Electoral Systems and Geographic Representation[1]

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Abstract

The degree to which political elites reflect their electorates in terms of e.g. gender, race, and class has been shown to be consequential for policy outcomes and strongly influenced by the electoral institutions that determine their selection. This paper examines an understudied dimension of descriptive representation – the extent to which lawmakers' geographical extraction maps onto the spatial distribution of voters – and investigate how it relates to the way legislators are elected. Using birthplace data for over 13,000 legislators in 62 democracies, we develop a novel 'Spatial Un-Representativeness of Legislatures Index' (SURLI), and regress it onto a series of electoral system variables. Contrary to received wisdom, we find that single-member district systems do not yield more geographically representative parliaments than multi-member district systems, while mixed-member systems perform significantly better than both. We also find tentative evidence that electoral rules allowing preferential voting improve spatial representativeness of legislatures. We attribute the overperformance of mixed-member systems to 'contamination' effects in their single-member tier, and present evidence for this explanation from a paired comparison of district- and legislator-level data in two case studies: the UK and Germany's single-member tier.

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1 Introduction

One of the key insights of the literature on political elites is that compositional differences in the demographic makeup of representatives and that of their voters have important consequences for the quality of democratic representation (Bratton and Ray, 2002; Preuhs, 2005; Carnes, 2012). While comparative scholarship in this field has made substantial advances in mapping representational gaps along the dimensions of gender, race and class origins, this paper aims to investigate *to what extent legislatures around the world reflect the geographic diversity of the voters they represent.* We do so by developing and computing a comparable measure of inequalities in the descriptive representation of *places* in parliaments, the Spatial Un-Representativeness of Legislatures Index (SURLI). Alongside this descriptive exercise, we theorise and investigate how electoral systems may explain cross-country variation on this variable, drawing on the common finding in the descriptive representation literature that different electoral institutions produce distinct opportunities for social groups to access political offices.

Our theoretical starting point is the tension in the incentives structure to select a representative political elite that stems from the divergent preferences of two gatekeepers of the process of elite selection: parties and voters. On the one hand, because of social inequalities in access to political office and due to the distinctive demographics of party memberships, parties are presented with an unrepresentative pool of aspirants, and indeed may actively prefer to recruit a certain *type* of candidate – usually, educated individuals from professional backgrounds with previous experience within party structures (Verba, Schlozman and Brady, 1995; Godmer and Gaxie, 2007; Bovens and Wille, 2017). As social traits almost inevitably map onto spatial inequalities – with some places being wealthier, more educated and closer to the institutional seats of power – we may thus expect that, if it were left entirely to their choice, parties would select not only a demographically unrepresentative pool of candidates, but also a *geographically* unrepresentative political elite.

On the other hand, scholars of political behaviour have found that voters consistently use candidates' *localness* as a heuristic shortcut to assess congruence with their own interests and views, rewarding electorally those with proven local ties over outsiders (Shugart, Valdini and Suominen, 2005). There is evidence that localness is a remarkable 'personal vote-earner at-

tribute' (PVEA): for instance, a conjoint survey experiment conducted in the UK found that "the impact of whether a candidate was local or not was *fifteen times* that of biological sex" (Campbell and Cowley, 2014, p. 758). This aspect of voter behaviour can be hypothesised to promote geographic representativeness in legislatures via two causal pathways: indirectly – by influencing the candidate selection choices that office-seeking parties make – and directly – by swaying voters' choices, and thus electoral outcomes. The indirect mechanism refers to how such 'localness premium' yields incentives for parties to select a geographically representative slew of candidates, so as to reap the electoral bonus of individual candidates' 'personal vote' in a larger number of places (Pedersen, Kjaer and Eliassen, 2007). Additionally, the direct mechanism implies that voters will punish parties when they fail to present them with a local choice, giving a higher share of the vote to the local alternative, if available (Put, Smulders and Maddens, 2019) – indeed, in the extreme case where voters only make their decision on the basis of localness, each locale will vote for the closest candidate available, yielding a legislature that approaches perfect geographic representation.

In exploring this dimension of descriptive representation, which has remained somewhat overlooked and undertheorised, we endeavour to make two contributions to the literature on elite traits. The first concerns measurement: we derive what is – to our knowledge – the first Spatial Un-Representativeness of Legislatures Index (SURLI) that is comparable across countries, using birthplace data available for 13,808 members of parliaments (MPs) in 62 democratic countries as a proxy for legislators' geographical ties. In brief, our strategy starts of with measuring the discrepancy between two spatial distributions: the distribution of where legislators are from, and the distribution of the 'target' population they should be representative of. We then repeat this calculation for a large number of random draws of MPs from the population. Finally, SURLI is computed as the number of standard deviations separating the 'real' value of spatial discrepancy and the mean spatial discrepancy in the set of 'fictitious' legislatures drawn at random from the distribution of the target population. The second contribution consists in investigating the effects of electoral institutions on this variable, under the assumption that outcomes of interactions between actors with conflicting preferences are at least in part determined by the 'rules of the game' under which these interactions take place. In view of the

countervailing incentives produced by parties' and voters' different preferences over prospective office-holders, we hypothesise that the degree of geographical representativeness of legislatures will be associated with the extent to which such incentives are magnified or suppressed by electoral institutions. We consider three sources of variation due to cross-country differences in institutional set-ups: electoral formula, ballot structure and district magnitude.

The paper is structured as follows. In section 2 we locate our work in the context of existing scholarly works on political geography, electoral behaviour and descriptive representation. In section 3 we discuss theoretically the possible channels through which features of electoral systems might influence how places are represented in a legislature. Section 4 tests the deriving theoretical expectations on a cross-country sample and presents this paper's main empirical contribution: the measurement of SURLI for 62 legislatures, and the results of a cross-country regression that describes how it varies across electoral systems. We build on the these findings to further probe whether the results of the cross-country regression are corroborated by district-level data analysis with a paired comparison of two case studies – the UK and Germany's single-member tier – discussed in section 5. Section 6 concludes by discussing briefly the normative implications of the study, its limitations, and further avenues for this research agenda.

2 Related literature

Early democratic theorists were extremely worried about the 'problem of space' (Minicucci, 2001): how large representative democracies could aggregate disparate interests of communities located far apart, avoiding risks of secession or domination of one subunit over the other. Indeed, the territorial segmentation of the electorate in constituencies was often justified explicitly on the grounds that it would improve the quality of representation via the *localness* of candidates (Rehfeld, 2005). For instance, Montesquieu in *The Spirit of Laws* highlights the advantages of local deliberation for selecting representatives:

> One knows the needs of one's own town better than those of other towns, and one judges the ability of one's neighbors better than that of one's other compatriots. Therefore, members of the legislative body must not be drawn from the body of the

> nation at large; it is proper for the inhabitants of each principal town to choose a representative from it. (De Montesquieu, 1989, p. 159)

In a similar vein, Alexander Hamilton in *Federalist 36* touches on how representatives' local ties and knowledge enhance the responsiveness of the centre to the peripheries' needs, thus improving democratic outputs:

> If any question is depending in a State legislature respecting one of the counties, which demands a knowledge of local details, how is it acquired? No doubt from the information of the members of the county. Cannot the like knowledge be obtained in the national legislature from the representatives of each State? (Hamilton, Madison and Jay, 2008, p. 169)

Even as national parties have emerged and cleavages based on class and religion have become more salient, the notions of *democratic* and *territorial* representation have remained tightly linked in the electoral institutions of modern states. Non-geographical ways of dividing voters into distinct constituencies (such as the class franchises in 19th-century Prussia and Austria or Zimbabwe's 'white rolls') have always been rare and are almost unheard of in contemporary democracies.[2] Apart from a few countries including Israel and the Netherlands, geographically-disjoint electoral districts remain basic building blocks in every national electoral system. Thus we can still say, with Rehfeld (2005, p. 3), that "in almost every democracy in the world, citizens are represented by where they live."

Correspondingly, *localness* continues to be an important prism through which voters evaluate candidates, as well as an electoral resource that candidates can count on in places where they have built long-standing personal and political networks. The electoral bonus candidates receive in 'their own beat' was famously described by Key (1949, p. 38) in *Southern Politics*:

> A candidate for governor normally carries his own county by a huge majority, and the harshest criticism that can be made of a politician is that he cannot win in his own beat or precinct. If his friends and neighbors who know him do not support him, why should those without this advantage trust a candidate?

[2] Hong Kong's 'functional constituencies' are a notable exception.

There is substantial scholarly agreement that candidates receive an electoral boost in places to which they have personal ties. Evidence in this direction abounds, from spatial ecological studies (Rice and Macht, 1987; Garand, 1988; Gimpel et al., 2008), experimental studies (Campbell and Cowley, 2014; Roy and Alcantara, 2015; Panagopoulos, Leighley and Hamel, 2017), and voter-level survey data (Johnson and Rosenblatt, 2006; Arzheimer and Evans, 2012, 2014; Evans et al., 2017). Moreover, the finding replicates in a variety of contexts: from the original testing grounds of the hypothesis in the United States (Rice and Macht, 1987; Garand, 1988; Gimpel et al., 2008) and Ireland (Gallagher, 1980; Marsh, 2007; Górecki and Marsh, 2012) to polities as diverse as Britain (Arzheimer and Evans, 2012, 2014; Evans et al., 2017), Japan (Horiuchi, Smith and Yamamoto, 2018), Canada (Roy and Alcantara, 2015; Blais and Daoust, 2017), Estonia (Tavits, 2010) and Norway (Fiva, Halse and Smith, 2018).

In contemporary scholarship, this effect is generally disaggregated into a *behavioral* and a textitperceptual component (Evans et al., 2017). The behavioral component refers to greater ability of candidates to mobilize supporters in their immediate social networks, including those who live in the immediate surroundings of the candidate's place of residence (Górecki and Marsh, 2012). The perceptual component describes how localness serves as a heuristic for candidate desirability in voters' considerations: in low-information environments, someone from 'around here' can be more easily assumed to have the community's interests at heart than a 'parachuter' or a 'carpetbagger' (Campbell and Cowley, 2014). In this sense, the micro-foundational mechanism is a form of in-group bias (Panagopoulos, Leighley and Hamel, 2017, pp. 867-868). Candidates are aware of this, and go to great lengths to cue their local credentials to voters. For instance, in a particularly striking example from the 2017 UK General Election, the Green Party candidate in Brent Central distributed campaign literature stating "I am a life long Brent resident, conceived in Harlesden, born in Kilburn, grew up in Queens Park and now reside Willesden" (Milazzo and Townsley, 2018, p. 10).

Do politicians with local ties to a certain locale make for 'better' representatives for that area? The evidence is mixed. Carozzi and Repetto (2016) find evidence of pork-barrel spending driven by legislators born *outside* of their district in favor of their municipality of birth: variation in birthplace composition of the Italian parliament (1994-2004) induced by parliamentary

turnover correlates with increases in state transfers to newcomer MPs' birthplace municipalities. Jennes and Persyn(2015, p 189) find that between 1995 and 2010 "per capita cash transfers to a Belgian electoral district are significantly higher for every federal minister originating from that electoral district", using an instrumental variable design that exploits exogenous ministerial changes and redistricting. But there are also null effects in the empirical literature. For instance, Fiva, Halse and Smith (2018) employ a regression discontinuity design, exploiting as-good-as-random close elections of Norwegian MPs (1953–2013), and find that marginally elected local representatives do *not* increase the level of state investment, road funding per resident or government employment in their hometown in the eight years following the election. Evidence in the same direction is provided by Fabre and Sangnier (2017), who find that municipalities where a French minister served in prior political offices receive an increased amount of discretionary investment during the time the minister is in office, but municipalities from where the minister originates do not. Finally, Sällberg and Hansen (2019) analyse constituency mentions in parliamentary debates over the 2015/2016 UK House of Commons parliamentary session and find that localness was unrelated to the number of constituency mentions. Hence – as with other aspects of the 'politics of presence' (Preuhs, 2005) – the literature suggests that descriptive representation does not automatically translate into policy representation, but rather the relationship can be contextual and contingent on institutional factors.

Furthermore, this paper draws on comparative work on the relationship between electoral institutions and descriptive representation in legislatures. In this literature, proportional representation is often found to be conducive to demographically more balanced legislative assemblies. For instance, as far as the gender gap in political representation is concerned, "one of the most stable results in empirical research is that the election of women is favored by electoral systems with party lists, proportional representation (PR), and large district magnitudes" (Wängnerud, 2009, p. 54). PR systems seem to be also more inclusive of younger members of parliament (Joshi, 2013) and to improve *policy* representation of low-income citizens (Carnes and Lupu, 2015). Existing evidence on the effect of electoral systems on ethnic minority representation (Kostadinova, 2007; Moser, 2008; Wagner, 2014) is less clear-cut. Cross-national findings on electoral systems and the descriptive representation of *places* is scarce, not least due to the

absence of comparable spatial measures of representational inequalities. Pedersen, Kjaer and Eliassen (2007) analysed *parachutage* – defined as the share of MPs residing outside the district at the time of election – in sixteen Western European countries, finding no clear association with electoral institutions. Perhaps the most influential work in this area is theoretical: Matthew Shugart and colleagues developed a series of models to derive candidates' incentive to seek a personal vote – and thus the likelihood of representatives being local – as a function of, among other factors, electoral rules. Their work suggests that the probability of a representative being local declines with district magnitude in closed-list PR, but increases with district magnitude in open-list PR systems (Shugart, Valdini and Suominen, 2005; Carey and Shugart, 1995). André, Depauw and Shugart (2014) tested these hypotheses in three open-list PR countries (Finland, Luxembourg, Switzerland) and three closed-list PR (Spain, Portugal, Norway), and confirmed that the share of representatives who had held previous local office in the district varies as predicted.

