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Which electoral systems succeed at providing proportionality and concentration? Promising designs and risky tools

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Electoral systems are typically faced with the problem of being asked to provide both proportional representation and party system concentration leading to accountable government. Which electoral system designs are able to successfully deliver on both these challenges and thus optimize the representativeness – accountability trade-off? This paper investigates the performance of different general electoral system designs as well as their specific technical details (such as legal threshold, tier linkages, and compensation mechanisms) based on a data set of 590 elections in 57 countries. The key results are that both proportional representation systems with moderate district magnitudes and mixed-member proportional systems are able to optimize performance. Going to the level of details confirms these results and deepens our understanding further: while different technical changes are able to improve the chances of reaching the best of both worlds, some of these (e.g. raising the legal threshold) also increase the risk of ending up with the worst.

Keywords: concentration; electoral systems; proportionality

Introduction

Electoral institutions present the very core of a democratic political system as they affect voter, candidate, and party behavior and eventually transform votes into parliamentary representation (Gallagher and Mitchell, 2005: 3; Farrell, 2011: 1). An evaluation of these elementary democratic institutions is therefore a key objective of political science. The focus with improving design typically lies on the question of how to satisfy the competing demands of providing proportional representation (PR) and facilitating accountable government via a concentrated party system – the representativeness–accountability trade-off (Carey and Hix, 2011: 385). While plurality systems are typically associated with single-party governments and PR systems with high representativeness, both often perform poorly with regard to the respective other dimension. Therefore, a desirable solution is not only to balance these two demands but to provide both of these functions to a satisfactory degree and thereby reach a superior middle-ground in electoral system design (see originally Lijphart, 1984).

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However, while there are general hopes as well as outright recommendations for general types of systems – mixed-member electoral systems (e.g. Shugart, 2001; Shugart and Wattenberg, 2001; Birch, 2003) or, most recently, PR systems with a moderate district magnitude (Carey and Hix, 2011) – a thorough empirical test of such competing claims is still lacking. Existing analyses either focus only on a subset of electoral systems and the concentration dimension (Kostadinova, 2002; Nishikawa and Herron, 2004) or on one specific technical element (typically district magnitude; Lijphart, 1994; Cox, 1997; Carey and Hix, 2011), and none directly investigate the role of different combinations of technical details. Following the study by Carey and Hix (2011) who were the first to explicitly investigate the (shape of the) proportionality–concentration trade-off in a large-n assessment, this paper seeks to thoroughly contribute to the research question by investigating all types of electoral systems and by understanding them both as general types as well as the sum of their technical features. This holistic approach allows us to reach very specific conclusions about how the precise institutional setup of an electoral system affects the likelihood of attaining desirable levels of proportionality and concentration. By looking carefully at the combinations of various technical details such as district magnitude, legal threshold, tier linkage, and the level of compensation in mixed-tier electoral systems, this paper explores whether instead of just one 'sweet spot' (Carey and Hix, 2011) there are potentially multiple promising electoral system designs. This importantly also includes an assessment of which technical features are safer and which are riskier tools in aiming for a superior middle-ground in electoral system design.

The paper proceeds as follows. First, we will revisit the quest for optimal performance with regard to both proportionality and concentration and map out the different arguments as to which electoral system designs are expected to do well in aiming for a superior middle-ground. In a next step, we highlight the importance of moving from a more general level of different types of systems to the level of technical details, also accounting for the fact that similar general electoral system types might be based on different technical specifications. After a discussion of our data, the variables we use and how we approach key methodological challenges, the empirical analysis of 590 elections in 57 countries will test which electoral system types and details lead to differences in their eventual performance. The conclusion summarizes the results and provides clear implications as to which and how different technical elements can be useful tools for reaching an efficient outcome along the trade-off between proportionality and concentration.

Successfully balancing proportionality and concentration: general design propositions

The biggest challenge for electoral system designers typically is to satisfy demands with respect to the competing general goals of proportionality and concentration (Nohlen, 1984; Powell, 2000; Raabe and Linhart, 2012; Raabe, 2015). While other functions and qualities of electoral systems, such as personal representation,

democratic legitimacy, and understandability, are not of minor importance, these demands do not contradict each other and may be fulfilled simultaneously. On the contrary, proportionality and concentration form the key trade-off in electoral system design: the more proportional an electoral system is, the less it can concentrate the party system and vice versa. Hence, the search for a superior middle-ground with respect to these goals is most pressing (initially Lijphart, 1984; also see Shugart and Wattenberg, 2001; Carey and Hix, 2011).

