table 2 presents the degree of country-level inequality captured by the RI index as a function of the proportion of parliament elected via small districts with magnitudes smaller than seven, five, or three members as proxies in all 20 states (see grayed column).<sup>13</sup> We expect a positive coefficient on the fraction of parliament elected via small districts (leading to a greater level of inequality). Importantly, the analysis controls for the magnitude of the central district. In every section of the table we use a different measure of central tendency commonly found in the literature (see discussion leading to H4 above): the magnitude of the average district, the magnitude of the median district, the magnitude of the district electing the median legislator (see footnote 7). We also include a control for the electoral formula as specified in Lijphart 1990 (1- Hare or Sainte Laguë, 2 - Hagenbach-Bischoff/ Droop, modified Sainte Laguë, or STV, 3 - D'Hondt, 4 - single-member plurality). Lastly, we control for whether a state has Single Transferable Vote. See Robustness section for alternative specifications of electoral formulae and other model specifications.

The results demonstrate the importance of the way in which the electorate is divided into districts. The greater is the share of parliament elected via small districts the greater is inequality across voters. These results hold for the three threshold magnitudes and for the three alternative central-tendency measures. Notice that the coefficient on central tendency (models 1, 5, and 9) is reduced once the fraction elected via small districts is added to the analysis. These results draw attention to an aspect of districting design and its effect on the quality of representation overlooked by the voluminous literature of electoral systems. How representationally unequal a democracy is is determined not only by *how majoritarian is the voting environment of the median or average voter*, but also to a large degree by *how many voters* cast their ballot in a majoritarian or almost majoritarian setting.

-- Table 2 here --

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<sup>13</sup> These are the cases reported in Table A1. They include 19 states and an additional data point for New Zealand.



### 3.5 Robustness analyses

We estimated our models in various ways. The results reported for hypotheses 1 through 3 are both country-by-country and pooled, where the former includes standard errors clustered by districts and the latter standard errors clustered by country and country fixed effects.<sup>14</sup> Although we think that this is the appropriate specification, we also estimated the models in alternative ways. For H1 and H2, we estimated each of the country-by-country models (i) with a cluster on parties instead on districts, (ii) with party fixed effects, and with (iii) party fixed effects and clustered standard errors by parties. For H1 results of all four estimations are nearly identical. Results for H2 are the same though standard errors do get larger. We also ran the analysis of H3 with party-clustered standard errors.<sup>15</sup> The results are similar though the standard errors are larger.

Table 2 presents our results for H4. In the table we present the models with control for central tendency, STV and Lijphart's rank of electoral formulae disproportionality. The results for the three alternative central-tendency measures (in the three sections of the table) are very similar. We estimated various versions of our model with the third, the magnitude of the median legislator. In particular, we varied inclusion of control variables, inclusion and specifications of the electoral formula ranking, and the cases included in the analysis. In a nutshell: results hold for districts smaller than five in almost all specifications, and depending on specification for districts smaller than three or seven. Follows is a more detailed description.

There is no one agreed upon scale of the degree of proportionality of electoral formulae, nor one criterion by which to order formulae. As Gallagher (1992) put it: 'To rank seat allocation methods in order of proportionality would be a subjective exercise, entailing the selection of one criterion as the acid test of proportionality' (p. 494). In addition to utilizing Lijphart's (1990) order of electoral formula, we ran the analysis using three alternative rankings: Rae's (1967) (consistent with Farrell's 2011 framework), Gallagher's (1992), and Benoit's (2000).<sup>16</sup>

Results with control for electoral formula alone hold for districts smaller than three and five for all rankings and smaller than seven depending on the ranking. Results with control for single-member district hold for districts smaller than five under Lijphart and Gallagher's rankings of formulae. Results with no control variables hold for districts smaller than three and five. When running the analysis controlling for Malta rather than STV, results hold for all three district magnitudes (both with and without formulae). Results with control

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<sup>14</sup> Given that analyses for H1-H3 include district magnitude on the right-hand side, a district fixed-effect cannot be included.

<sup>15</sup> Given that the analysis for H3 includes party ideology on the right-hand side, a party fixed-effect cannot be included.

<sup>16</sup> Rae's coding: 1- Hare or Hagenbach-Bischoff/ Droop, 2 - Sainte Laguë or modified Sainte Laguë, or D'Hondt, 3 - single-member plurality. Gallagher's coding: 1 - Hare or Sainte Laguë, 2 - modified Sainte Laguë, 3 - Hagenbach-Bischoff/ Droop, 4 - STV, 5 - D'Hondt, 6 - single-member plurality. Benoit's coding: 1 - Sainte Laguë, 2 - Hare, 3 - Hagenbach-Bischoff/ Droop, 4 - modified Sainte Laguë, 5 - D'Hondt, 6 - single-member plurality.

for single-member district and STV hold for districts smaller than five depending on the formula coding. When only the thirteen districted PR states are included in the analysis, results hold for districts smaller than five controlling for electoral formula (the four alternative rankings) or STV. This is also the case when both formula and STV are included in the model, although there, they hold only under Lijphart's and Gallagher's formula rankings. Lastly, we ran the analysis on the districted PR cases omitting Malta. Results hold for districts smaller than five and seven, and once the electoral formula is added, they hold under Lijphart's and Gallagher's rankings.