3 Theory

How might electoral institutions affect geographical representation? Our theoretical starting point is that voters and parties have different preferences over the geographic extraction of legislators. The former would prefer, *ceteris paribus*, legislators from their local areas; the latter are biased towards certain parts of the country due to the unequal distribution of 'political credentials' such as wealth, education, and closeness to the nodes of political power. Hence, if voters had their way, each sufficiently large territorial unit would express one 'local' legislator, yielding a roughly balanced spatial representation in the legislature.[3] If parties had their way, the resulting legislature would reflect the extent and direction of their aggregate biases. It follows that the *probability that a territorial unit expresses a local representative* is a key variable in determining where a legislature falls on the continuum comprised between voters' preference for a spatially representative selection of MPs and parties' preference for a spatially biased one. As

[3]Specifically, territorial units would need to have a number of voters N_u that satisfies $N_u \geq \frac{N}{S}$, where N is the total number of voters in the country and S is assembly size. Note that this coincides with electoral constituencies in fully- single member district systems, net of malapportionment. We use 'territorial unit' in this sense as each of the smallest possible, spatially compact subdivisions of the country sufficient to elect one legislator.

we will see, features of electoral systems can be expected to alter the value of this variable for territorial units participating in elections under different rules.

In this section we outline theoretical expectations that apply to territorial units in three different types of *constituency structure* (Reeve and Ware, 2013, pp. 64-68): single-member, multi-member and mixed-member districts. Specifically with regards to multi-member districts, we also make some further considerations on the potential effect on patterns of spatial representation of two other features of electoral systems: *district magnitude* and *ballot structure*. We assess electoral systems on the basis of two criteria which we posit should increase the probability of a territorial unit being represented by local representatives in parliament. The first is the extent to which electoral institutions produce incentives for viable seat-winning parties to field candidates who are geographically representative of their district (*party incentives*). As discussed, we assume that parties, as well as seeking to maximise their parliamentary representation, also have preferences over prospective candidates' political credentials: *at least for some territorial units*, a party would prefer to 'parachute' a non-local (say, because they are a long-time party worker, or because they appear more 'qualified') if it comes with no or little risk of electoral damage.[4] The second criterion concerns the extent to which electoral institutions allow voters to express a meaningful preference for local candidates over non-local ones (*voter leverage*). For *voter leverage* to be meaningful, voters should have ways to enforce their bias for locals in a way that is (1) independent of parties' own preferences over their own pool of candidates, and (2) potentially consequential for electoral outcomes. The criteria of *party incentives* and *voter leverage*, in this order, are logically sequential: obviously, if viable parties have no incentives to field local candidates, voters' 'hypothetical' ability to express a preference for local candidates is of limited value if that option is either unavailable or unviable.

We think of the role of localness in shaping election outcomes as a 'second-order' consideration of voters relative to partisanship. Voters have – to different extent – partisan preferences and preferences over candidates' geographic extraction, but the former normally carry more weight in their decisions at the ballot box. A useful simplification for our theoretical discus-

[4]This phenomenon is not uncommon. To take two prominent examples from single-member district systems, Winston Churchill represented five constituencies to which he had essentially no prior connection with, and Hillary Clinton was elected to the U.S. Senate for New York in 2000 despite never having lived there.

sion is to recast the complex interaction of 'party' and 'candidate' evaluations in terms of a discrete distinction between voter types: i.e. we posit that voters are either entirely 'partisan' or entirely 'localist'. That is, while most voters will prioritise their party preference over their preferences over candidates' geographic extraction when casting a ballot, there is a subset of the electorate will vote for a local over a non-local regardless of party affiliation, while being indifferent between two locals (or two non-locals).[5] This 'localist' vote can be thought of in terms of nonpartisans who can be swayed one way or the other only by candidates' local ties (the 'friends and neighbours' effect) rather than policy appeals. The rest of the electorate will choose a local candidate over a non-local one *of the same party* if given the chance by electoral rules, but their first-order preference is over parties rather over individual candidates. In electoral systems where votes are pooled by party – e.g. list PR – we may further assume that 'localist' voters break across party lists proportionally to the share of local candidates in each party's slate, as the chance of one of these voters being 'reached' via local ties should increase proportionally to the number of local candidates each party fields.[6]

3.1 Single-member Districts Systems

Single-member districts are often thought to foster normative expectations of a close relationship between legislators and the districts they represent: the smaller the constituency a legislator is directly accountable to, the more visible and accessible she will be to voters (Wessels, 1999). The particularistic nature of the electoral linkage in single-member districts can therefore be expected to favour a higher degree of candidate recognition and stronger personalisation of electoral competition relative to larger, multi-member constituencies (Curtice and Shively, 2009; Cain, Ferejohn and Fiorina, 2013). It follows that personal vote-earning attributes like localness should carry significant weight in the considerations voters make in single-member district elections. In other words, the visibility of individual candidates relative to their 'party brand' should increase as the district magnitude – and therefore the optimal number of candidates per party – decreases to one. Due to this higher visibility of individual electoral competitors,

[5] We are also assuming at this point that localness is the only candidate trait voters consider.

[6] For instance, if Party A fields a list with 50% locals and 50% non-locals, while Party B fields a list with all locals, Party A will receive $\frac{0.5}{0.5+1} = \frac{1}{3}$ of the 'localist' vote.

therefore, the share of voters that can be swayed by candidate localness – our 'localists' – can correspondingly be expected to increase. This would suggest, *prima facie*, high incentives for parties to field local candidates in single-member districts: if there is a larger expected electoral gain to selecting locals in highly personalised single-member district elections, parties should be more likely to select them. An additional consideration in this direction concerns how the winner-takes-all nature of single-member district contests affects the 'stakes' involved in selecting a local over a non-local. That is, in all districts where the 'localist' vote is greater than the difference in expected 'partisan' votes between the first and second largest party, the selection of a local candidate can effectively make the difference between a party getting 100% of these seats or none. This is unlike multi-member districts, where shifts of fractions of the vote share correspond to a fraction of the seats in play changing hands.

If high candidate visibility and the pivotality of the 'localist' vote in competitive seats would point to high incentives for parties to field local candidates in single-member districts, there is an important countervailing consideration to be made concerning the role of non-competitive, or 'safe', districts. Due to the uneven geographical distribution of spatial support, in fact, parties may have very strong priors on the expected election results of many individual constituencies.[7] In a safe district, which we can think of for our purposes as a district where the expected difference in the 'partisan' share of the vote between the two largest parties is greater than the expected share of 'localist' voters, the calculus of candidate selection is fundamentally different from a competitive one, insofar as the expected difference in seat gains from choosing a local over a non-local is null. These districts therefore present low *party incentives* to select a local: if a party has reasons to prefer a non-local prospective candidate over local alternatives, it can safely 'parachute' her in the district with no risk of losing the seat.

Let us now turn to the second criterion, *voter leverage*. Here as well we need to distinguish between cases where 'localist' voters are pivotal to electoral outcomes under at least some configuration of party selection strategies (competitive districts), and cases where the expected difference between the largest party and its closest competitor is larger than the 'localist' vote

[7]Empirically, this phenomenon has been long evident in majoritarian democracies: Jones (1963) noted that 87% of UK seats remained under the same party's control over four elections (1950-1959); in the US, Bullock (1975) similarly found that over three quarters of districts remained under the same party's control over five cycles (1962-1970).

(safe districts). In the first case, elections will always satisfy voters' localness bias when at least one the viable parties selects a local candidate – which, as we have seen, is a strategy that parties have high incentives to pursue anyway. In a two-party election, if both parties select local candidates, the one from the most popular party net of localness will be elected; if one party does and the other does not, the local candidate will be elected; only if both parties 'parachute' non-locals voters' preferences for locals will be frustrated. In non-competitive districts, conversely, voters are entirely unable to express such a preference in elections, as the largest party's selection choice effectively determines the outcome of the contest.[8] It follows that, in single-member districts, the extent of *voter leverage* is entirely dependent on *party incentives* to select a local candidate: where parties have high incentives to do so, i.e. in competitive districts, voters will in most cases be able to choose a local over a non-local; where parties have very low incentives to do so, i.e. in safe districts, voters have no ability to overrule them.

3.2 Multi-member Districts Systems

Elections in multi-member districts – which encompass all variants of proportional representation, and include some plurality formulae such as plurality-at-large or bloc voting – are often thought to be more 'particized' than 'personalized' (Wessels, 1999). Generalizing the argument outlined in the previous section on the relationship between candidate visibility and the weight of the personal vote, we may conclude that as district magnitude (number of seats-per-district) increases, the visibility of each individual candidate and therefore *party incentives* to select local candidates decrease. The implication is that there will be fewer 'localist' voters in multi-member district elections than we would expect in single-member district contests, and that among multi-member districts the share of the 'localist' vote should be larger in those with smaller district magnitude.

On the other hand, we must also consider how the different relationship between expected party votes and expected number of seats in multi-member districts differ from single-member

[8] Party primaries and non-partisan blanket primaries can however change this: to the extent that the primaries' selectorate coincides with the district electorate, voters have an effective option to overrule the party's preferred choice, and therefore have meaningful input on the selection of local representatives in competitive districts as well. In this sense, primaries may serve as a surrogate for preferential voting (see below) in single-member district systems. They are however very rare in parliamentary elections outside the United States.

districts – and in turn, how that affects *party incentives*. As we discussed, the relationship is essentially S-shaped in the latter: the marginal increase in expected number of seats is virtually zero for a party that expects to win either too few or too many votes in the district. Conversely, in multi-member districts the relationship is closer to a linear one: fractions of the vote correspond to approximately constant increases in the expected number of seats. The implication is that, while incentives to vie for the 'localist vote' may be small due to low candidate visibility, *they are never null* in any kind of multi-member districts, as long as there are 'localist' voters. In a two-party election in a district of magnitude M where a fraction l of the vote is composed of 'localists', the choice of fielding a fully local 'slate' of M candidates relative to a fully 'parachuted' one can be expected to win Party A a minimum of $\frac{l}{2} \cdot M$ seats (if Party B also fields all local candidates) to a maximum of $l \cdot M$ seats (if Party B fields all non-local candidates). [9]

Being normally more extensive than single-member district, multi-member districts introduce an additional possible source of bias in party selection of local candidates: unequal selection of candidates across territorial units *within* a district. For instance, in a multi-member seat comprising wealthy and a poor areas, even when parties do select candidates from the district they might select them disproportionally from the wealthy part, assuming they prefer on average the personal or political profile of wealthy-area candidate.[10] Now, obviously the strategy of maximising representation of wealthy units over poor units comes with diminishing marginal returns, insofar as a party is maximising their share of the 'localist' vote *from those units*, instead of maximising their share of the overall 'localist' vote. But it introduces an additional mechanism, alongside downright 'parachuting', for parties to select unrepresentative slates of candidates with relatively low electoral downsides. Consider for instance a ten-seat multi-member PR district composed in equal parts of poor and wealthy areas, where Party A can field a maximum of ten candidates and is faced with a single competitor, Party B, fielding

[9] This argument must however be tempered with the consideration that, for very small district magnitudes, multi-member seats may also be reasonably 'safe': i.e. the share of the expected party vote share needed to win or lose an additional seat may be too large for the 'localist' vote to make a difference. Granted, it unlikely that in practice parties have such precise foreknowledge, especially as multi-member districts tend to coincide also with more fragmented party systems, and therefore substantial inter-party competition over at least some seats.

[10] In the limit, in polities like Israel and the Netherlands that employ one single country-wide constituency, all candidates will technically be 'local' to the district, but they might be highly unrepresentative of territorial units within them.

a perfectly representative slate of five wealthy-area candidates and five poor-area candidates. Assume further that the 'localist' vote l is uniformly distributed across wealthy and poor areas ($l_w = l_p = \frac{l}{2}$). If Party A fields only 'wealthy-area' local candidates it gains the majority of the wealthy-area 'localist' vote – i.e. $\frac{10 \cdot l_w}{15}$ – but none of the poor-area personal vote l_p, for a total of $\frac{10 \cdot l_w}{15} + \frac{0 \cdot l_p}{5} = \frac{l}{3}$. This is a fraction smaller than the $\frac{l}{2}$ Party A would gain from fielding five locals from poor areas and five locals from wealthy areas, but greater than no 'localist' voters at all, which is what it would gain from fielding all non-locals. The implication is that in multi-member districts rather than 'parachuting' out-of-district candidates parties may prefer targeting some territorial units over others within the district. This would yield parliamentary delegations that – while local to the constituency – are still unrepresentative of the territorial units within it.

Party incentives to select locals in multi-member districts therefore seem modest, though non-null, falling somewhere in between the incentives parties have in 'competitive' and 'safe' single member districts. What of our second criterion, *voter leverage*? In multi-member districts, voters can be expected to be faced with a much greater number of candidates from a larger number of viable parties, so the probability of having *no* feasible local choice at all – as in the case of 'safe' single-member districts where the largest party chooses to 'parachute' – is much smaller. The extent to which voters can in fact see that local choice elected, however, depends on the ballot structure of the electoral system, rather than on district type. In closed-list systems, voters are not given such a choice: seats are apportioned between party lists according to voters' list preference, and subsequently attributed within party lists according to the party's preferred ranking. Under such rules, parties may simply place their preferred candidates in higher-ranking positions, and voters would still be unable to move 'locals' on the list ahead of them (Espírito-Santo and Sanches, 2018). Conversely, in a number of countries *preferential voting* devices have been introduced to allow a higher degree of *voter leverage* in the process of intra-party allocation of seats (Renwick and Pilet, 2016; Passarelli, 2020). In some multi-member systems – like Ireland's Single Transferable Vote or Mongolia's Plurality-at-Large – voters choose candidates directly rather than parties, and therefore they have a meaningful opportunity to express a preference for 'locals' over non-locals of the same party. In others –

like Brazil's open lists or Belgium's flexible list system – they vote for both a party and one candidate (or more), the latter vote determining in whole or in part the intra-party attribution of seats. We consider together all these different ways in which voters may meaningfully affect intra-party allocation of seats as instances of preferential voting. Note that, under preferential voting rules, it is not only 'localists' but also 'partisans' that can have an input on seat allocation, as their second-order candidate preference does not undermine their first-order party preference. The expectation is therefore that preferential voting, to the extent to which it gives voters real leverage in picking candidates as well as parties, should therefore lead to a higher probability of territorial units being represented by a local candidate.