Proportionality primarily focuses on accurate representation of voter groups within the parliament. The main idea behind this principle is that parliamentary representation mirroring the sizes of voter groups can be considered as fair. This principle also includes that minority groups should get realistic chances for parliamentary representation. The advantage of concentrated party systems, on the other hand, is that government formation is connected more strongly to the voters' choice. In the clearest cases, one single party wins a majority of seats and forms a government – and thus can be held responsible for its performance in the upcoming elections. The more fragmented a party system is, the less clear it becomes who is an election winner and the more government formation depends on coalition bargaining between parties instead of election results. At the same time, more fragmented party systems generally lead to more parties in government so that single parties in government can be held accountable by the voters only partially (Powell, 2000).[1]

As polar design options, pure PR electoral systems are associated with highly representative parliaments that allow for a more nuanced representation of the electorate, while plurality electoral rules are associated with the creation of accountable single-party governments (Duverger, 1954; Rae, 1967; Farrell, 2011). However, PR systems typically fail to concentrate the party system in order to enable swift government formation and plurality systems fail to provide accurate representation and to account for minority interests (Shugart, 2001). So far, the literature has come up with two general design propositions for achieving a superior balance of proportionality and concentration.

The first general approach is to combine the elements of both pure system types in mixed-member electoral systems (Lijphart, 1984: 207; Shugart and Wattenberg, 2001; Birch, 2003). Spurred by the success story of the German mixed-member system (Kaase, 1984; Nishikawa and Herron, 2004: 767; Saalfeld, 2005), the high expectations for these systems led to a wave of electoral reforms to mixed-member electoral systems in the late 1980s and early 1990s (e.g. in New Zealand, Japan, Venezuela, and a plethora of Eastern European and South East Asian countries; see Massicotte and Blais, 1999; Ferrara *et al.*, 2005: 1–14). The argument for why mixed-member systems should be able to provide for both high levels of proportionality and concentration is that the presence of elections in single-member districts should focus party competition on two main parties with which a few

[1] Furthermore, the more parties in government are able to break the government by leaving it, the less stable is the government.

smaller parties are associated in political blocs (see Shugart and Wattenberg, 2001; Kostadinova, 2002: 25; D'Alimonte *et al*., 2012). As this is largely a psychological, coordinating effect, election outcomes should still remain fairly proportional in these systems. This general idea was initially upheld notwithstanding the technical specification of the mixed-member electoral system (Shugart, 2001; Shugart and Wattenberg, 2001). After a first period of empirical evaluation, the mixed-member proportional (MMP) type (in which disproportionalities arising in the plurality tier are compensated by the PR tier) has received much more acclaim than the mixed-member majoritarian (MMM) type where both tiers operate independently (see Nishikawa and Herron, 2004: 767; Bowler *et al*., 2005; Gallagher, 2005: 575; Farrell, 2011: 108). We thus denote the first general proposition as to which design approach should reach a superior middle-ground in electoral system performance.

MIXED-MEMBER SYSTEM PROPOSITION: Mixed-member electoral systems are best able to successfully provide both proportionality and concentration. Especially MMP electoral systems are expected to provide such successful balance.

The second general approach is to apply a PR electoral system but with moderate district magnitudes (Carey and Hix, 2011). The argument why this electoral system design should provide for a superior balance of proportionality and concentration is similar to the one for mixed-member electoral systems: moderate district magnitudes (between three and nine) mark the 'sweet spot' in electoral system design as they allow for a vastly improved degree of representativeness compared to plurality systems in single-member districts but still put pressure on voters and parties to coordinate on the most viable candidates (Carey and Hix, 2011; also see Cox and Shugart, 1996). Carey and Hix (2011) focus on the core technical element of district magnitude and its coordination effects (as do Lijphart, 1994; Cox, 1997) but eventually turn their argument into a sweeping general design advice. We therefore denote the second general proposition as to how to reach a superior balance of proportionality and concentration.

MODERATE MAGNITUDE PR PROPOSITION: PR electoral systems with moderate district magnitudes are best able to successfully provide both proportionality and concentration.