Lastly, we added malapportionment, a key suspect for causing representational disproportionality (Samuels and Snyder 2001). Our inequality analysis is related to malapportionment but is by no means identical to it (in our data, our RI index correlates with malapportionment at 0.44.) The following illustration might shed light on the relationship between the two concepts. Assume a state with twenty single-member districts and no malapportionment. Assume further a two-party competition such that party A wins districts 1-10 with 51% of the vote and party B wins districts 11-20 with 51% of the vote. Each of the two parties ends up with ten seats in the legislature. At the national level, therefore, each party has 50% of the votes and 50% of the seats. Our analysis would produce an inequality curve of a straight horizontal line at zero up to 49% (twenty groups of voters that gained no representation and cast 49% of the votes in their district each) and an IR index of 0.49. By comparison, both malapportionment and disproportionality measures would show no representational discrepancy. At the same time, since our measure identifies votes (seats) by the district in which they are cast (to which they are allotted), other things equal, had the state been malapportioned representational inequality would have been even greater. Results including malapportionment hold for magnitudes smaller than three and five for almost all specifications and hold in direction but are not statistically significant for magnitude smaller than seven once malapportionment is included. Malapportionment itself is not statistically significant.

#### **4. Conclusion**

This paper offers a new approach to the study of representation. We take a bottom-up strategy whereby we focus on the representation of a single vote and ask how equal it is to that of others under proportional representation. Our answer is: often not so equal. Some votes, we find, translate to more seats than others. We find a systematic pattern to voter inequality – division of the parliamentary pie is biased in favor of supporters of large parties and right-wing parties in comparison to the electorate. We further demonstrate that districted PR is substantially less egalitarian than PR in a single district and is in fact colored by majoritarianism, especially in those countries where the districting structure relies on many small districts next to a few large ones. Irrespective of the institutional environment of the average (or median) voter, how many voters cast their ballot under semi-majoritarian institutions, indeed how many legislators are elected under semi-majoritarian institutions, affects the bias of the parliamentary pie.

Our analysis carries both normative and positive implications. Normatively, the questions we ask about equality in representation and the answers we provide suggest that districted PR, the most common electoral system in the democratic world, does not deliver as well as common wisdom suggests. Even if representational discrepancies across districts were to cancel out entirely such that no systematic bias for some interests over others would have existed, our analysis challenges the common assumption that representation can be accomplished “on average”. Few voters would be comforted by the thought that although their voice is muted, an anonymous supporter at the other end of the country probably has her own voice amplified.

Our analysis opens the door to new avenues of research in the study of electoral politics. First, on voters’ side, it extends our definition of strategic voting. Traditionally strategic voting explains why voters shun parties whose chances to obtain a seat are not viable. Our analysis suggests a potentially broader consideration. Voters may desert parties whose ability to convert their votes to parliamentary representation is just hindered (Gunther 1989) and prefer those who amplify their voice. In other words, strategic voting may be not only about getting a seat or not but also about getting a smaller or larger fraction of a seat for one’s vote. This is consistent with the regularity of desertion of relatively small parties in small multi-member districts.

That the parliamentary pie under PR is systematically biased in favor of some voters has implications for parties. If seats rather than votes matter to at least some degree, then political consequences of representational inequality are likely to follow not only at the parliamentary but also at the party level. Even though our analysis does not rely on the assumption that parties conduct their strategies according to conversion ratios, one might wonder how the intra-party inequality we observe may affect regional control over party institutions and decision making, policy promoted by parties, and allocation of resources both at the campaign stage and after the elections. Furthermore, these effects may differ by party. Decentralized parties and ones that pursue region-specific policies might be particularly sensitive to intra-party inequality in the representation of its supporters.

Third, our analysis points at the importance of districting under PR. What is often considered to be crucial in the Anglo-American world of FPTP turns out to be no less central under districted PR. The drawing of district boundaries affects minority representation as well as turnout. Additionally, changing magnitudes of districts even if keeping the median (or average) district constant and generating no malapportionment may be politically consequential for the representation of various interests.

Electoral districts are considered an effective democratic instrument that channels local interests into legislative politics. We show that this very same instrument, even under a proportional framework, also compromises a cornerstone of democracy: the equality of the vote. It is the quintessential association between district magnitude and interests of a district community that biases the playfield: within one state, different interests are being channeled by different rules of the game. This puts both a normative question and a professional challenge at the doorstep of institutional designers.