3.3 Mixed-member systems

Mixed-member systems present overlapping single- and multi-member tiers, where seats are allocated – respectively – nominally and by party list (Shugart and Wattenberg, 2001). Thus, in the first instance, we may want to think of these systems as hybrids, yielding an intermediate degree of spatial representation between single- and multi-member district systems.[11] There is however a substantial amount of literature that casts doubt on such a 'naive' view of the dynamics of mixed-member elections as simply a combination of those observed in single- and multi-member systems (Herron and Nishikawa, 2001; Cox and Schoppa, 2002; Ferrara, Herron and Nishikawa, 2005; Ferrara and Herron, 2005). In this perspective, the interaction between the single- and multi-member tiers produces incentive structures for parties, voters and legislators in both sets of electoral districts that are specific to mixed-member systems: these are generally known as 'contamination effects'.

For our purposes, there are two possible contamination effects in the single-member tier of a mixed-member system that deserve consideration. The first is the well-known deviation from Duverger's Law in patterns of party competition in single-member tiers of mixed-member

[11] Specifically, if the two tiers are parallel, as with Mexico's mixed-member majoritarian system, *party incentives* and *voter leverage* in the two tiers should exactly map onto those we highlighted in fully single- or multi-member district systems. Where the linkage between the two tiers is compensatory, as in Germany's mixed-member proportional system, we must however discount the argument that the 'winner-takes-all' nature of single-member district elections leads to higher stakes in winning the 'localist' vote, as the compensatory multi-member tier can make up for narrow losses at single-member district level. However, even under mixed-member proportional rules, the higher visibility of single-member district candidates should point to stronger *party incentives* to select locals for these races than is the case in the multi-member tier.

systems: parties with no prospect of winning single-member districts are more likely to enter the contest under mixed-member rules than in fully single-member district elections. This is because parties expect that putting up a 'face' to their list can boost their vote in the multi-member tier (where they do have chance of winning seats), and realise that there are informational costs for voters to split the ballot across the two tiers. This constrains the 'centripetal' force of Duverger's Law that pulls the effective number of electoral parties in single-member districts down towards two, and makes for more fragmented party systems at district level. In turn, multi-party competition in single-member districts can be expected to lead to smaller margins of victory, and therefore fewer safe seats, which – as discussed – are a 'bad' equilibrium where parties have no incentive to put up local candidates and voters have no way to overrule them.

The second type of contamination effect concerns party incentives to put up local candidates *net of the nature of district-level competition.* Unlike fully single-member district systems, in the single-member tier of a mixed-member system, parties may in fact have good reasons to put up local candidates in *both* competitive *and* safe single-member districts equally. This is because (1) single-member district candidates are more visible to the electorate, and therefore can reach a larger number of 'localist' apartisans, and (2) voters are more likely to choose in the multi-member tier the same party list as the single-member district candidate. Therefore, even in a non-competitive district, there is an added value for parties to seek the 'localist' vote by making sure the most visible representative is from the district, as her personal vote may also translate into a stronger party performance on the multi-member district tier. In the single-member tier of a mixed-member system, therefore, we may expect parties to adopt selection strategies that take into account candidate localness in a wider set of districts than they would under fully single-member district electoral rules. In sum, we expect the single-member tier of a mixed-member district to yield overall the most favourable conditions for local representation. Electoral contests in these districts can be expected to have in fact a similarly high level of 'personalisation' as single-member elections, but without the counteracting effect of seat safety: even if the single-member district race is a foregone conclusion, parties also care about increasing their vote share in the multi-member tier, where small fractions of the vote can matter at the margins. Conversely, we do not have strong reasons to believe that the multi-member tier of a

		Party incentives to select local candidates		
		High	Moderate	Low
Voter leverage (ability to express a preference for locals)	High	competitive seats in SM systems SM tier in MXM systems	MTM seats with PV (in both MTM and MXM systems)	
	Low		MTM seats without PV (in both MTM and MXM systems)	'safe' seats in SM systems

Table 1: Probability of a territorial unit being represented by a local by type of district and presence of preferential vote (PV). SM = single-member, MTM = multi-member, MXM = mixed-member.

mixed-member system – whether with or without preferential voting – would be much different from what we observe in multi-member district systems.

3.4 Summing Up

In this section, we have assessed a number of theoretical considerations to take into account in predicting the probability that a territorial unit expresses a local as the representative - – or one of the representatives – for their district. Table 1 summarises how different types of districts fare according to our criteria of *party incentives* and *voter leverage*. There are a number of countervailing considerations to take into account for each of the types of constituency structure considered, so that in aggregate we have few unambiguous theoretical expectations on their relative performance. The question of electoral systems and spatial representativeness remains therefore primarily an empirical one, which we will seek to address empirically in the following sections. Our theoretical review does, however, yield some tentative priors on the aggregate level of spatial representativeness of legislatures under different electoral rules:

1. The probability of territorial units expressing local candidates is most uneven in single-member district systems, which combine the most favourable context for local representation in competitive districts with the least favourable setting in safe districts. Therefore,

the performance of single-member districts should be highly contingent on a 'political' factor relatively independent from the formal features of the electoral systems: levels of seat competitiveness. It follows that, contrary to the 'constituency linkage' argument suggesting better district representation in single-member district systems, on this specific measure of spatial representation we do not have reasons to expect them to outperform multi- or mixed-member district systems.

2. Conversely, because of contamination effects, we expect that the single-member district tier of mixed-member systems *should* make a positive contribution to overall representativeness relative to multi-member districts. As far as the single-member district tier is concerned, not only should there be relatively few 'safe' seats in mixed-member district systems, but party incentives to select local candidates remain substantial in all single-member districts, regardless of seat marginality. Therefore, mixed-member systems should yield more representative legislatures than multi-member systems, as their additional single-member tier comprises districts where the likelihood of local representation is high. Again, we have no clear expectations on mixed-member systems' aggregate performance relative to single-member systems, as we cannot *a priori* determine the relative impact of the potential sources of spatial bias we find in the two systems: the multi-member tier in mixed-member systems, and safe seats in single-member systems.

3. Within multi-member districts (both in multi-member and mixed-member systems), the presence of preferential voting mechanisms should increase spatial representativeness of legislatures. Larger district magnitudes may be associated with more unrepresentative legislatures.

4 Cross-Country Analysis

We proceed to test these theoretical expectations on a sample of legislatures from 62 democratic countries, for which we measure our Spatial Unrepresentativeness of Legislatures Index (SURLI) from data on MPs' and population spatial distributions. These data are described in subsection 4.1, alongside other country-level variables that we use to capture variation in electoral institu-

tions and other socio-political variables in the sample. Subsection 4.2 presents the methodology employed to derive two alternative measures of SURLI: one that compares the distribution of legislators' birthplaces to the population distribution, and one that compares the distribution of legislators' birthplaces to a proxy for the distribution of birthplaces of potential legislators. Finally, subsection 4.3 discusses the results of a cross-country regression, which allows us to assess how variation in electoral system features explains cross-country variation in SURLI.

4.1 Data

4.1.1 Legislator Data

To measure the extent to which legislators' local ties are representative of the population, we gathered legislators' birthplaces for 62 legislatures in democratic countries in one year. We chose to focus on politicians' birthplaces because these are often an important indicator of geographical ties (e.g. the case of the Green Party candidate for Brent Central mentioned above) and because it is certainly the most practical measure to collect on any broad scale. Ideally, we might ask each politician where she is 'from', and perhaps compare this to politicians' self-presentation and voters' perceptions; we expect that the politician's birthplace would be a very common answer, though this likely varies across countries based on the geographical mobility of the political class. Some politicians undoubtedly have little connection to the place of their birth and have a stronger connection to a different place where they grew up or spent most of their adult lives, but we see no feasible way to collect data at scale on where legislators spent their youth or other periods of their life, while legislators' official profiles and Wikipedia pages often list their birthplace.

As our source for legislator birthplaces we rely primarily on data from the Global Leadership Project (GLP) (Gerring et al., 2014) and focus exclusively on lower-house members. The GLP dataset we used includes biographical facts about over 38,000 MPs and other top officials in 145 countries, typically as of 2010 or 2011; much of this data was collected from official government websites. Crucially the GLP also includes politicians' birthplaces, recorded as text strings. Coverage of birthplaces in the GLP ranges widely, with many cases near 100% coverage and others (including Portugal, Ireland, Jamaica, and Romania) much lower. We undertook substantial

effort to collect birthplaces in cases where they were missing in the GLP; we also checked and corrected the variable identifying legislators to distinguish legislators from unelected cabinet officials and party leaders who did not have seats in the legislature. We supplemented the GLP data with original data collection for six other legislatures: Cape Verde, Chile, Cyprus, Macedonia, Montenegro, and Taiwan. After filling in missing entries where possible and editing entries that were insufficiently precise (e.g. referring to regions rather than municipalities of birth), we excluded foreign-born legislators and geocoded birthplaces using the Google Maps API, resolving ambiguities where they appeared. Figure 1 lists the countries we analyze and provides information on data completeness for each one: for most legislature-years, we have valid birthplaces for over 90% of legislators.[12] In terms of case selection, we started with the list of all democracies – countries rated free or partly free in Freedom House (2012) – and proceeded to exclude countries for which, between the GLP and our own efforts, we were not able to obtain a sufficient proportion of MP birthplaces.

4.1.2 Population Data

Having collected data on *where legislators are from*, we proceeded to collect data on *where voters are*, in order to compare the two spatial distributions. Specifically, we derive two alternative spatial unrepresentativeness of legislatures measures: one that compares legislators' birthplace distribution to population distribution just before their election (we use 2005 as benchmark year), and one that compares legislators' birthplace distribution to the population distribution in the mean legislator birth year.[13] We chose to introduce the latter measurement because distribution of birthplaces may be significantly different from the population distribution due to internal migration, and therefore older population data can serve as a proxy for the birthplace distribution of potential candidates. We therefore chose to rely on gridded population data from the latest version of the History Dataset of the Global Environment (HYDE 3.2)[14], which

[12]The exclusion of foreign-born legislators is particularly significant for countries like Israel (68% valid entries) and Australia (88% valid entries). In four cases (Argentina, Colombia, Luxembourg, Timor-Leste) we have 2-5 more legislators than the assembly size, so that the share of valid entry is slightly above 100%. This is because we were unable to identify and exclude 'substitutes', who took their seats over the year in which the GLP data was collected.

[13]Legislators' birth year were drawn from the same source as their birthplaces (see previous subsection). The legislature means range from 1951 (France) to 1967 (Macedonia).

[14]https://www.pbl.nl/en/publications/new-anthropogenic-land-use-estimates-for-the-holocene-hyde-32

Figure 1: Valid non-foreign-born legislator birthplaces as share of assembly size

includes population estimates for every year between 1861 and 2005 at the level of 5-by-5 arcminute spatial grids (i.e. cells of roughly 10km side at the equator). These have subsequently been assigned to countries via geocoding of their centroids, and aggregated up to 15-arcminute side grids. In the aggregation, we made sure that, for each country, these larger cells add up all the 5-arcminute side grids *whose centroid falls in the country*, so as to minimise information loss or measurement error in cells along borders and coastlines. We used 2005 population estimates to compute the main index of spatial unrepresentativeness,[15] and then we computed mean legislator birth year for each legislature and use population distribution *in that year* to derive the 'alternative' measure of spatial unrepresentativeness.

4.1.3 Country Data

Finally, we gathered country-level variables capturing cross-country variation in electoral institutions in force in the last election prior to legislator data collection, as well as other socio-political characteristics. For *constituency structure*, we constructed both a categorical variable (single-, multi- and mixed-member systems), and an interval variable measuring the share of legislators elected in multi-member seats, which we use in the cross-country regression alongside a 'mixed-member system' dummy. For *district magnitude*, we followed the coding rules in Carey and Hix (2011), and computed *median district magnitude* and *mean district magnitude* variables, calculated excluding from the count constituencies that are either non- or extra-territorial (e.g. ethnic constituencies, Greenland, nationals abroad). A dummy variable for *preferential voting* was coded via a qualitative assessment of ballot rules from legislation or secondary sources. The variable takes the value of 1 if (1) voters can express a preference for one or more individual candidates that is functionally different from a party vote, and (2) the preference vote can practically determine at least in part the allocation of seats,[16] and 0 otherwise. We also collected country-level data on *level of democracy* (V-Dem's unified democracy score), *federalism* (using the list of countries in Roeder, 2009) and a measure of geographic economic inequality, the

[15] Our legislator data was collected normally in 2010 or 2011, so it refers to legislatures elected approximately in the latter half of the 2000s.

[16] This second criterion excludes, for instance, the case of Norway, where voters can in theory rearrange the ranking of candidates or cross out candidates they do not want elected, but more than 50% of the party voters have to 'move up' or 'cross out' a candidate to alter the party's preferred ranking – which has never happened, making these options entirely symbolic (Aardal, 2007).