The above has solely focused on how mixed-member and moderate magnitude PR systems might lead to an improved electoral system performance considering the trade-off between proportionality and concentration. However, several researchers highlight that the opposite may well be true in that mixed-member electoral systems could also lead to perverse effects and a combination of pure systems' weaknesses (see Sartori, 1997: 74–75; Monroe, 2003). The same is possible for PR systems with moderate district magnitudes as these could disturb proportionality to a substantial degree but still fail to concentrate the party system in cases where party system

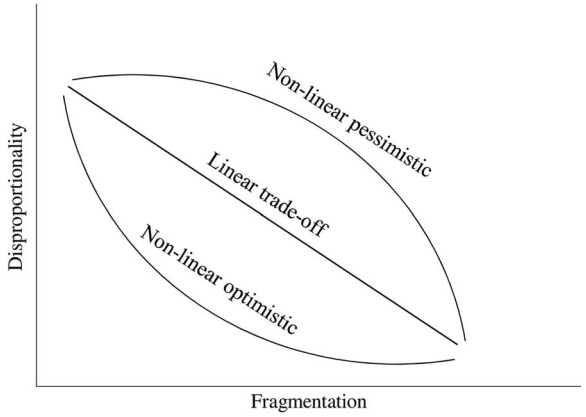

Figure 1 Promises and pitfalls of aiming for a superior balance.

nationalization is low and different parties compete in different districts (see Cox, 1997, 1999; Morgenstern *et al.*, 2009). Thus, the empirical analysis will also assess in how far the propositions risk undesirable performances with regard to proportionality, concentration, or even both. Figure 1 (based on Carey and Hix, 2011; Linhart, 2009) depicts three possible shapes of the trade-off between reducing party system fragmentation (i.e. concentrating the party system) and disturbing the proportionality of parliamentary representation. The trade-off would be completely linear if there was no real potential for a superior middle-ground in electoral system design – every improvement in one dimension would cause a disruption in the other. As suggested by the two general propositions above, the trade-off might be non-linear, performing well with regard to both proportionality and concentration for electoral systems combining incentives from pure types (also see Taagepera and Shugart, 1989). However, as implied by the potential riskiness of adopting such systems, a non-linear trade-off could also work in the opposite way suggesting sub-par performances in both dimensions.

The underappreciated role of (combinations of) technical details

The proposition of general types of systems is certainly necessary to categorize electoral systems but to a certain degree can block our view on the different combinations of technical components that are subsumed under these general types. Obviously, it would be of great help if general types of electoral systems could be categorized as to how they perform along the lines of the proportionality – concentration trade-off and this would then lead to clear-cut implications for electoral reform. However, these sweeping design propositions suggest a design-uniformity that simply is not given in the world of electoral systems. Electoral systems are – technically spoken – combinations of different mathematical

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Table 1. Technical details of electoral systems

Technical element	Simple plurality	Intermediate cases	PR
District magnitude	1	Multiple districts, at least one district with a magnitude greater than one	Equals parliament size
Legal threshold[a]	High	Moderate	None
Formula	Plurality or majority rule	Use of both formulas (mixed-member systems)	PR method (e.g. d'Hondt)
Compensation via additional tiers	No compensation via a PR tier	Partial compensation of disproportionalities via a PR tier	Full compensation of disproportionalities via a PR tier

PR = proportional representation.
Based on Raabe and Linhart (2012: 508).
[a]Of course, a high legal threshold does not say that an electoral system is of the simple plurality type, however, high thresholds lead to the same type of structural effects favoring the (two) largest parties.

tools, and variations in the performance of electoral systems might be caused by more subtle differences in their technical setup than suggested by their general types. It is thus critical to move from the level of fundamental type differences between electoral systems to that of technical details. Table 1 presents an overview of those details that are relevant to the proportionality–concentration trade-off. First, the district magnitude – arguably the most prominent tool to move electoral systems between the worlds of plurality and PR (Lijphart, 1994; Carey and Hix, 2011) – allows for nuanced design as lowering district magnitude leads to a lower number of viable parties (Cox, 1997). Second, a similar effect might arise from employing legal thresholds that restrict parliamentary representation to those parties accumulating a certain share of the total votes. Third, electoral systems might either use a specific plurality rule or a specific PR method for seat allocation in pure systems. It is, however, also possible to allocate a subset of parliamentary seats according to the first and the rest according to the other type of allocation rule. The latter is done in all mixed-member electoral systems with the share of seats allocated under each formula being an important mechanism for steering the electoral system between outcomes closer to those of simple plurality or full-bore PR systems. Finally, additional tiers may be used to compensate for disproportionalities arising in other tiers. For mixed-member electoral systems, the question of whether the second tier of PR seats is used to compensate for the results in the single-member district tier is critical and sometimes overlooked when mixed-member systems are treated as a coherent group. MMM systems have no such compensatory linkage while MMP systems do (Massicotte and Blais, 1999). Furthermore, the degree of compensation that is possible is vital – if there are many PR seats available to compensate for disproportionalities, full compensation may be achieved. Note that, especially for mixed-member systems, formula and compensation are not one and the same. Deciding how many seats are allocated under which formula is one detail question,