### Appendix A: Districting Structure in Twenty Western Democracies

Country	Election year	Total seats	Avg. DM	Med. DM	Min. DM	Max. DM	No. of districts
Canada	2011	301	1.00	1	1	1	301
New Zealand	1993	99	1.00	1	1	1	99
UK	2010	650	1.00	1	1	1	650
Belgium	2010	150	13.64	15	4	24	11
Denmark	2007	179	11.58	13	2	21	12
Finland	2007	200	13.33	12	1	34	15
Greece	2007	300	5.14	4	1	42	56
Iceland	2009	63	10.50	10.5	10	11	6
Ireland	2011	166	3.86	4	3	5	43
Italy	2008	630	22.50	21	1	44	28
Luxemburg	2009	60	15.00	15	7	23	4
Malta	2008	65	5.00	5	5	5	13
Norway	2009	169	8.89	8	4	17	19
Portugal	2009	230	10.45	6	2	47	22
Spain	2008	350	6.73	5	1	35	52
Sweden	2006	310	10.69	9	2	36	29
Germany	2009	600	600.00	600	600	600	1
Israel	2009	120	120.00	120	120	120	1
the Netherlands	2010	150	150.00	150	150	150	1
New Zealand	1996	120	120.00	120	120	120	1

Note: The table includes sixteen west European democracies plus Canada, Israel and New Zealand grouped by districting structure (SMD, districted PR, PR in a single district). Both Germany and New Zealand '96 are classified as mixed member proportional (MMP) systems (Shugart and Wattenberg 2001). Voters in these systems have two votes, personal and list (proportional) vote. The final allocation of seats in parliament is in proportion to the total share of list votes (overhang seats may apply). We thus consider these cases as single national district with magnitude equals to the final size of parliament.

Appendix B

Table B1: Conversion of Votes to Seats: The Effect of Party Size

Country	Vote-Share	ln(DM)	VS×DM	Constant	N	R <sup>2</sup>
Belgium	<b>3.79</b> (1.51)	0.08 (0.09)	0.19 (0.59)	-0.04 (0.26)	118	0.43
Denmark	<b>10.99</b> (0.33)	<b>0.22</b> (0.01)	<b>-2.36</b> (0.15)	<b>-0.50</b> (0.02)	97	0.71
Finland	<b>2.08</b> (0.93)	0.05 (0.08)	0.61 (0.33)	0.11 (0.24)	135	0.40
Greece	<b>2.83</b> (0.18)	<b>0.17</b> (0.03)	-0.24 (0.13)	<b>-0.14</b> (0.03)	558	0.42
Iceland	<b>66.93</b> (12.49)	<b>1.96</b> (0.67)	<b>-28.45</b> (5.64)	<b>-4.22</b> (1.49)	42	0.74
Ireland	<b>4.50</b> (1.37)	0.31 (0.15)	-0.44 (1.08)	-0.38 (0.20)	299	0.40
Italy	<b>4.30</b> (0.39)	<b>0.10</b> (0.02)	<b>-0.41</b> (0.12)	<b>-0.16</b> (0.06)	396	0.45
Luxemburg	<b>11.69</b> (0.92)	-0.14 (0.04)	<b>-3.02</b> (0.43)	<b>0.75</b> (0.13)	30	0.48
Norway	<b>7.90</b> (1.76)	0.11 (0.05)	<b>-2.02</b> (0.74)	0.02 (0.12)	221	0.29
Portugal	<b>8.22</b> (2.62)	<b>0.14</b> (0.04)	-1.89 (1.05)	<b>-0.30</b> (0.11)	271	0.58
Spain	<b>5.46</b> (0.36)	<b>0.15</b> (0.06)	<b>-1.47</b> (0.22)	<b>-0.22</b> (0.05)	279	0.52
Sweden	<b>5.87</b> (0.94)	<b>0.44</b> (0.11)	<b>-1.68</b> (0.42)	-0.48 (0.25)	261	0.17
Pooled	<b>4.20</b> (0.84)	<b>0.11</b> (0.02)	-0.46 (0.33)	-0.06 (0.05)	2707	0.39

Note: Dependent variable: CR, the conversion ratio of votes to seats. Explanatory variables are party vote-share in a district, (logged) district magnitude, and their interaction (VS×DM). Excluded are eight countries with no variation in district magnitude. In Bold p-value <0.05. Standard errors are clustered by district. The pooled model includes country fixed effects and clustered standard errors by district.

## B2: Conversion of Votes to Seats: The Effect of Party Ideology

Country	Party LR	ln(DM)	LR×DM	Constant	N	R <sup>2</sup>
Belgium	0.03 (0.07)	0.17 (0.20)	-0.01 (0.02)	0.57 (0.55)	63	0.02
Denmark	<b>0.06</b> (0.01)	0.11 (0.06)	<b>-0.01</b> (0.01)	0.11 (0.10)	80	0.06
Finland	0.02 (0.05)	0.25 (0.24)	-0.01 (0.02)	0.23 (0.60)	102	0.01
Greece	<b>0.18</b> (0.02)	<b>0.88</b> (0.16)	<b>-0.07</b> (0.01)	<b>-1.36</b> (0.22)	224	0.35
Iceland	-0.18 (0.23)	<b>-4.48</b> (1.44)	0.08 (0.10)	<b>10.91</b> (3.16)	30	0.18
Ireland	-0.05 (0.08)	-0.54 (0.58)	0.09 (0.06)	0.80 (0.80)	210	0.10
Luxemburg	<b>0.30</b> (0.03)	0.25 (0.14)	<b>-0.09</b> (0.02)	-0.09 (0.31)	24	0.44
Norway	0.16 (0.10)	0.65 (0.46)	-0.07 (0.04)	-0.57 (1.10)	133	0.02
Portugal	<b>0.12</b> (0.05)	<b>0.30</b> (0.09)	-0.03 (0.02)	-0.22 (0.23)	110	0.08
Spain	<b>0.22</b> (0.03)	<b>0.42</b> (0.18)	<b>-0.08</b> (0.02)	-0.60 (0.34)	151	0.51
Sweden	<b>0.09</b> (0.03)	<b>0.70</b> (0.18)	<b>-0.03</b> (0.01)	-0.75 (0.43)	203	0.10
Pooled	<b>0.15</b> (0.01)	<b>0.60</b> (0.06)	<b>-0.05</b> (0.01)	<b>-0.77</b> (0.12)	1330	0.13