	Mean	SD	Min	Max	N
Share multi-member districts	0.758	0.389	0	1	62
Median district magnitude	20.49	44.019	1	250	62
Mean district magnitude	22.927	45.449	1	250	62
Preferential voting	0.419	0.497	0	1	62
Population ('000)	51,989	165,073	319	1,250,288	62
Population (log)	16.20	1.737	12.67	20.95	62
Km^2 Land area	917,435	2,125,164	320	9,147,420	62
Km^2 Land area (log)	11.952	2.030	5.768	16.029	62
GDP per capita (2011 $ PPP)	24,764	22,435.250	1410	105,265	62
GDP per capita (log)	9,658	1.045	7,252	11,564	62
Level of democracy	1.145	0.555	0.160	2.263	62
Federalism	0.226	0.421	0	1	62
Spatial Gini	0.0492	0.027	0.0128	0.0623	60
Constituency structure					
Single-member	-	-	-	-	9 (16.1%)
Multi-member	-	-	-	-	43 (69.3%)
Mixed-member	-	-	-	-	10 (14.5%)

Table 2: Country-level data

spatial Gini (population-weighted Gini index of estimated regional GDP per capita, estimated from satellite nighttime light data in Lessmann and Seidel, 2017). Finally, we also collected data on *population*, *land area* and *GDP per capita* from the World Bank's (2010) World Development Indicator catalog. Descriptive statistics for these variables are presented in Table 2.

4.2 Measurement of SURLI

To measure SURLI for a country's legislature, we begin with the geocoded location of each MP's birthplace and the proportion of the population in each grid square of the country. After assigning legislators' birthplaces to each grid, we can express the two distributions (birthplaces and population) in terms of the proportion observed in each grid square. Our objective is to measure the discrepancy between these two distributions in a way that is comparable across countries of greatly differing territorial size and shape. A natural choice for comparing the two distributions is the Earth Mover's Distance (EMD, Rubner, Tomasi and Guibas, 2000), a metric borrowed from computer science and introduced to political science by Lupu, Selios and Warner (2017). Simply put, EMD measures the amount of work (mass times distance) necessary to transform one distribution to another; as Lupu, Selios and Warner (2017) argue,

this closely matches our intuitions about when one distribution is close to another. We thus use EMD as the basis for SURLI.

Although the EMD should pick up variation in the (un-)representativeness of a legislature due to e.g. the electoral system, in cross-country comparisons it will also reflect other differences between countries that may obscure these patterns. Notably, it will depend on a country's size: if a country consists of just two cities separated by a desert, then (assuming the proportion of MPs born in each city differs to some extent from the proportion of people living there) the EMD is increasing in the distance between the cities; also, if a country consists of a single grid square, its EMD is zero regardless of its political institutions. The EMD will also depend on the size of the legislature relative to the size of the country: generally, the more seats in the legislature the more closely the distribution of MP birthplaces can potentially match the distribution of inhabitants. Clearly an investigation of the effect of electoral institutions on geographical representation using observational data requires addressing these country-specific determinants of the EMD score. As a first line of defense we control for land area and population in the regressions below. To further address these and other sources of heterogeneity, we compute the SURLI for each country as a z-score that compares the country's actual EMD against the distribution of EMDs we obtain for that country when MPs are selected at random from the population over a large number of simulated draws. Thus a positive SURLI for a country means that the country's observed EMD is higher than the average EMD across random representative legislatures for that country; country i's SURLI will be higher than country j's if country i's EMD is higher *relative to its own null distribution* than country j's is.[17]

A final measurement problem is that the time to compute EMD increases exponentially in the number of grid squares, so that computing SURLI for a large country like the US (with over 14 thousand grid squares) can take weeks. The complexity of computing EMD in two or more dimensions is well known, prompting efforts to develop efficient implementations and approximations (e.g. Cuturi, 2013). We discovered that, at least for our application of the algorithm on square grids, we could obtain a very efficient approximation to the EMD by computing the one-dimensional EMD for each of several rotations of the gridded map (e.g.

[17] More formally, let d denote a country's actual EMD, and let $\delta = \{\delta_1, \delta_2, \ldots, \delta_M\}$ denote M counterfactual EMDs assuming a representative legislature. Then SURLI is $(d - \overline{\delta})/\text{sd}(\overline{\delta})$.

east to west, northeast to southwest, north to south, northwest to southeast) and averaging those. As we show in section A of the appendix, the resulting estimate correlates very highly with the two-dimensional EMD in actual cases and can be computed dramatically faster. In one dimension, in fact, the EMD between two distributions is known to be equivalent to the computationally cheap procedure of integrating the area between two CDFs (as proven in Cohen and Guibas, 1997, pp. 13–16), which is the method Golder and Stramski (2010) had suggested for comparing distributions.[18]

Therefore we derive our main measure of SURLI – which we refer to henceforth as *SURLI (2005 population)* – in three steps. First, for each country we compute the one-dimensional EMD average across four rotations of the gridded map to get a value of the spatial difference between the distribution of the population in 2005 (i.e. around the time of the last election) and the distribution of legislators' birthplaces. Secondly, for each country we recompute the same measure but for 500 'fictional' legislatures where MPs are drawn at random from the population distribution. Thirdly, we compute SURLI as the z-score of the value obtained in the first step over the distribution obtained in the second step, which provides a value that should be comparable across countries of different size. Note that SURLI scores can take negative values, indicating that the actual measure of discrepancy between MPs' extraction and population distribution is *smaller* than we would expect if legislators were chosen at random. The average SURLI in our sample is 2.1, indicating that the average spatial bias in the 'actual' legislatures of our sample is around two standard deviations higher than we would expect if MPs were selected without any spatial bias.

Additionally, we repeat the same procedure with an alternative target population distribution – population distribution in the mean legislator birth year – which serves as a proxy for distribution of birthplaces of the potential candidate population. We choose to derive this *SURLI (mean legislator birth year)* alternative set of scores to check our results against an index that aims to net out the effects of e.g. internal migration. The intuition is simple: if population in one part of the country has grown faster than the others over the average lifespan of

[18] Lupu, Selios and Warner (2017), in advocating EMD over Golder and Stramski (2010)'s method, were apparently unaware of the equivalence. Our contribution in section A of the appendix is to show that one can closely approximate a two-dimensional EMD by repeatedly integrating one-dimensional CDF discrepancies.

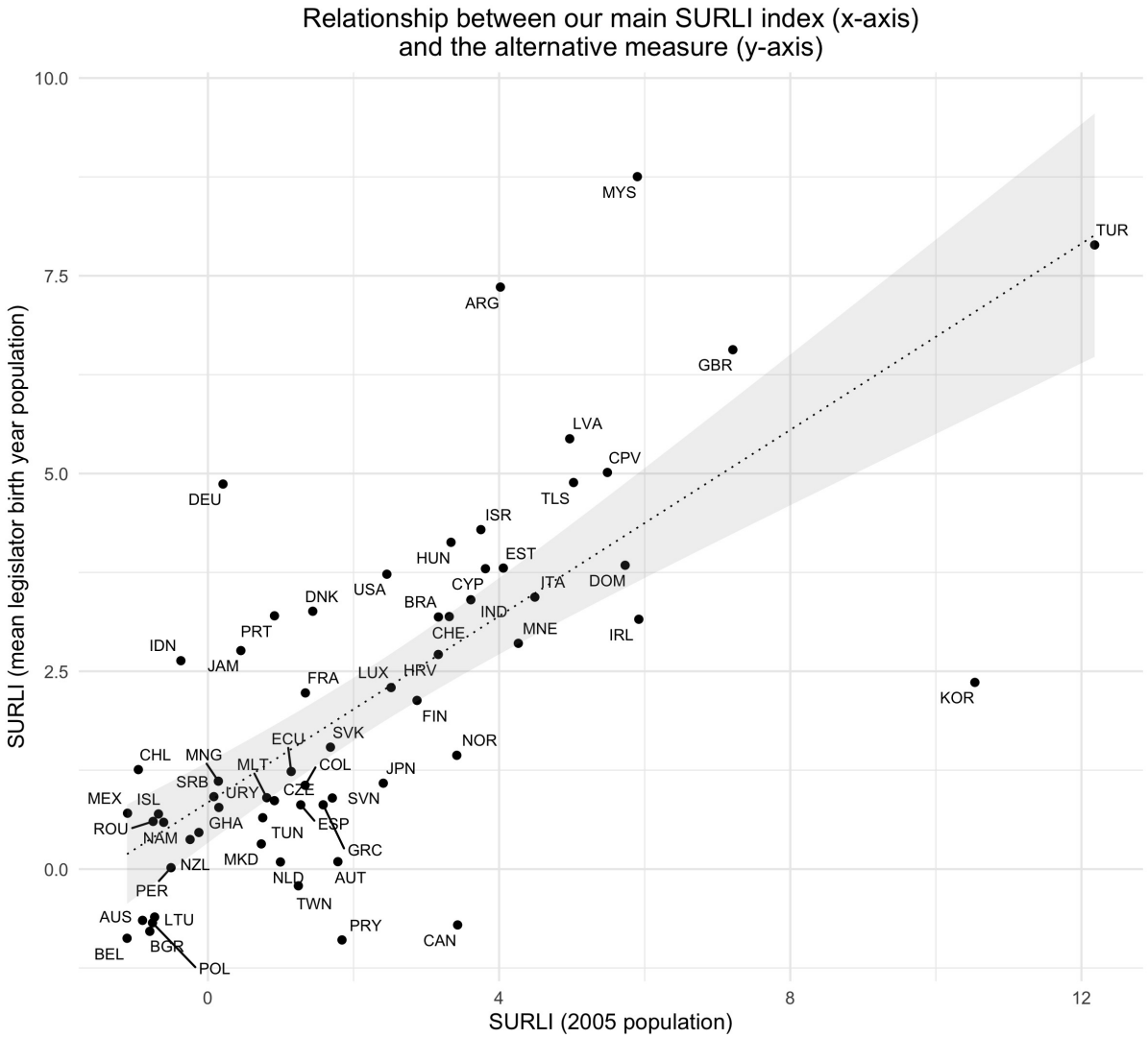

Figure 2: Comparison between SURLI computed against the distribution of the population around the time of the election, and SURLI computed against the distribution of population in the mean birth year of a country's legislators.

legislators, it will have relatively more voters than it has birthplaces of potential MPs; this will bias upwards the overall SURLI score. It is important to not that the two resulting measures of geographic unrepresentativeness of legislatures capture two slightly different dimensions of spatial bias. By comparing legislators' birthplaces to population distribution around the time these legislators were elected, the main variable *SURLI (2005 population)* measures the extent to which each part of the country is represented by a 'local-born' legislator, regardless of the different share of local-born people in each territorial unit. By comparing legislators' birthplaces to population distribution around the time these legislators were born, the variable

SURLI (mean legislator birth year distribution) measures the extent of inequality of access to public office between people born in different parts of the country. Both these dimensions – we believe – are substantially interesting. As shown in figure 2, the correlation between two sets of scores is quite high (Pearson's $r = 0.72$), though there are some significant differences for some outliers. The correlation between land area and the main measure of SURLI is -0.03, suggesting that our method does appear to net out differences in country size, as desired.

4.3 Results and Discussion

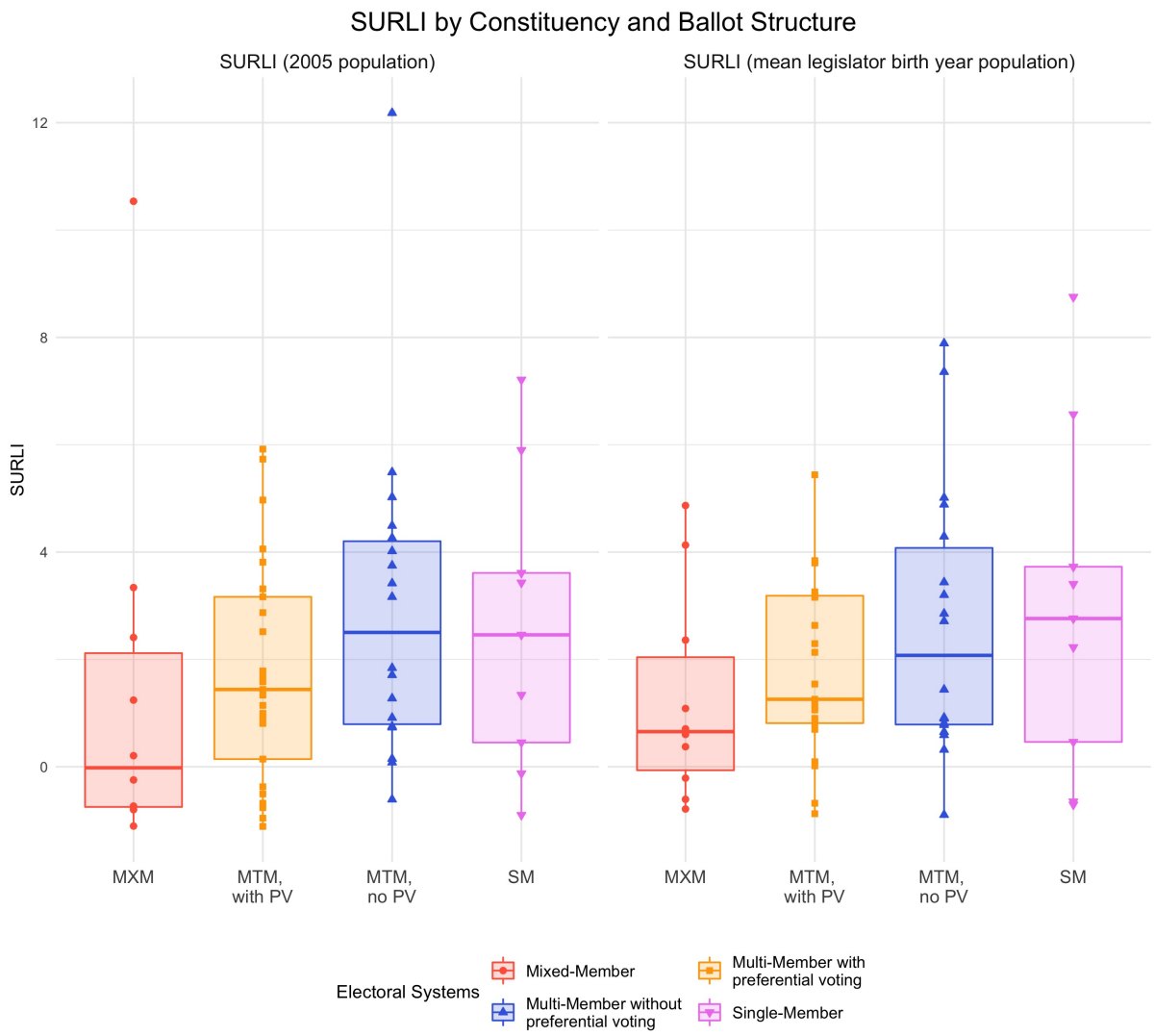

Figure 3: SURLI scores by electoral systems. SM = single-member, MTM = multi-member, MXM = mixed-member, PV = preferential voting. The only MXM country in our sample with PV in the MTM tier (Lithuania) was grouped with MXM for illustrative purposes.