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another is whether the subset of seats allocated via PR is used to compensate for disproportionalities arising from the seat allocation according to the plurality formula or not. The distinction between formula and compensation is further highlighted by the fact that PR systems (using only a PR formula) with multiple districts can have an additional (national) tier of seats that aims at correcting the disproportionalities arising from PR allocation within smaller multi-member districts ('national top-up seats'; Rose, 1983: 38).

All of these technical elements are thus highly useful in moving an overall design closer to plurality or PR rules as well as for trying to reach intermediate positions on the proportionality–concentration trade-off. What becomes apparent immediately is that the sorting of electoral systems into different general types appears to build on only one (at best two) technical elements. Mixed-member systems do make use of both plurality/majority and PR formulas. However, they may vary in whether or not they are compensatory mixed-member systems, the height of their legal threshold for the seat allocation in the PR tier, and the district magnitudes. While for mixed-member systems a differentiation between MMM and MMP is now commonplace, this distinction can still mislead. An MMM system with relatively few single-member districts is likely to perform more like a pure PR system than an MMP system where only a few PR seats are available for compensation (see Bochsler, 2012). Similarly, PR systems with moderate district magnitudes might also additionally employ a legal threshold or a compensatory tier. By only looking at general types, researchers run the risk of neglecting other technical elements which may point to an overall technical design that is not described properly by the type variable. Kostadinova (2002, 31) underlines this argument when she states that the legal threshold is a 'powerful mechanism for reducing fragmentation in the assembly […] without changing the fundamentals of the system itself' and its importance might often go unnoticed due to its relative independence from general system types. As a consequence, it remains unclear why exactly experts favor the MMP system type (Bowler *et al.*, 2005) – potentially because the reason is not so much type – as it is detail related and experts prefer an MMP system with a 5% legal threshold as applied in Germany and New Zealand (Bowler and Farrell, 2006: 450). We thus propose to take all relevant technical details into account and assess general propositions and design advice based on different possible technical specifications on the detail level.

TECHNICAL DETAILS PROPOSITION: We expect that the share of single-member districts, the district magnitude, the legal threshold, and the level of compensation each exert individual effects on the propensity of an electoral system to successfully provide both proportionality and concentration.

Taking this proposition of paying close attention to the detail level seriously should lead to multiple benefits: first, unlike with general type propositions, this perspective does not unnecessarily narrow the scope of possibly attractive design options by

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focusing too heavily on one specific technical element that is fundamental to the respective type definition. This should also lead to less noisy results caused by the potentially unwarranted inclusion of fairly different systems into the same general type category. Second, the detail-level approach should lead to more clear-cut implications by allowing for inferences regarding very specific design options. And finally, as concerns shaping the trade-off between proportionality and concentration into a desirable direction, it will be crucial to differentiate between those technical details that are safer and those that are riskier tools for doing so. Accordingly, the empirical analysis will consider both the possibility of there being multiple 'sweet spots' instead of just one (Carey and Hix, 2011) as well as the problem of design pitfalls.

Data, variables, and methodological challenges

Our data set consists of 590 elections in 57 countries after 1945. Relying on existing data sources such as Dawn Brancati's Global Elections Database (Brancati, 2015), Adam Carr's Election Archive (Carr, 2015), different volumes (co-)edited by Nohlen (Nohlen, 1999, 2005; Nohlen and Stöver, 2010), and official election statistics from the respective national institutions we compiled complete election results for a large number of competitive elections.[2] Information about the precise technical design of these systems partly come from Bormann and Golder (2013) but were updated substantially in order to also cover the legal threshold on the national level (for which we consulted and amended the data from Beck *et al.*, 2001) and the exact share of seats allocated in single-member districts. Based on these data we are able to sort electoral systems into general types and, in a second step, to disaggregate them into their technical details as listed in Table 1. We present summary statistics of our data set in online Appendix A which shows that the data set includes many elections under mixed-member electoral systems (21% of all elections) and that there is quite a lot of variation in the share of single-member districts among electoral systems as well as regarding the presence of compensation mechanisms (compensation via a PR tier in an MMP electoral system or via a national top-up tier in an otherwise PR system). Similarly, there is a lot of variation with respect to district magnitude and the height of the legal threshold. The empirical analyses will make full use of these variations in estimating electoral system effects.