Note: Dependent variable: CR, the conversion ratio of votes to seats. Explanatory variables are party ideology placement (Party LR), (logged) district magnitude, and an interaction term (LR×DM). Excluded are eight countries with no variation in district magnitude as well as Italy which lacked data on party ideology on the relevant election year. In bold p-value <0.05. Standard errors are clustered by districts. The pooled model includes country fixed effects and clustered standard errors by districts.

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**Table 1: Voter Inequality and District Magnitude**

Country	ln(DM)	SE	N	R <sup>2</sup>
Belgium	<b>-0.16</b>	(0.06)	118	0.05
Denmark	<b>-0.31</b>	(0.03)	97	0.18
Finland	<b>-0.24</b>	(0.04)	135	0.07
Greece	<b>-0.09</b>	(0.02)	558	0.04
Iceland	-1.70	(0.70)	42	0.08
Ireland	<b>-0.24</b>	(0.07)	299	0.02
Italy	<b>-0.08</b>	(0.01)	396	0.02
Luxemburg	<b>-0.59</b>	(0.14)	30	0.37
Norway	<b>-0.31</b>	(0.07)	221	0.07
Portugal	<b>-0.19</b>	(0.06)	271	0.06
Spain	<b>-0.24</b>	(0.04)	279	0.07
Sweden	<b>-0.25</b>	(0.03)	261	0.10
Pooled	<b>-0.16</b>	(0.02)	2707	0.06

Note: Dependent variable:  $\text{abs}(1-\text{CR})$ , the absolute difference from perfect conversion of votes to seats. Explanatory variable is (logged) district magnitude. Excluded are eight countries with no variation in district magnitude. In bold  $p\text{-value} < 0.05$ . Standard errors are clustered by districts. The pooled model includes country fixed effects and clustered standard errors by districts (see robustness checks subsection for additional estimations).

**Table 2: Representational Inequality: the Effect of Districting Structure**

Model	% legislators elected in districts <7, 5, 3		Central DM	STV	Electoral formula (Lijphart)	Constant	R <sup>2</sup>
			<b>avg. DM</b>				
<b>1</b>			<b>-0.07</b> (0.02)	-0.07 (0.08)	0.03 (0.03)	<b>0.35</b> (0.10)	0.72
<b>2</b>	%<7	<b>0.36</b> (0.09)	<b>-0.03</b> (0.02)	<b>-0.32</b> (0.08)	-0.02 (0.02)	<b>0.28</b> (0.07)	0.87
<b>3</b>	%<5	<b>0.38</b> (0.03)	<b>-0.04</b> (0.01)	<b>-0.10</b> (0.03)	<b>-0.03</b> (0.01)	<b>0.32</b> (0.03)	0.97
<b>4</b>	%<3	<b>0.34</b> (0.06)	<b>-0.05</b> (0.01)	-0.01 (0.05)	-0.02 (0.02)	<b>0.35</b> (0.05)	0.91
			<b>med. DM</b>				
<b>5</b>			<b>-0.07</b> (0.02)	-0.08 (0.08)	0.03 (0.03)	<b>0.36</b> (0.10)	0.72
<b>6</b>	%<7	<b>0.36</b> (0.09)	<b>-0.03</b> (0.02)	<b>-0.32</b> (0.08)	-0.02 (0.02)	<b>0.28</b> (0.07)	0.86
<b>7</b>	%<5	<b>0.38</b> (0.03)	<b>-0.04</b> (0.01)	<b>-0.11</b> (0.03)	<b>-0.03</b> (0.01)	<b>0.32</b> (0.03)	0.97
<b>8</b>	%<3	<b>0.34</b> (0.06)	<b>-0.05</b> (0.01)	-0.01 (0.05)	-0.03 (0.02)	<b>0.36</b> (0.06)	0.91
			<b>med. leg.</b>				
<b>9</b>			<b>-0.08</b> (0.02)	<b>-0.10</b> (0.07)	0.02 (0.07)	<b>0.41</b> (0.09)	0.77
<b>10</b>	%<7	<b>0.32</b> (0.09)	<b>-0.04</b> (0.02)	<b>-0.31</b> (0.08)	-0.02 (0.02)	<b>0.31</b> (0.07)	0.88
<b>11</b>	%<5	<b>0.36</b> (0.03)	<b>-0.04</b> (0.01)	<b>-0.11</b> (0.03)	<b>-0.03</b> (0.01)	<b>0.34</b> (0.03)	0.97
<b>12</b>	%<3	<b>0.31</b> (0.06)	<b>-0.05</b> (0.01)	-0.02 (0.05)	-0.02 (0.02)	<b>0.37</b> (0.06)	0.91

Note: Dependent variable: RI. Data is at the national level. In bold p-value <0.05. Standard errors in parentheses. avg. DM is the average district magnitude and med. DM is the median district magnitude. med. leg is the district magnitude of the median legislator in parliament (Amorim Neto and Cox 1997). STV is a control for electoral systems with Single Transferable Vote (Ireland and Malta). Electoral formula is an ordinal index of electoral formulas based on Lijphart 1990. Robustness checks are reported in the robustness subsection.