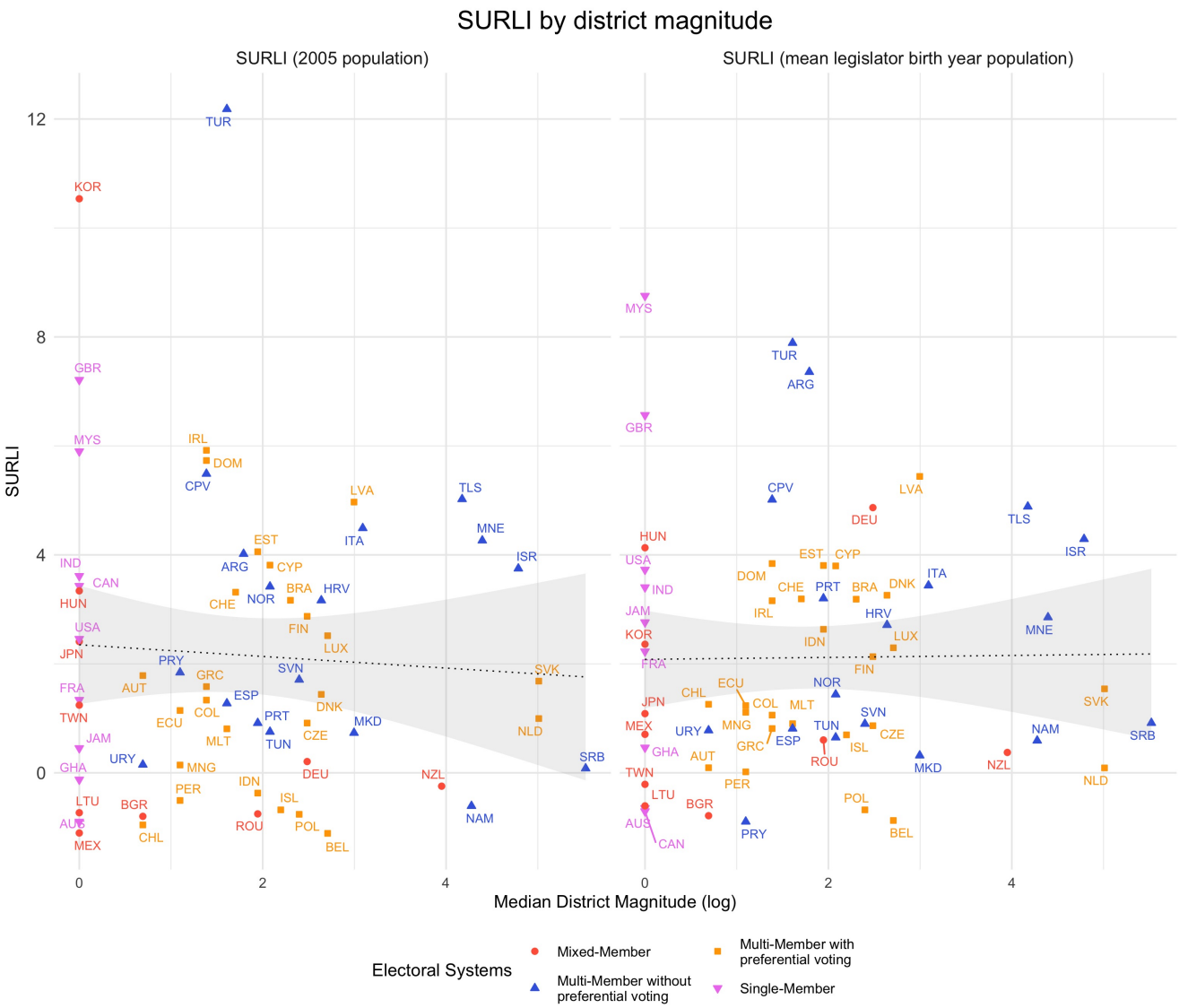

Figure 4: SURLI scores by median district magnitude.

Having derived the spatial unrepresentativeness of legislatures index (SURLI), we can now proceed to investigate its relationship with electoral institutions. Figure 3 shows the distribution of *SURLI (2005 population)* and *SURLI (mean legislator birth year population)* across four major families of electoral systems, defined by their constituency and ballot structures. For both versions of SURLI, the median value in mixed-member systems is the lowest, with scores below 1 indicating that the spatial bias in the median mixed-member system is less than one standard deviation higher than the spatial bias we would expect from random draws of legislators from the distribution of the target population. Preferential voting in multi-member districts is associated with slightly lower median SURLI scores, and single-member districts fare poorly

relative to multi-member districts. Conversely, the scatterplots in Figure 4 show no discernible relationship between SURLI and district magnitude, using either the mean or the median of a country's districts.

Table 3 show the results of Ordinary Least Square linear regression models where SURLI is regressed on a series of electoral system, demographic and institutional characteristics of our country-sample. In models 1 and 3, we operationalise constituency structure as a three-factor categorical variable; in models 2 and 4, we employ a continuous variable for the share of legislators elected via multi-member districts alongside a dummy for mixed-member systems. This dummy effectively captures the 'additional' effect of mixed-member relative to the predicted value of SURLI if these systems simply functioned as hybrids of single- and multi-member systems. *SURLI (2005 population)* is used as dependent variable in models 1 and 2; the alternative specification computed against the proxy for birthplace distribution of the potential population of office-seekers – i.e. *SURLI (mean legislator birth year population)* – is used in the models of models 3 and 4. We control for *preferential voting*, the log of *median district magnitude*, the log of *population*, the log of *land area* and the log of *GDP per capita* and *democracy score*. It goes without saying that – due to the limited number of observations and potential omitted variable bias – this is more a descriptive exercise than an inferential one.

Once again, we find a noticeable overperformance of mixed-member systems relative to other constituency structures. Across model specifications, the expected average value of SURLI is between 1.6 and 2.6 points lower than in multi-member systems and between 1.6 and 2.2 points lower than single-member systems. Overall, SURLI in mixed-member systems is between 1.9 and 2.1 points lower than the rest of the sample, net of the share of legislators elected via multi-member districts. Obviously, each of these estimates comes with rather large standard errors; it is however noticeable that the coefficients capturing the effect of mixed-member systems on SURLI reach or approach conventional thresholds of statistical significance even in our small sample. The findings for the effect of *preferential voting* are less clear-cut: the effect is in the predicted direction – i.e. preferential voting reduces unrepresentativeness of legislatures – but it only reaches significance at $p < 0.1$ in models 1 and 2, where the regressand is the version of SURLI computed against the distribution of voters. We find no significant effect of *median*

	Dependent variable:			
	SURLI (2005)		SURLI (mean MP birth year)	
	Model 1	Model 2	Model 3	Model 4
Constituency Structure[a]				
Multi-Member	2.63** (1.15)		1.63* (0.96)	
Single-Member	1.56 (1.28)		2.19** (1.07)	
Share multi-member		0.64 (1.34)		−0.35 (1.12)
Mixed-member		−2.08** (1.01)		−1.92** (0.84)
Preferential Voting	−1.58* (0.82)	−1.46* (0.81)	−0.82 (0.68)	−0.88 (0.68)
Median dist. mag. (log)	−0.40 (0.30)	−0.35 (0.29)	−0.01 (0.25)	−0.03 (0.25)
Population (log)	0.39 (0.32)	0.37 (0.32)	0.29 (0.27)	0.30 (0.27)
Land area (log)	−0.43* (0.25)	−0.43 (0.26)	−0.28 (0.21)	−0.28 (0.21)
GDP p.c. (log)	1.10* (0.56)	1.13* (0.56)	0.68 (0.47)	0.66 (0.47)
Democracy score	−1.73 (1.09)	−1.82* (1.09)	−1.55* (0.91)	−1.51 (0.91)
Constant	−8.31 (5.49)	−6.46 (5.50)	−5.12 (4.60)	−3.07 (4.59)
Observations	62	62	62	62
R^2	0.21	0.20	0.18	0.18
Adjusted R^2	0.09	0.08	0.05	0.05
Residual Std. Error (df = 53)	2.58	2.59	2.16	2.17
F Statistic (df = 8; 53)	1.74	1.68	1.44	1.42

[a]: reference category: Mixed-member; *p<0.1; **p<0.05; ***p<0.01

Table 3

district magnitude on either dependent variable. Larger countries seem to have, *ceteris paribus*, more representative legislatures than smaller ones. This finding can be interpreted substantively in terms of stronger and more politically relevant regional identities in larger countries, but it cannot be excluded that it might be due to less precise measurement in countries where SURLI is computed across fewer grids. Democracy scores are negatively associated with SURLI, which suggests that descriptive spatial representativeness at least partly maps onto other dimensions of democratic quality. In section B of the appendix, we present alternative specifications where *federalism* and *spatial Gini* are substituted to *democracy score*, and *mean district magnitude* is employed in lieu of the median: the substantive interpretation of the coefficients is unchanged. Geographic inequality in GDP per capita, captured by spatial Gini, is positively correlated – but nowhere near significance – with unrepresentativeness of legislatures across model specifications.

In sum, in the cross-country analysis we find no evidence that single-member districts perform any better than multi-member districts on this descriptive dimension of geographic representation. The supposedly personalised and localised nature of single-member district elections, therefore, does not seem to translate into a more equal access to political office for people born in different parts of the country. Conversely, mixed-member systems appear the most conducive

institutional environment for geographically representative legislatures. Among other electoral institutions, while we do not find any effect of district magnitude on SURLI, there is some tentative evidence that mechanisms allowing voters to express a candidate preference alongside a party preference may improve spatial representativeness of legislatures.

5 Paired Comparison

The cross-country analysis therefore suggests that mixed-member systems are not only superior to multi-member districts on our measure of spatial representativeness, which is in line with our theoretical expectations; *but they also overperform single-member districts*. In this section, we investigate further via a paired comparison whether this finding can be interpreted in accordance with our theoretical explanation that this overperformance of mixed-member systems is due to 'contamination effects' in their single-member tier. Moreover, while SURLI gives us an aggregate picture of geographic representation, for single-member districts we can use district-level data to explore whether the results are indeed the product of different extents of *local* representation. In fact, in theory, if parties select their candidates without bias and scatter them randomly in districts across the country, a legislature may be have MPs whose birthplaces match exactly the distribution without any MPs being local to *their own* constituency. Recalling our discussion in section 3, we identified two types of 'contamination effects' that led us to conclude that the single-member tier of mixed-member districts should create a particularly favourable environment for local representation. First, the single-member tier of a mixed-member system tends to be more competitive than we would expect in single-member district elections, resulting in a higher number of seats where parties have incentives to vie for the localist vote. Secondly, the presence of a multi-member tier incentivises parties to field local candidates *even in safe single-member districts*, regardless of their priors on election outcomes, because putting up a 'local' in the most visible ballot spot can help parties maximise the number of expected seats from such tier as well.

For reasons of data availability, we select two countries – Britain and Germany – representative of, respectively, a single-member district plurality and a compensatory mixed-member system. The analysis is restricted to Germany's single-member tier. In sum,

1. We expect German single-member district elections to be more competitive than British single-member district elections, due to 'contamination effects' increasing the effective number of parties in the former relative to the Duvergerian equilibrium we expect to find in the latter.

2. And therefore, we expect German single-member district MPs to be more likely to be local to the seat they represent.

3. Additionally, we expect seat safety to reduce the likelihood that a local is elected in UK single-member districts, but not in German single-member districts, because of the second type of 'compensation effects' reducing incentives to parachute in safe constituencies.

It goes without saying that the two cases differ on a number of dimensions not considered here, so that it is impossible to establish clear-cut causal relationships. However, we can use the paired comparison as a 'hoop test', to probe whether district-level outcomes are at least compatible with the testable implications of both our theory and our cross-country findings.

We created for each of our two cases a dataset that combines biographical information on legislators, district-level data on parties' electoral performance, and spatial data from constituency boundary digital vector files. For both countries, our primary source for MPs' data is the *legislatoR* database, which includes – among other information – legislator birthplaces, party affiliation, constituency and electoral tier. We selected British and German single-member district MPs elected in the past six parliamentary elections (respectively, 2001-2019 and 1998-2017), for a total of – respectively – 3971 British and 1823 German legislator-session entries.[19] We complemented the birthplace data in the dataset with further research and geocoded the locations found, yielding a virtually complete coverage of the sample for this variable (see tables 4 and 5). Using constituency names and codes, we linked each entry to party shares of the vote *in the previous election* (this approximates parties' priors in the candidate selection stage). To account for redistricting, for the UK sample we combined data from the House of Commons library with notional seat shares estimated by Rallings and Thrasher;[20] for Germany, we used

[19]The British sample also includes MPs elected via by-elections held between 1997 and 2019.