In order to be able to control for sociopolitical scope conditions we added several variables relating to the overall political system such as the level of presidential power

[2] The data set contains election results for the following countries: Albania, Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, El Salvador, Estonia, Finland, France, Georgia, Germany, Greece, Guatemala, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lesotho, Lithuania, Luxembourg, Macedonia, Malta, Mexico, Mongolia, Nepal, the Netherlands, New Zealand, Norway, Paraguay, Poland, Portugal, Romania, Senegal, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Kingdom, Venezuela.

(Doyle and Elgie, 2016), ethnic heterogeneity (Fearon, 2003), and whether a country is politically decentralized, providing elected sub-national governments with policy-making authority (Brancati, 2008; Hooghe *et al.*, 2010). More context variables relating to the level and age of democracy come from the Polity IV data set (Marshall *et al.*, 2014). Finally, additional characteristics of a country's overall institutional setup are added from the Database of Political Institutions (Beck *et al.*, 2001).

Turning to the dependent variables – the level of proportionality and the degree of concentration of the party system – we use the two most widely applied measures in electoral system research in order to be able to directly compare our conclusions regarding the usefulness of type-based electoral system evaluations *vis-à-vis* detail-based evaluations with the conclusions of existing studies based on these measures (e.g. Lijphart, 1994; Kostadinova, 2002; Nishikawa and Herron, 2004; Gallagher and Mitchell, 2005; Carey and Hix, 2011). We measure the level of proportionality with the least squares index (LSI; Gallagher, 1991) that provides a measure of how disproportional the distribution of parliamentary seats is compared to the distribution of vote shares: $\text{LSI} = \sqrt{\sum_p (s_p - v_p)^2 / 2}$, where s_p denotes the seat share of a party p and v_p its vote share).[3] When it comes to the concentration of the party system we apply the 'effective number of parties' (ENP) measure based on parliamentary seat distributions (Laakso and Taagepera, 1979): $\text{ENP} = 1 \Big/ \left(\sum_p s_p^2 \right)$. This measure gives an intuitive account of the fragmentation of the party system in displaying the number of hypothetical equal-sized parties and implies the likely size of governing coalitions. The ENP has quite clear implications for how easily governments may be formed and how stable they will be (e.g. Powell, 2000) as well as whether voters will be able to hold governments accountable by assigning responsibility (e.g. Hobolt *et al.*, 2013). The higher the ENP, the more difficult it becomes to achieve aforementioned goals. In this way the ENP not only provides a comprehensive overview of the party system structure but also is a proven – albeit indirect – measure of the governability and accountability dimension (also see Carey and Hix, 2011). In using the LSI and ENP we thus rely on well-established measures of proportionality and concentration that have also been linked theoretically as well as empirically to other important qualities of electoral systems and democracies as a whole.

A cross-country analysis of electoral systems is always confronted with the key challenge that (large-scale) electoral reforms are rare and thus electoral system variables

[3] In the case of mixed-member systems in which voters cast two separate votes (one in the single-member district tier and one in the PR tier) we use parties' vote shares in the PR tier for calculating the disproportionality index since the distribution in the PR tier – basically by definition – is more reflecting of what voters would like the parliamentary seat distribution to look like. Nevertheless, it is worth noting that, given the typically limited tendencies of voters to split their votes in established and especially new democracies (Moser and Scheiner, 2009), results would not change strongly if disproportionality was based on total votes in both tiers for mixed-member systems.

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are usually rather stable over time. Hence, the typical use of country fixed effects in order to capture effects specific to single countries is not feasible here because such models would not be able to provide coherent estimates of electoral system effects (Greene, 2011).[4] The key problem with the fixed effects approach is that due to the relative time-invariance of electoral system variables, there is a high level of multicollinearity between country dummies, and electoral system variables and estimates in that case become unstable and unreliable as it is unclear whether electoral system effects are picked up by electoral system variables or country dummies (also see Bell and Jones, 2015). Thus the results of our paper have to be understood to be based heavily on the cross-sectional variation within our data set. By including multiple sociopolitical control variables (see above) into our statistical models we capture some general differences between countries without using country fixed effects.