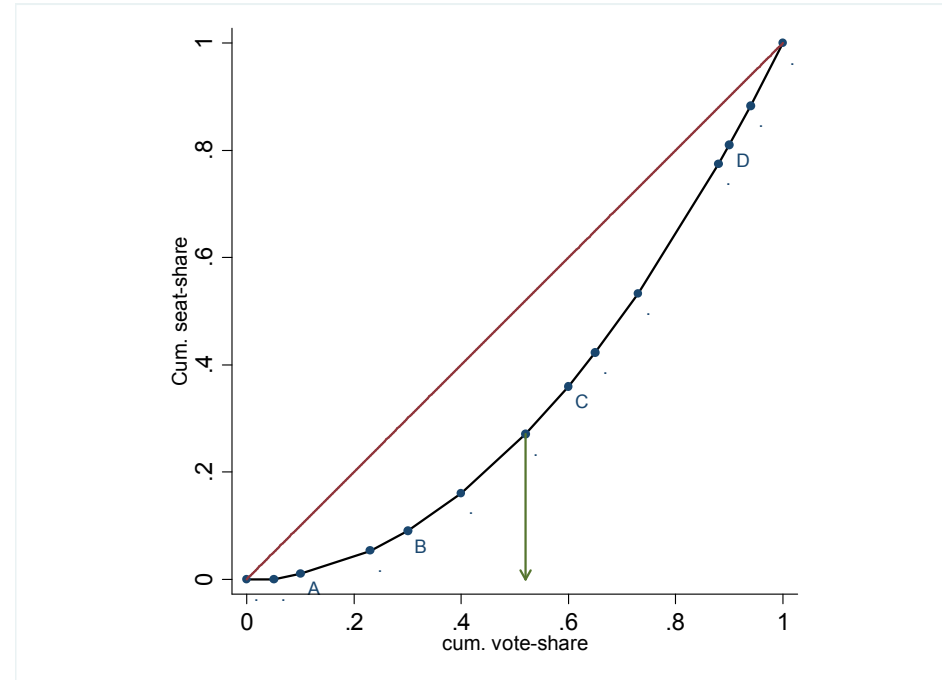
Figure 1. Voter (In)equality in Two Contexts

	$p_1$	$p_2$	...	$p_K$	Total
$d^1$	Anne	Bob			
$d^2$	Cindy	David			
:					
$d^N$					
Total					V,S

**A**

	$p_1$	$p_2$	...	$p_K$	Total
$d^1$	$v_{1,S_1}^1$	$v_{2,S_2}^1$			
$d^2$	$v_{1,S_1}^2$	$v_{2,S_2}^2$			
:					
$d^N$					
Total					V,S