[20]In the period under consideration, English and Welsh constituency boundaries changed between the 2005 and 2010 elections, while Scottish and Northern Irish seats were redistricted between 2001 and 2005. We could not find notional estimates of party shares in the 2001 election for Northern Ireland seats as configured in 2005. Data for

both 'real' and notional district-level results published for each election by the *Bundeswahlleiter* (German federal electoral commission). Constituencies were then linked to geocoded vector polygon data in shapefiles obtained from the *UK Data Service* and the *Bundeswahlleiter*.

	United Kingdom						
Election year	2001	2005	2010	2015	2017	2019	overall
% valid birthplaces	0.93	0.99	0.98	0.98	0.98	0.97	0.97
Mean margin in last election	0.24	0.23	0.19	0.18	0.24	0.24	0.22
Med. margin in last election	0.21	0.20	0.18	0.17	0.24	0.23	0.20
% Safe seats (> 10% margin)	0.76	0.79	0.74	0.69	0.81	0.74	0.76
% Ultrasafe seats (> 20% margin)	0.51	0.51	0.43	0.43	0.59	0.57	0.51
Med. distance MP birthplace-seat (km)	93.97	100.20	89.21	73.09	72.00	57.74	79.50
% MPs born in seat	0.25	0.24	0.25	0.28	0.29	0.32	0.27

Table 4: Descriptive statistics, UK MPs sample

	Germany (single-member district tier)						
Election year	1998	2002	2005	2009	2013	2017	overall
% valid birthplaces	0.99	0.99	0.99	1.00	1.00	1.00	1.00
Mean margin in last election	0.14	0.13	0.15	0.14	0.14	0.18	0.14
Med. margin in last election	0.11	0.10	0.13	0.12	0.11	0.16	0.12
% Safe seats (> 10% margin)	0.55	0.53	0.59	0.57	0.54	0.68	0.57
% Ultrasafe seats (> 20% margin)	0.27	0.22	0.27	0.23	0.26	0.39	0.27
Med. distance MP birthplace-seat (km)	29.48	26.16	24.83	20.68	18.54	18.88	21.76
% MPs born in seat	0.62	0.71	0.70	0.73	0.78	0.74	0.71

Table 5: Descriptive statistics, German single-member district MPs sample

We addressed the first two hypotheses – concerning district competitiveness and extent of local representation – via simple descriptive analysis. From real or notional district-level electoral data, we computed a *margin in last election* variable, as the difference between the share of the vote for the largest party in the previous election and the share of its closest competitor. Furthermore, we used the digital vector data to compute, for each legislator, the seat in the current election that includes the legislator's birthplace. Additionally, we computed the geodesic distance between the legislator's birthplace and the centroid of the seat she represents. Finally, we combined these two pieces of information to create a binary *MP born in seat* variable that takes the value of 1 if either (1) the legislator's birthplace falls within the seat she represents, or (2) the legislator is born within 20km of the centroid of the seat she represents. This double-safe coding rule is meant to minimise type II measurement errors in districts of varying size. For instance, using only the first criterion, any legislator born in London would be coded as

2005 notional results are available from Pippa Norris's personal website at https://www.pippanorris.com/data; we are thankful to Lewis Baston for providing data for 2001 notional results for Scotland.

being from the central seat of 'Cities of London and Westminster', but obviously given that information they are just as likely to be 'local' to any other London seat. Equally, using only the second criterion an MP born in Dumfries – the major settlement in the 4,000 km^2 rural Scottish constituency of Dumfries and Galloway – would not be coded as local because the town is not close enough to the constituency's centroid.

Tables 4 and 5 show descriptive statistics for the measures of district competitiveness and local representation described above: on both accounts, the results confirm our priors. For median values of seat competitiveness, a German single-member district election takes place in a context where the largest party's margin is almost half as large as in British constituencies. Unsurprisingly, over three quarters of UK constituencies are 'safe' (the margin is larger than 10%) and over half are 'ultra-safe' (the margin is larger than 20%), against 57% and 27% in German single-member districts. As far as local representation is concerned, the contrast is equally stark. Under the aforementioned definition of being 'born in the seat', 71% of German single-member district legislators are local to their area, against only 27% of British MPs. This does not appear to be simply an artifact of German constituencies being larger: the median distance between an MP's birthplace and the centroid of the constituency she represents is 22km in Germany and 79km in the UK.

Having found the expected differences in competitive environments in the two institutional contexts, we can proceed to further probe the last hypothesis, concerning the different effect of seat marginality on party incentives to 'parachute' candidates in single-member and mixed-member district systems. To do so, we first restrict the two samples to newly-elected legislators only, in order to have observations that capture outcomes of party and voter choices taken at the same time and based on known priors of seat competitiveness. Incumbents may in fact have secured a seat many electoral cycles prior to each individual election, when the calculus of party selection was different: e.g. a seat may have 'become' more or less safe over time. But parties seldom reassess candidate selection for seats in which a legislator intends to run again, demanding her to step down for a candidate they like better if the seat has become safer, or for a candidate with stronger local credentials if the seat has become more competitive. Within these samples, which amount to 904 entries for the UK and 605 for Germany's single-member

	Dependent variable:	
	MP born in seat (UK)	
	Model 1	Model 2
Party margin in previous election	-0.962^{**} (0.446)	-1.153^{**} (0.490)
Constituency area (km^2)	-0.0001 (0.0001)	-0.0002 (0.0001)
Party[a]		
Labour	1.240^{***} (0.202)	2.488^{***} (0.820)
Lib Dem	0.369 (0.348)	2.049^{**} (0.958)
Other	1.301^{***} (0.379)	2.225^{**} (1.039)
SNP	0.729^{**} (0.312)	1.953 (1.382)
Election[b]		
2005	-0.037 (0.328)	0.868 (0.826)
2010	0.207 (0.297)	1.130 (0.763)
2015	0.654^{**} (0.314)	1.779^{**} (0.778)
2017	0.492 (0.342)	1.644^{*} (0.841)
2019	0.818^{***} (0.313)	1.961^{**} (0.762)
By-Election	0.196 (0.659)	1.578 (1.368)
Constant	-1.544^{***} (0.285)	-2.536^{***} (0.733)
Party × Election Interaction	No	Yes
Observations	864	864
Log Likelihood	-509.949	-496.581
Akaike Inf. Crit.	1,045.897	1,063.163

[a] = ref. cat. Conservative, [b] = ref. cat. 2001
*p<0.1; **p<0.05; ***p<0.01

Table 6: Binomial logistic models. The estimates capture the variables' effect on the probability that a newly elected British MP is born in the constituency she represents. Model 2 includes Party × Election interactions: interaction terms' coefficients not shown for reasons of space.

district tier, we analyse the effect on the binary outcome variable *MP born in seat* of a variable capturing the newly elected legislator's party position *in the previous election.* This *party margin in previous election* regressor was computed by subtracting the winning MP party's share in the previous election from the top-ranking competitor, which may be the first or the second largest party overall. Unlike the absolute measure of marginality discussed before, this variable can take negative values when the legislator's party lost the previous contest – or at least would have, under the current boundaries. We control for a *party* variable, a categorical *election* variable, and *constituency land area* (a proxy for urban/rural seat distinction). Moreover, we present an alternative specification (model 2), where alongside the *party* and *election* variables, we also allow for interactions between the two. This is because the more seats a party wins from their competitors in one election, the larger will be the share of its newly-elected legislators from marginal constituencies they 'gained'; but if in the following election the party's overall

	Dependent variable:	
	MP born in seat (German SM tier)	
	Model 1	Model 2
Party margin in previous election	1.235* (0.692)	1.661** (0.811)
Constituency area (km^2)	−0.0002** (0.0001)	−0.0002* (0.0001)
Party[a]		
Others	0.395 (0.528)	13.942 (882.744)
SPD	0.088 (0.231)	−0.066 (0.565)
Election[b]		
2002	0.500* (0.299)	0.394 (0.601)
2005	0.456 (0.342)	0.267 (0.617)
2009	0.734** (0.318)	0.737 (0.574)
2013	0.890** (0.365)	0.621 (0.593)
2017	0.282 (0.336)	−0.169 (0.575)
Constant	0.465 (0.289)	0.571 (0.537)
Party × Election Interaction	No	Yes
Observations	604	604
Log Likelihood	−365.319	−361.198
Akaike Inf. Crit.	750.638	760.396

[a] = ref. cat. CDU/CSU, [b] = ref. cat. 1998
*p<0.1; **p<0.05; ***p<0.01

Table 7: Binomial logistic models. The estimates capture the variables' effect on the probability that a newly elected German single-member district MP is born in the constituency she represents. Model 2 includes Party × Election interactions: interaction terms' coefficients not shown for reasons of space.

share of the vote decreases, their newly-elected legislators will be mostly drawn from the safer constituencies the party already held. Interaction terms allow to adjust for these possible confounders. As the dependent variable is binary, we employ logistic models. In section C we present alternative specifications of the models, where we use the log transformation of the constituency area variable, and introduce controls for country or region and MP's gender.

The regression results for the British and German samples of legislators are shown in tables 6 and 7; the marginal effects of party margin on the dependent variable across model specifications are plotted in Figure 5. In the UK sample, we find the expected inverse relationship between seat safety and likelihood of electing a legislator born in the constituency. Perhaps unexpectedly, the relationship is instead *positive* in German single-member districts. The finding makes however intuitive sense: once incentives for parachuting are removed and parties have reasons to field local candidates in single-member districts, they will be more likely to find such candidates in areas where they are more rooted, the number of their supporters is higher, and therefore the

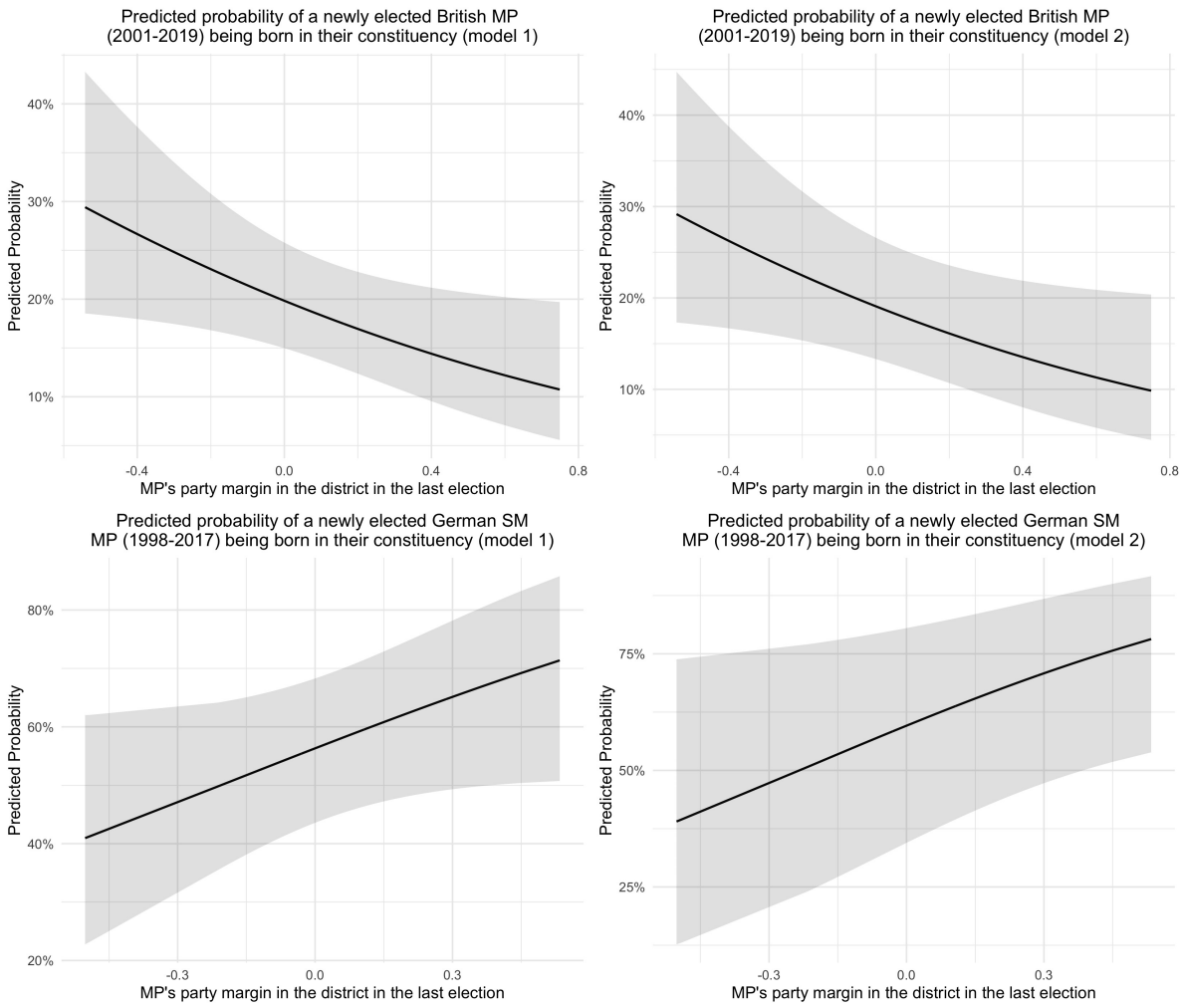

Figure 5: Marginal effects of seat safety on the probability that a newly elected single-member district MP is 'local' to her seat (logistic models in Tables 6 and 7).

pool of aspirants is larger. Conversely, party 'heartlands' in a single-member district systems like Britain are *less* likely to get local representation, as their function – from the party leadership's perspective – is to provide cushy safe seats for insiders.