Empirical analysis

Our empirical part relies on two types of tests: first, we investigate the impact of different electoral system designs on both dimensions – proportionality and concentration – separately. Second, we use logit regression models to predict whether an electoral system will perform well (better than the median outcome; also see Carey and Hix, 2011: 393) in both dimensions simultaneously.

The general design propositions

Starting with an investigation of general electoral system types, Figure 2 splits electoral systems into five categories: PR with high mean district magnitude (10 or above),[5] PR with moderate district magnitudes (below 10), MMP and MMM systems, and plurality/majority systems where all seats are contested in single-member districts (SMDs). We show boxplots for all general designs with regard to ENP and LSI. The horizontal lines represent the respective median outcomes considering all observations in the data set. While PR systems, generally, are associated with the lowest LSI and highest ENP values, we see differences between PR systems with moderate and high district magnitudes. These discrepancies are more striking for party system concentration which is a first hint that there could be a better trade-off between the two dimensions in moderate district magnitude PR systems. Turning to the two design options of the mixed-member proposition, we further clearly see how the two different types differ starkly with regard to their level of proportionality – with MMP systems, as expected, leading to much more proportional outcomes. MMM systems, however, are connected with lower levels of party system fragmentation. Yet, the latter difference in the

[4] In this regard, studies of district magnitude at the district level (such as Carey and Hix, 2011) have the clear advantage of substantial within-country variation.

[5] We follow Carey and Hix (2011: 393) in defining what is a low-to-moderate district magnitude PR system. However, the results presented below are not sensitive to the exact cut-off point for demarcating different types of PR systems.

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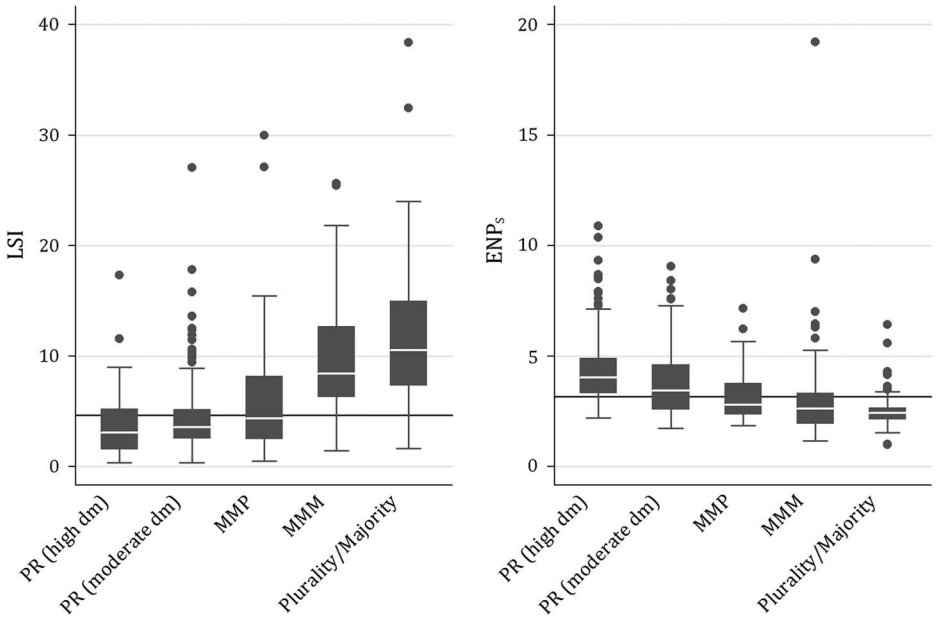

Figure 2 Performance of system types in separate dimensions. LSI = least squares index; ENP = effective number of parties; PR = proportional representation; dm = district magnitudes; MMP = mixed-member proportional; MMM = mixed-member majoritarian.

concentration dimension is less pronounced. Thus, Figure 2 suggests that – in line with the more recent suggestions about mixed-member systems – the MMP design, too, could very well be able to provide for both PR and a sufficiently concentrated party system. MMP is the only general system type for which the median outcomes in both dimensions lie below the overall median outcomes.[6] The MMM variant, on the other hand, seems more akin to the pure plurality design in how it shapes the party system.