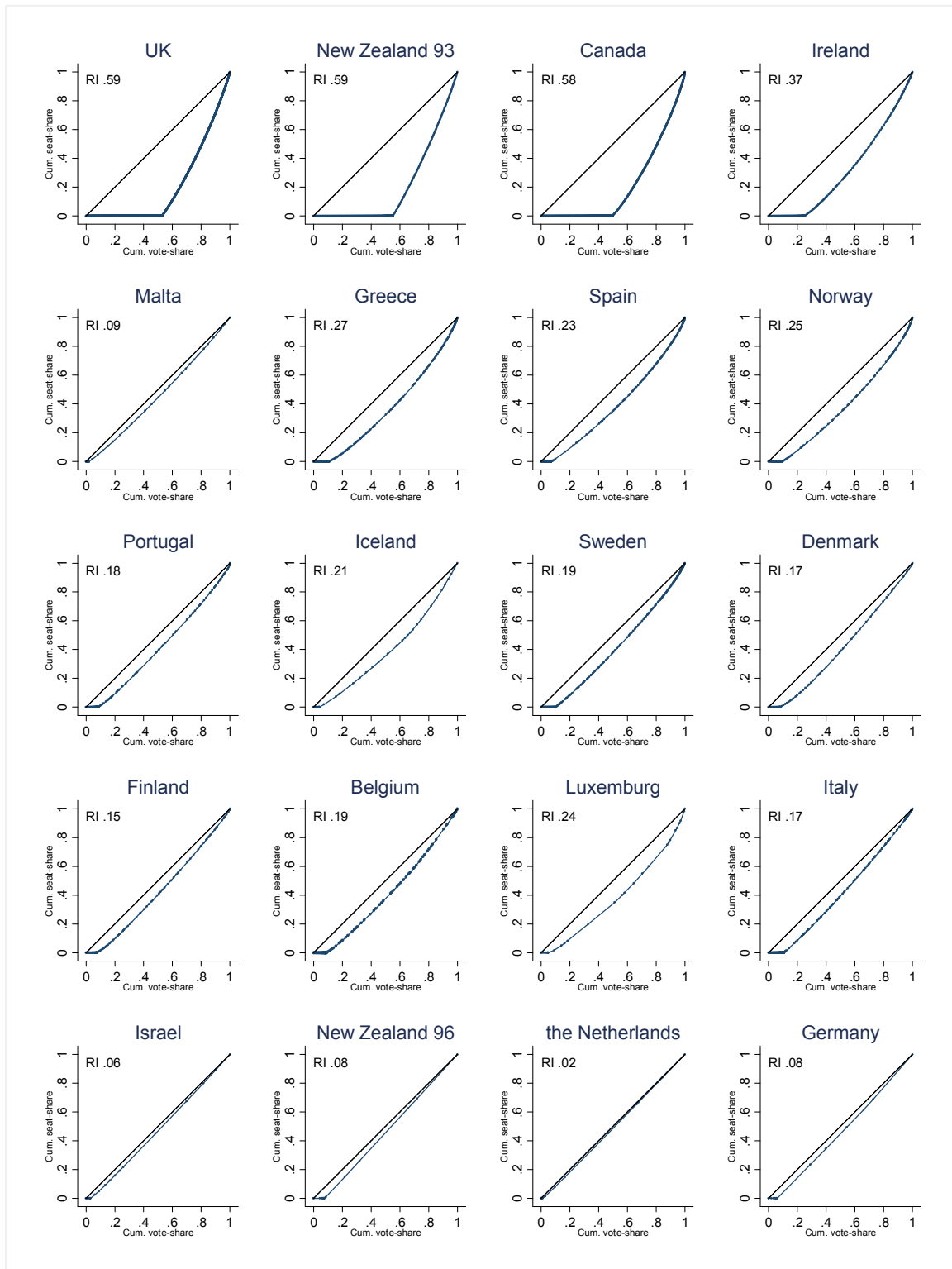
**B**



**C**

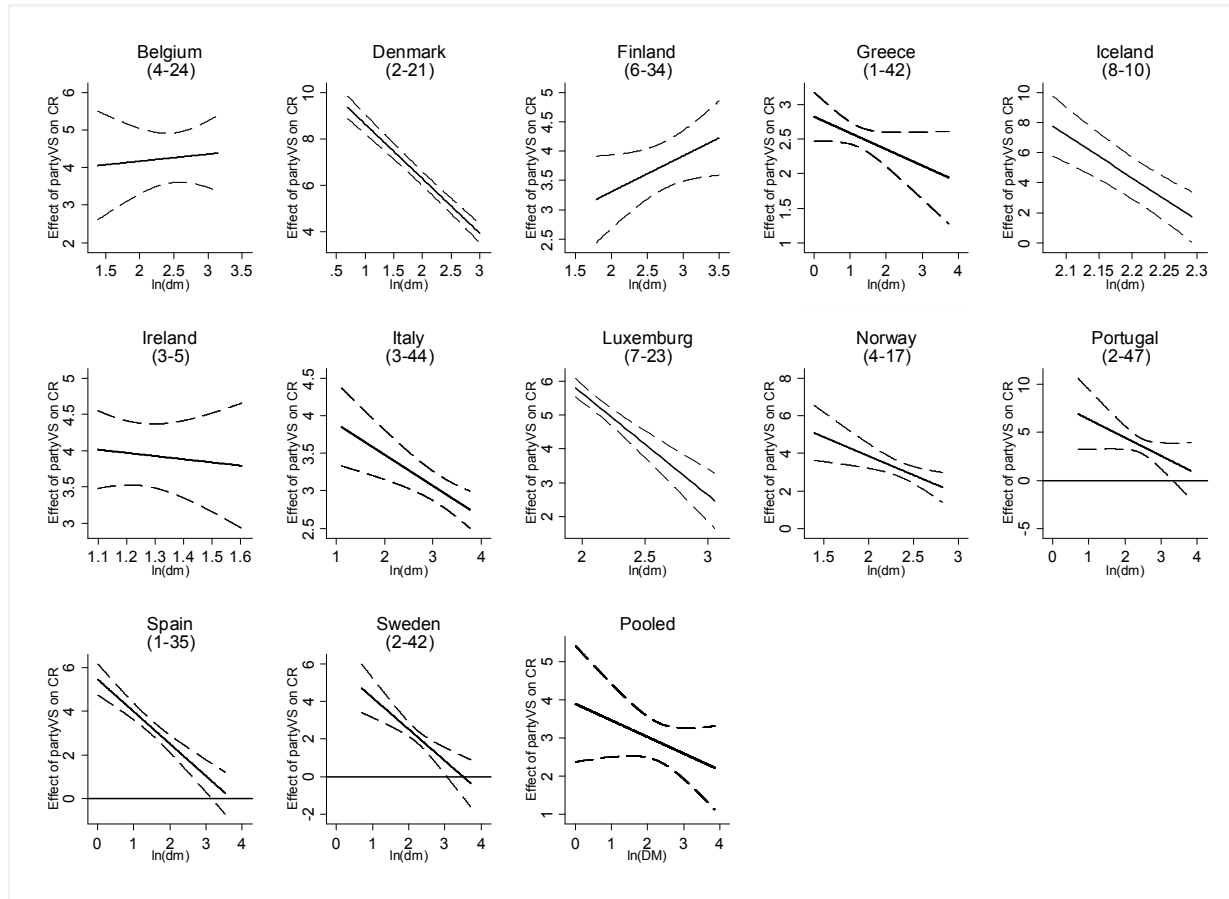
Note: The setup (panels A and B): voters cast  $V$  votes in total, electing representatives for an  $S$  seats parliament.  $K$  parties ( $j=1, \dots, K$ ) compete in  $N$  districts ( $i=1, \dots, N$ ). Panel C: on the axes are cumulative vote-share against cumulative seat-share. The downward arrow notes the position (cumulative vote-share) where the inequality curve dips the most and  $CR=1$  (hence votes of voters left of it are underconverted to seats and of those to its right are overconverted).