6 Conclusion

In the title of their influential edited volume on mixed-member systems, Shugart and Wattenberg (2001) asked whether these offer the 'best of both worlds' relative to single-member districts and proportional representation. From the point of view of descriptive representation of places in parliaments, our analysis suggests that we can answer that question positively. On a novel

measure of spatial disparity between where legislators are 'from' and where voters are, in fact, legislatures elected under mixed-member systems seem to be significantly more representative than those elected in countries with other constituency structures. This finding chimes with our theoretical intuition that the single-member tier of mixed-member systems reduces the depersonalized nature of electoral competition we find in multi-member district contests, while also creating disincentives for parties to 'parachute' out-of-district candidates in non-competitive seats, which can be a source of geographic bias in single-member district systems. Alongside a cross-country analysis, we provide additional evidence in this direction by comparing German legislators elected in single-member districts with British MPs. We found that not only the former are much more likely to represent a district they have local ties to than their British colleagues, but also that seat 'safety' does not have the effect of depressing likelihood of local representation in German single-member districts as it does in Britain's constituencies.

As a first stab at an understudied dimension of representation, the analysis presented has still some limitations. Due to the small number of observations, for instance, we had to choose rather coarse classifications that may not capture the full extent of variation across electoral institutions. We mentioned in passing the possible effect of US-style party primaries, but there are other institutional features that we just do not have enough variation in the sample to study comparatively at this stage: different electoral formulae in single-member systems, the nature of tier linkage in mixed-member systems, legal electoral thresholds in multi and mixed-member systems etc. An additional limitation, already noted in section 4.1, is that inferring MPs' ties to geographic locales from birthplaces discounts other aspect of a legislator's biography – education, work, length of residence – that may link her to a community. Nonetheless, we believe that this paper makes valuable contributions in at least two senses. From a methodological point of view, it develops a method to derive measures of congruence between spatial distributions that are comparable across polities and can therefore be applied to the study of other spatial inequalities in political outcomes. From a substantive point of view, the analysis has normative implications for electoral system design, providing evidence against the 'constituency linkage' argument according to which single-member districts lead to better, more personalised representation of locales: an argument not only made by supporters of existing majoritarian systems

(Kelly, 2008) but also often conceded by electoral reformers (Jenkins, 1998; British Columbia Citizens' Assembly on Electoral Reform, 2004). *To the extent that having legislators that reflect the geographic diversity of a country can be considered a relevant 'descriptive' dimension of local representation*, it emerges that other electoral institutions – mixed-member systems, and possibly preferential voting – may be more effective means to such democratic *desideratum*.

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Appendix

A Validation of EMD Proxy

This section illustrates our approach to deriving a proxy for two-dimensional Earth Mover's Distance (EMD) measure of discrepancy between two spatial distributions. We begin with two distributions, each characterized by a set of coordinates in two dimensions and associated weights, with each distribution's weights summing to 1. In one dimension, the EMD is equivalent to the integral of the discrepancy between the two cumulative distribution functions (CDFs), and can thus be computed quickly. In more than one dimension, the EMD is computationally costly and thus inconvenient for distributions with many coordinates.

Our proposed proxy computes the EMD in one dimension, then repeats the calculation over several rotations of the data, and finally averages these measurements. Figure 6 below conveys the concept: we sweep through the data in the direction of each arrow, computing the 1-dimensional EMD (equivalently, the integral of CDF discrepancy) in each pass – in the figure, the cases for 3 and 6 rotations are shown – and then average the values of the EMD obtained in each of these passes.

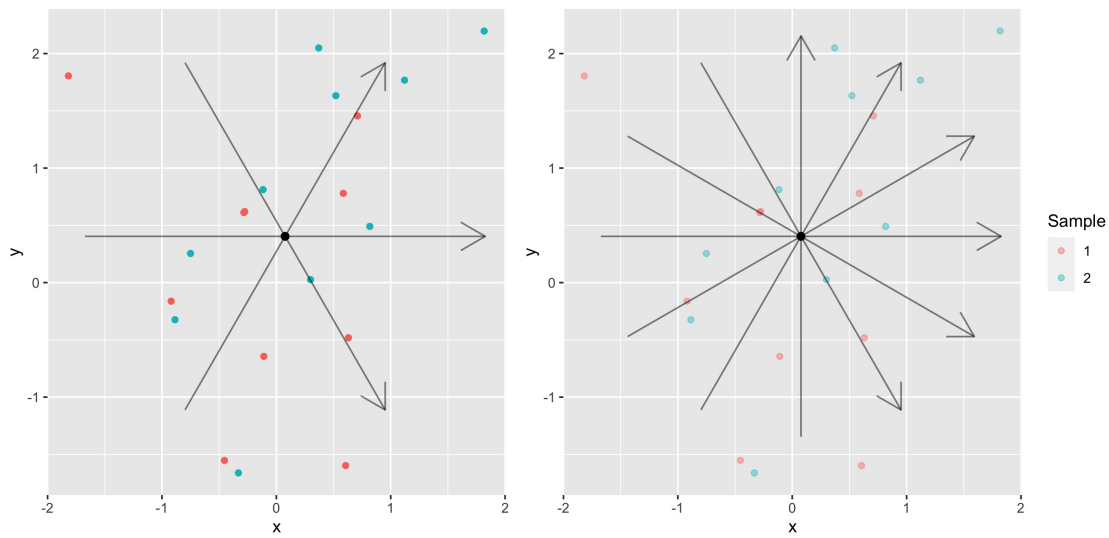

Figure 6

There is no expectation that the two procedures would agree perfectly. For example, suppose to begin with that two distributions are identical; then the 2-dimensional EMD will be zero, as will the 1-dimensional EMD in each rotation, so the two measures will agree. If we then shift one distribution one unit to the east, the EMD will be approximately 1; the 1-dimensional CDF discrepancy will be 1 in the east-west direction, 0 in the north-south direction, and something in between in other directions (so that the mean will be between 0 and 1). The properties of the proposed proxy may require deeper investigation for other uses, but for the purpose of this paper we seek only to show that the proxy agrees closely with the two-dimensional EMD in the data we analyze. To show that it is the case, we compute the EMD and the proposed proxy (with a number of rotations ranging from 3 to 10), and compare the distribution of legislator birthplaces to the distribution of the population (both gridded) in 53 countries (all but the largest 10). The

results plotted below show that the two measures agree very closely. In figure 7, we show the scatter plots of the EMD and its proxy for the 53 countries in the restricted sample across different parameters for the number of rotations. Figure 8 shows how the correlation (in red) and the correlation of ranks (in blue) varies with the number of rotations. For this dataset, the correlation of ranks is slightly lower for lower numbers of rotations, but all correlations are well above .95, suggesting the proxy is valid for our purposes across all values tested.

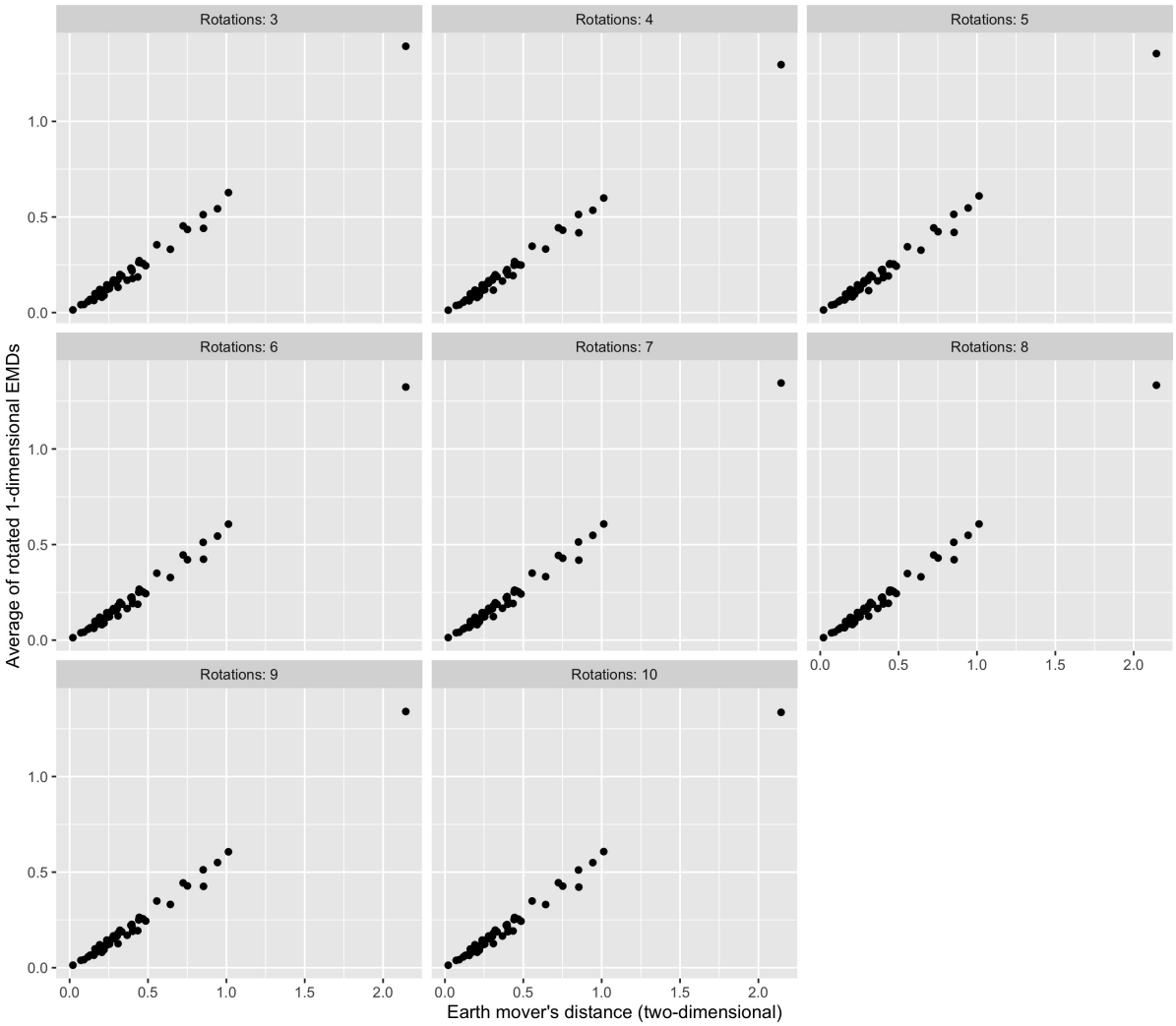

Figure 7

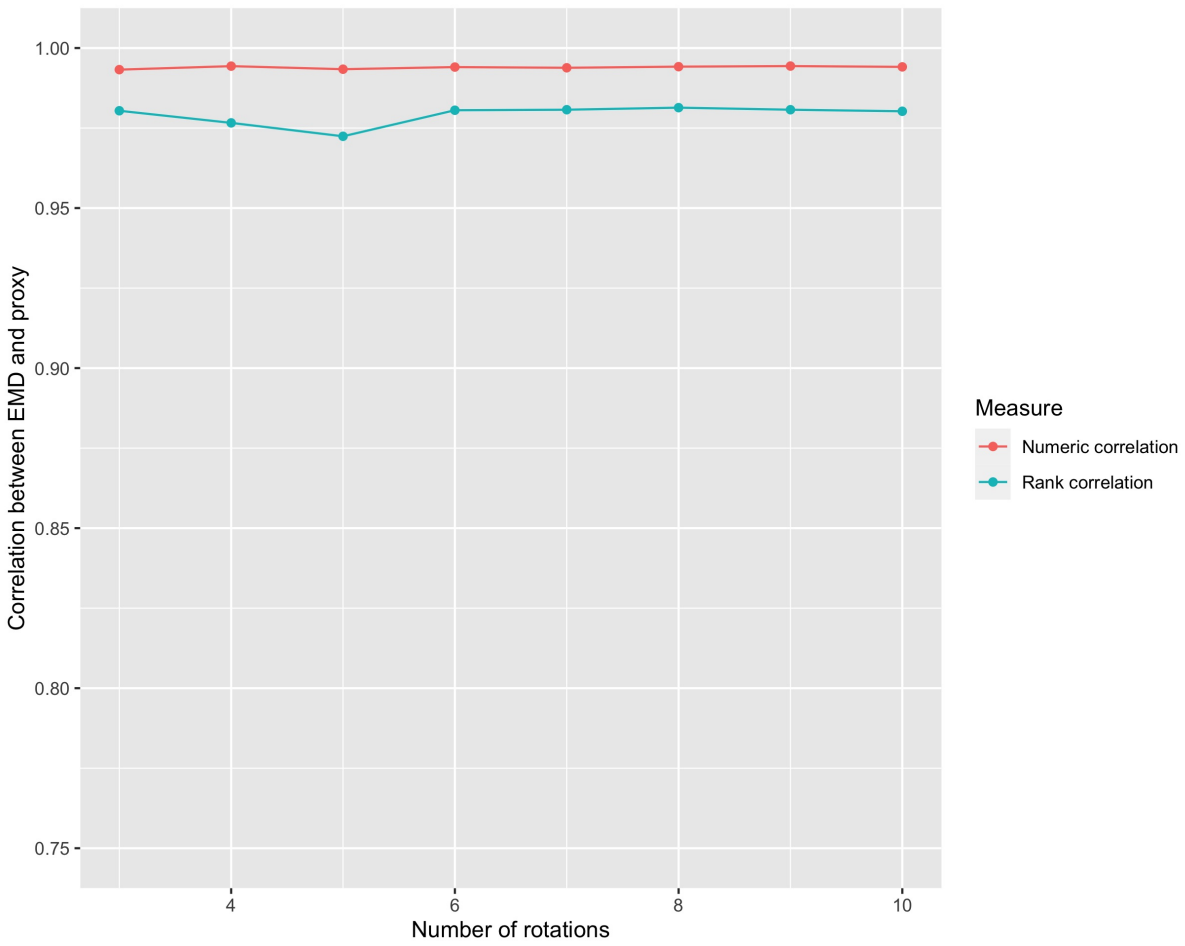
1.00
0.95
0.90
0.85
0.80
0.75
Correlation between EMD and proxy
4
6
8
10
Number of rotations
Measure
Numeric correlation
Rank correlation