Considering the performance in both dimensions simultaneously, the scatterplot in Figure 3 helps us get a better idea of whether the general differences suggested by Figure 2 hold up.[7] The cross hairs are based on the overall medians in both dimensions and provide a benchmark with which to distinguish between doubly good performance (lower-left quadrant), especially weak performance (upper-right quadrant), and one-sided performance (remaining quadrants). Accordingly, Table 2 provides an overview of how often doubly good, doubly bad performances, or good performance in one and bad performance in the other dimension are reached under different general

[6] It should be mentioned that the two (surprisingly) extreme cases of disproportionality under MMP rules can be explained by a manipulation strategy aimed at circumventing the compensation mechanism in MMP systems as discussed in-depth by Bochsler (2012; also see Elklit, 2008).

[7] The scatterplots exclude outliers (ENP > 10; LSI > 20) in order to enable the reader to interpret the scatterplots already dense with many observations.

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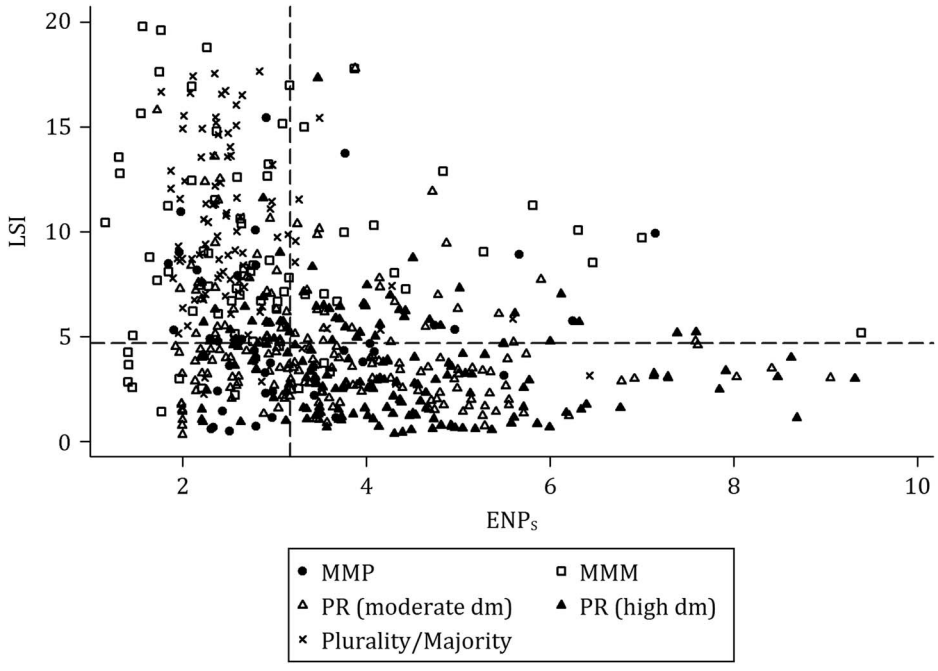

Figure 3 Overall performance of different general designs. LSI = least squares index; ENP = effective number of parties; PR = proportional representation; dm = district magnitude; MMP = mixed-member proportional; MMM = mixed-member majoritarian.

Table 2. General designs and their performance

Electoral system	Doubly good performance	Doubly bad performance	Proportional but fragmented	Concentrated but disproportional	*N*
PR (high dm)	18 (11%)	31 (19%)	94 (58%)	18 (11%)	161
PR (moderate dm)	45 (23%)	28 (15%)	91 (46%)	35 (18%)	199
MMP	16 (34%)	7 (15%)	9 (19%)	15 (32%)	47
MMM	9 (12%)	17 (23%)	3 (4%)	46 (61%)	75
Plurality/majority	5 (5%)	10 (10%)	3 (3%)	86 (83%)	104
All	93 (16%)	93 (16%)	200 (34%)	200 (34%)	586

PR = proportional representation; dm = district magnitudes; MMP = mixed-member proportional; MMM = mixed-member majoritarian.
Percentages provided in parentheses are row percentages rounded to the nearest whole number.

designs. Corroborating the results presented in Figure 2, MMP systems as well as PR systems with moderate district magnitude often combine desirable results in both dimensions (they appear fairly often in the lower-left quadrant and the regions

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close to it). As both these systems lead to doubly good performance above average and much more often than to doubly bad performance, Table 2 suggests that both these general designs are able to realize a non-linear trade-off that sees good performance in both dimensions. Elections under MMM rules are scattered all over Figure 3, implying that MMM systems are unlikely to provide for a successful balance of proportionality and concentration on a consistent basis – Table 2 even suggests that MMM systems are relatively prone to lead to worst of both worlds outcomes. Unsurprisingly, highlighted by Figure 3 and Table 2, plurality/majority systems and PR systems with high district magnitude usually perform well in one and badly in the other dimension. That PR systems with high district magnitudes are also frequently found to perform badly in both dimensions can be explained sensibly only by considering technical details such as legal thresholds.