**Figure 2. Representational Inequality in Twenty Democracies**



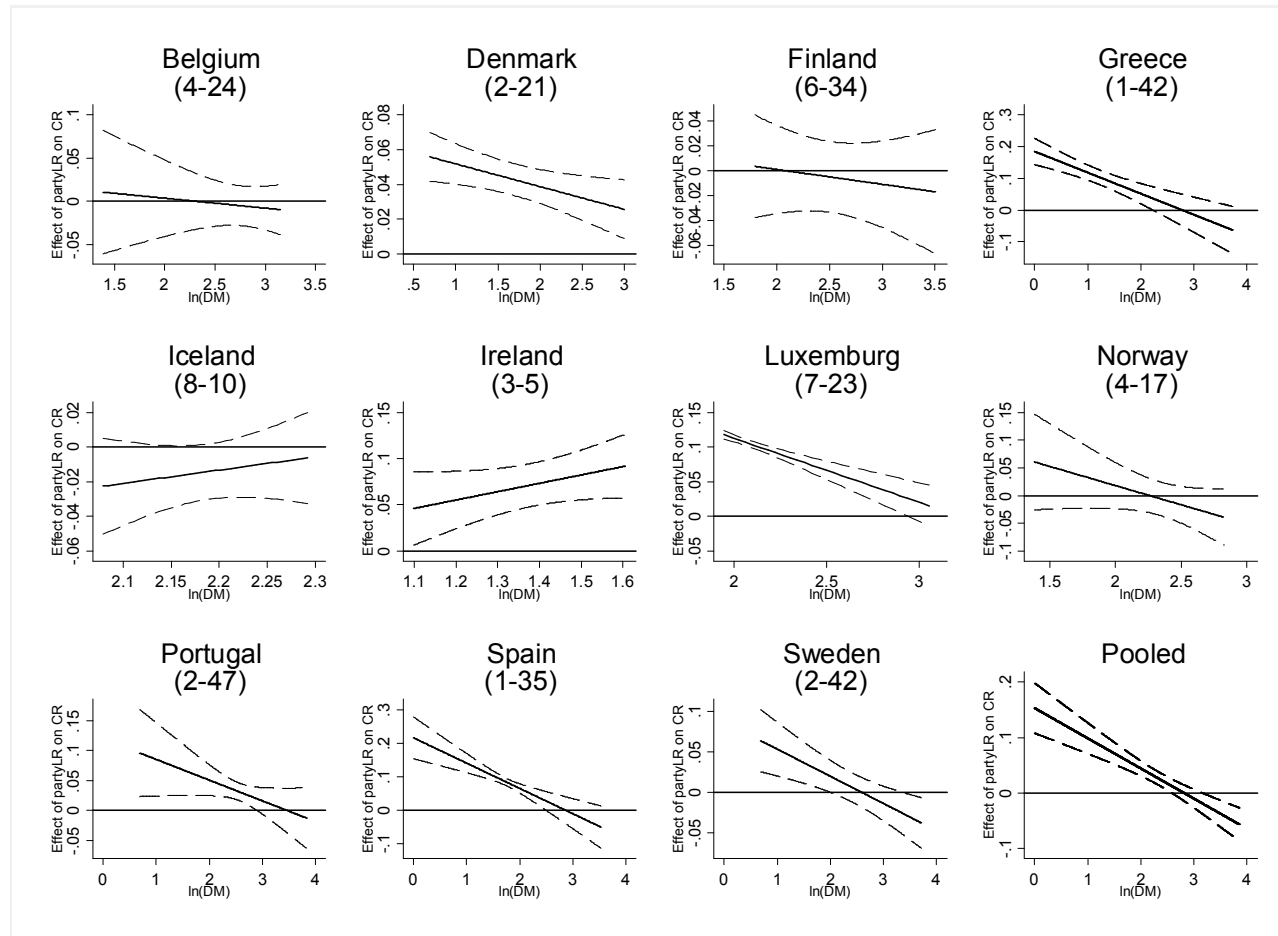
Note: The figure presents representational inequality curves for the twenty election/years in our analysis. At the top left corner is the Representational Inequality index (RI) for each election. Countries are organized by ascending order of average district magnitude (see Table A1 for details).