Figure 8

B Robustness Checks (Cross-country analysis)

	Dependent variable:				
	SURLI (2005 benchmark)				
	(1)	(2)	(3)	(4)	(5)
Multi-Member	2.81** (1.17)	2.79** (1.19)	2.53** (1.10)	2.70** (1.12)	2.67** (1.13)
Single-Member	1.32 (1.28)	1.16 (1.29)	1.19 (1.33)	0.95 (1.34)	0.72 (1.35)
Preferential Voting	−1.73** (0.82)	−1.58* (0.84)	−1.64* (0.82)	−1.79** (0.82)	−1.65* (0.84)
Log(Median DM)	−0.40 (0.30)	−0.49 (0.32)			
Log(Mean DM)			−0.45 (0.31)	−0.46 (0.31)	−0.56* (0.33)
log(Population)	0.64** (0.32)	0.62* (0.35)	0.39 (0.32)	0.62* (0.32)	0.61* (0.35)
log(Land area)	−0.48* (0.26)	−0.63* (0.34)	−0.42 (0.25)	−0.47* (0.25)	−0.61* (0.34)
log(GDP pc)	0.43 (0.34)	0.45 (0.38)	1.08* (0.56)	0.43 (0.34)	0.45 (0.38)
Federalism	−0.95 (0.99)			−0.86 (0.99)	
Spatial Gini		1.78 (18.97)			1.39 (18.78)
Democracy score			−1.67 (1.09)		
Constant	−7.15 (5.65)	−5.40 (6.19)	−7.91 (5.50)	−6.66 (5.67)	−4.96 (6.18)
Observations	62	60	62	62	60
R^2	0.18	0.19	0.21	0.19	0.20
Adjusted R^2	0.06	0.06	0.09	0.07	0.07
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 8

	Dependent variable:				
	SURLI (mean legislator birth year benchmark)				
	(1)	(2)	(3)	(4)	(5)
Multi-Member	1.66* (0.99)	1.63 (1.00)	1.56* (0.93)	1.62* (0.95)	1.56 (0.95)
Single-Member	1.64 (1.08)	1.96* (1.08)	2.27** (1.12)	1.68 (1.13)	2.02* (1.14)
Preferential Voting	−1.01 (0.69)	−0.77 (0.70)	−0.78 (0.69)	−0.99 (0.70)	−0.74 (0.71)
log(Median DM)	−0.001 (0.26)	−0.01 (0.27)			
log(Mean DM)			0.05 (0.26)	0.03 (0.26)	0.04 (0.28)
log(Population)	0.39 (0.27)	0.61** (0.30)	0.29 (0.27)	0.40 (0.27)	0.62** (0.30)
log(Land area)	−0.39* (0.22)	−0.57* (0.28)	−0.27 (0.21)	−0.38* (0.22)	−0.57** (0.28)
log(GDP pc)	−0.02 (0.29)	0.21 (0.32)	0.67 (0.47)	−0.02 (0.29)	0.21 (0.32)
Federalism	0.59 (0.84)			0.59 (0.84)	
Spatial Gini		14.63 (15.91)			15.33 (15.83)
Democracy score			−1.55* (0.91)		
Constant	−0.59 (4.77)	−4.80 (5.19)	−5.25 (4.62)	−0.66 (4.79)	−5.00 (5.21)
Observations	62	60	62	62	60
R^2	0.14	0.15	0.18	0.14	0.15
Adjusted R^2	0.01	0.02	0.06	0.01	0.02
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 9

	Dependent variable:				
	SURLI (2005 benchmark)				
	(1)	(2)	(3)	(4)	(5)
Share multi-member	1.06 (1.33)	1.10 (1.38)	0.94 (1.43)	1.36 (1.42)	1.49 (1.46)
Mixed	−2.03* (1.03)	−1.93* (1.03)	−1.85* (1.01)	−1.79* (1.03)	−1.65 (1.02)
Preferential Voting	−1.62* (0.82)	−1.44* (0.84)	−1.54* (0.82)	−1.69** (0.83)	−1.54* (0.84)
log(Median DM)	−0.35 (0.30)	−0.42 (0.32)			
log(Mean DM)			−0.41 (0.31)	−0.41 (0.32)	−0.51 (0.33)
log(Population)	0.64* (0.32)	0.63* (0.36)	0.37 (0.32)	0.63* (0.32)	0.62* (0.36)
log(Land area)	−0.48* (0.26)	−0.66* (0.34)	−0.42 (0.25)	−0.47* (0.26)	−0.64* (0.34)
log(GDP pc)	0.43 (0.34)	0.46 (0.38)	1.11* (0.56)	0.43 (0.34)	0.46 (0.38)
Federalism	−1.01 (0.99)			−0.94 (0.99)	
Spatial Gini		4.02 (18.91)			3.29 (18.77)
Democracy score			−1.76 (1.08)		
Constant	−5.52 (5.70)	−4.08 (6.24)	−6.52 (5.48)	−5.52 (5.68)	−4.14 (6.18)
Observations	62	60	62	62	60
R^2	0.18	0.18	0.21	0.18	0.19
Adjusted R^2	0.05	0.05	0.09	0.06	0.06
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 10

	Dependent variable:				
	SURLI (mean legislator birth year benchmark)				
	(1)	(2)	(3)	(4)	(5)
Share multi-member	0.11 (1.12)	−0.15 (1.15)	−0.49 (1.20)	0.04 (1.19)	−0.26 (1.23)
Mixed	−1.64* (0.86)	−1.79** (0.86)	−1.92** (0.84)	−1.64* (0.86)	−1.79** (0.86)
Preferential Voting	−1.04 (0.69)	−0.82 (0.70)	−0.84 (0.69)	−1.02 (0.70)	−0.79 (0.71)
log(Median DM)	−0.01 (0.25)	−0.03 (0.26)			
log(Mean DM)			0.03 (0.26)	0.02 (0.27)	0.01 (0.28)
log(Population)	0.40 (0.27)	0.61** (0.30)	0.30 (0.27)	0.40 (0.27)	0.62** (0.30)
log(Land area)	−0.39* (0.22)	−0.56* (0.28)	−0.27 (0.21)	−0.38* (0.22)	−0.56* (0.28)
log(GDP pc)	−0.02 (0.29)	0.21 (0.32)	0.65 (0.47)	−0.02 (0.29)	0.21 (0.32)
Federalism	0.60 (0.83)			0.60 (0.83)	
Spatial Gini		13.93 (15.77)			14.58 (15.74)
Democracy score			−1.50 (0.91)		
Constant	0.92 (4.78)	−2.94 (5.20)	−3.10 (4.59)	0.91 (4.78)	−3.07 (5.18)
Observations	62	60	62	62	60
R^2	0.14	0.15	0.18	0.14	0.15
Adjusted R^2	0.01	0.02	0.05	0.01	0.02
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 11

C Robustness Checks (Paired Comparison)

	Dependent variable:		
	MP born in seat (UK)		
	(1)	(2)	(3)
Party margin in previous election	-0.87^{*} (0.45)	-0.90^{**} (0.45)	-0.95^{**} (0.45)
Log(Constituency area)	-0.18^{***} (0.06)		
Constituency area		-0.0002^{*} (0.0001)	-0.0002 (0.0001)
Country[a]			
Northern Ireland		0.80 (1.01)	
Scotland		0.48 (0.32)	
Wales		0.37 (0.31)	
MP's Gender (male)			0.27 (0.17)
Party[b]			
Labour	1.06^{***} (0.21)	1.16^{***} (0.21)	1.31^{***} (0.21)
Lib Dem	0.27 (0.35)	0.33 (0.35)	0.43 (0.35)
Other	1.43^{***} (0.38)	0.65 (0.94)	1.34^{***} (0.38)
SNP	0.77^{**} (0.31)	0.30 (0.43)	0.75^{**} (0.31)
Election[c]			
2005	-0.09 (0.33)	0.02 (0.33)	0.02 (0.33)
2010	0.17 (0.30)	0.26 (0.30)	0.27 (0.30)
2015	0.58^{*} (0.32)	0.74^{**} (0.32)	0.76^{**} (0.32)
2017	0.48 (0.34)	0.51 (0.34)	0.56 (0.35)
2019	0.74^{**} (0.31)	0.87^{***} (0.32)	0.93^{***} (0.32)
By-election	0.07 (0.66)	0.21 (0.67)	0.19 (0.66)
Constant	-0.64 (0.43)	-1.62^{***} (0.29)	-1.82^{***} (0.34)
Party × Election Interaction	No	No	No
Observations	864	864	864
Log Likelihood	-506.54	-508.15	-508.66
Akaike Inf. Crit.	1,039.09	1,048.30	1,045.33

[a] = ref. cat. England, [b] = ref. cat. Conservative, [c] = ref. cat. 2001.
*p<0.1; **p<0.05; ***p<0.01

Table 12

	Dependent variable:		
	MP born in seat (UK)		
	(1)	(2)	(3)
Party margin in previous election	-1.06^{**} (0.49)	-1.04^{**} (0.50)	-1.14^{**} (0.49)
log(Constituency area)	-0.19^{***} (0.06)		
Constituency area		-0.0002^{*} (0.0001)	-0.0002^{*} (0.0001)
Country[a]			
Northern Ireland		0.76 (1.16)	
Scotland		0.49 (0.34)	
Wales		0.33 (0.31)	
MP's gender (male)			0.22 (0.17)
Party[b]			
Labour	2.29^{***} (0.82)	2.26^{***} (0.83)	2.49^{***} (0.82)
Lib Dem	2.01^{**} (0.96)	1.96^{**} (0.96)	2.09^{**} (0.96)
Other	2.37^{**} (1.04)	1.61 (1.39)	2.31^{**} (1.04)
SNP	2.06 (1.37)	1.53 (1.42)	2.02 (1.38)
Election[c]			
2005	0.81 (0.83)	0.86 (0.83)	0.88 (0.83)
2010	1.09 (0.76)	1.13 (0.76)	1.17 (0.76)
2015	1.74^{**} (0.78)	1.77^{**} (0.78)	1.84^{**} (0.78)
2017	1.65^{*} (0.84)	1.48^{*} (0.85)	1.69^{**} (0.84)
2019	1.91^{**} (0.76)	1.94^{**} (0.76)	2.02^{***} (0.76)
By-election	1.31 (1.38)	1.58 (1.37)	1.62 (1.37)
Constant	-1.59^{**} (0.80)	-2.54^{***} (0.73)	-2.74^{***} (0.75)
Party × Election Interaction	Yes	Yes	Yes
Observations	864	864	864
Log Likelihood	−493.07	−495.12	−495.77
Akaike Inf. Crit.	1,056.14	1,066.24	1,063.55

[a] = ref. cat. England, [b] = ref. cat. Conservative, [c] = ref. cat. 2001.
*p<0.1; **p<0.05; ***p<0.01

Table 13

	Dependent variable:		
	MP born in seat (German SM tier)		
	(1)	(2)	(3)
Party margin in previous election	1.19* (0.69)	1.07 (0.71)	1.21* (0.69)
log(Constituency area)	−0.04 (0.07)		
Constituency area		−0.0001 (0.0001)	−0.0002** (0.0001)
Region (West)		0.26 (0.25)	
MP's gender (male)			0.10 (0.20)
Party[a]			
Others	0.34 (0.52)	0.50 (0.54)	0.41 (0.53)
SPD	0.14 (0.23)	0.11 (0.23)	0.10 (0.23)
Election[b]			
2002	0.54* (0.30)	0.50* (0.30)	0.50* (0.30)
2005	0.48 (0.34)	0.46 (0.34)	0.45 (0.34)
2009	0.73** (0.32)	0.73** (0.32)	0.74** (0.32)
2013	0.89** (0.36)	0.91** (0.37)	0.89** (0.37)
2017	0.32 (0.33)	0.29 (0.34)	0.29 (0.34)
Constant	0.46 (0.57)	0.21 (0.38)	0.39 (0.33)
Party × Election Interaction	No	No	No
Observations	604	604	604
Log Likelihood	−367.36	−364.78	−365.21
Akaike Inf. Crit.	754.73	751.56	752.41

[a] = ref. cat. CDU/CSU, [b] = ref. cat. 1998; *p<0.1; **p<0.05; ***p<0.01

Table 14

	Dependent variable:		
	MP born in seat (German SM tier)		
	(1)	(2)	(3)
Party margin in previous election	1.59** (0.81)	1.53* (0.84)	1.64** (0.81)
log(Constituency area)	−0.01 (0.08)		
Constituency area		−0.0001 (0.0001)	−0.0002* (0.0001)
Region (West)		0.17 (0.25)	
MP's gender (male)			0.08 (0.20)
Others	14.11 (882.74)	13.94 (882.74)	14.01 (882.74)
SPD	−0.05 (0.56)	−0.06 (0.56)	−0.05 (0.57)
2002	0.39 (0.60)	0.38 (0.60)	0.40 (0.60)
2005	0.26 (0.62)	0.25 (0.62)	0.28 (0.62)
2009 election	0.72 (0.57)	0.73 (0.57)	0.75 (0.57)
2013	0.57 (0.59)	0.64 (0.59)	0.63 (0.59)
2017	−0.15 (0.57)	−0.16 (0.57)	−0.15 (0.58)
Party × Election Interaction	Yes	Yes	Yes
Observations	604	604	604
Log Likelihood	−362.78	−360.98	−361.12
Akaike Inf. Crit.	763.57	761.96	762.25
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 15