**Figure 3. Conversion of Votes to Seats: The Effect of Party Size**



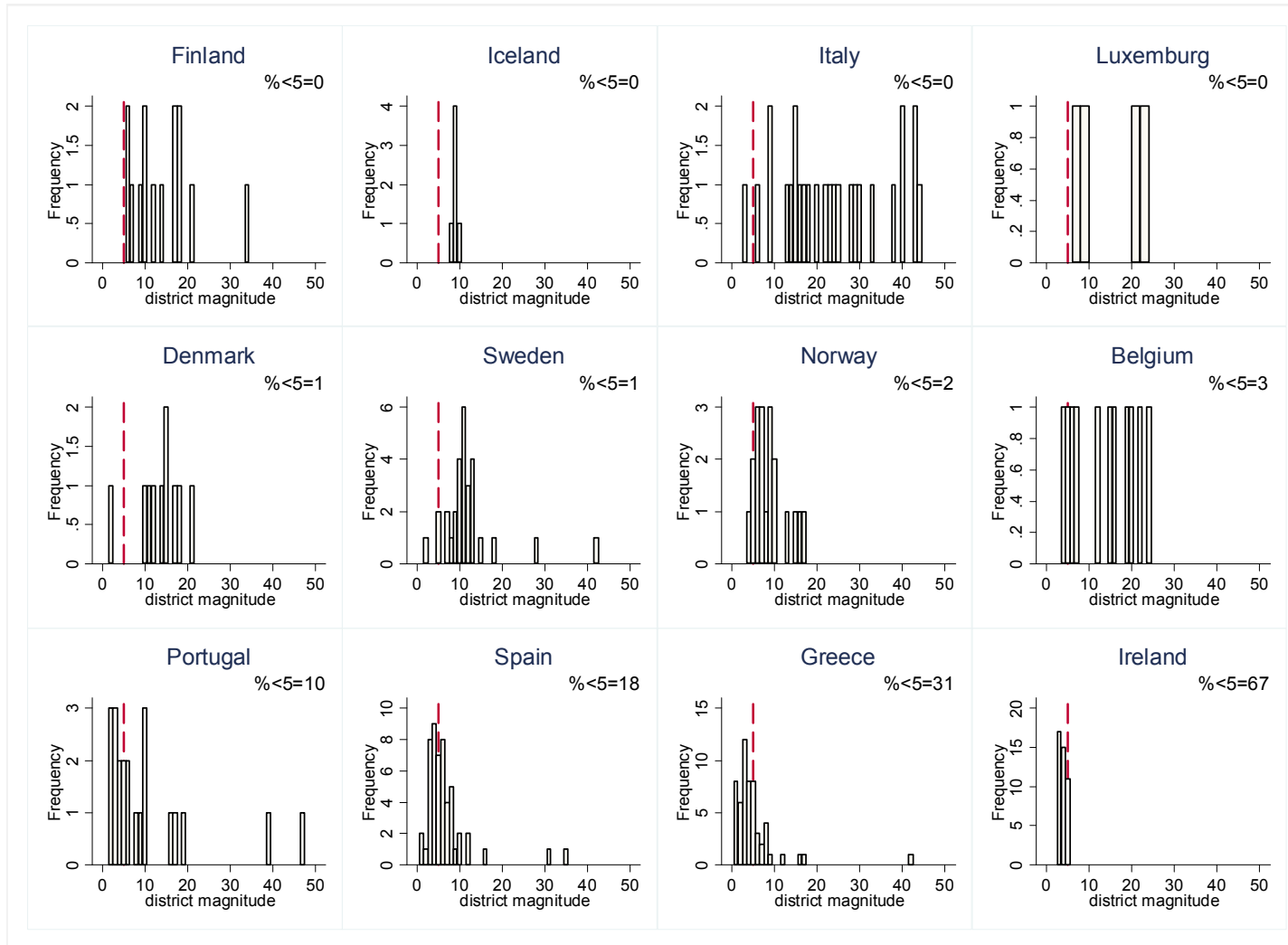
Note: minimum and maximum district magnitudes are reported under country names. The line represents the marginal effect of party vote share on CR, modified by district magnitude. 95% confidence intervals are marked. Standard errors are clustered by districts. The pooled model includes country fixed effects and clustered standard errors by districts. Estimation results are reported in Table B1. See robustness checks subsection for additional estimations.

**Figure 4. Conversion of Votes to Seats: The Effect of Party Ideology**



Note: minimum and maximum district magnitudes are reported under country names. The line represents the marginal effect of party ideological placement on CR modified by district magnitude. 95% confidence intervals are marked. Standard errors are clustered by districts. The pooled model includes country fixed effects and clustered standard errors by districts. Estimation results are reported in Table B2. See robustness checks subsection for additional estimations.

**Figure 5. Distributions of District Magnitudes under Districted PR**



Note: The figure presents histograms of districts magnitudes in twelve west European districted PR systems. The dashed line marks district magnitude of five. On the upper right corner is the percentage of seats in parliament elected in districts smaller than five.