In order to confirm the above results, we use a logit regression with a dependent dummy variable equaling one if an election is both more proportional and more concentrated than the median election. Controlling for the level and age of democracy, the level of presidential power, political decentralization, and ethnic heterogeneity, the estimation confirms what we have described above. The logit results are provided in online Appendix B, Figure 4 summarizes the results by presenting predicted probabilities of doubly good performance for all five design types. MMP and PR with moderate district magnitude are the two systems most likely to perform well in both dimensions, while plurality/majority, PR with large district magnitudes as well as MMM are extremely unlikely to perform well in both dimensions.[8]

Looking at the worst of both worlds potential of different systems, running the same logit model for a dummy variable signaling doubly bad performance yields no significant differences between design types and thus provides little design guidance (see online Appendix B). Here, only context variables such as the age of democracy (exerting a negative effect) and the level of ethnic heterogeneity (making doubly bad performance much more likely) are important predictors. In sum, these results with respect to general types suggest that some designs (MMP and PR with moderate district magnitudes) are more likely to produce the best of both worlds and at the same time are not more 'risky' in the sense that they are more likely to produce doubly bad results. Yet, as highlighted by Figure 3 and Table 2, many performance differences are left unexplained. Especially the lack of any guidance regarding how to avoid the undesirable event of a worst of both worlds outcome seems problematic. Furthermore, neglecting technical details could lead to problematic inferences based on the results with respect to general types – both praise and criticism could potentially be misdirected.

[8] We also ran a regression model using the normalized distance from the outcome of ENP = 1 and LSI = 0 as a dependent variable. This model leads to the same substantial conclusions as the more straightforward logit model with PR systems performing slightly better in the former model.

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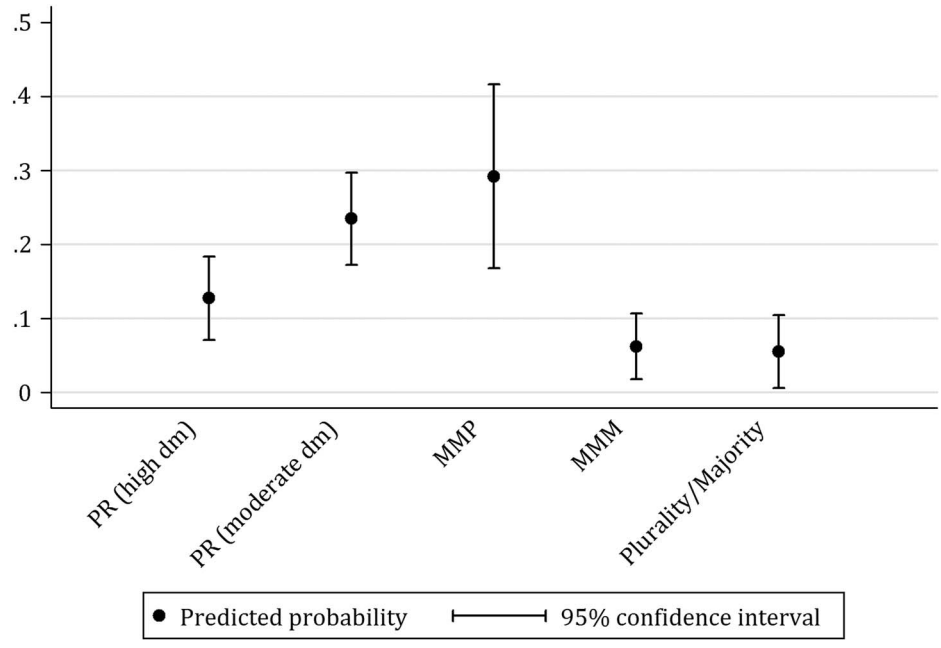

Figure 4 Predicted probabilities of performing well in both dimensions. PR = proportional representation; dm = district magnitudes; MMP = mixed-member proportional; MMM = mixed-member majoritarian.

The role of technical details

As we move on to investigate the technical details that affect how an electoral system performs with regard to the proportionality–concentration trade-off, Table 3 presents the results of regressions for the performance in the different dimensions. Table 3 highlights how the addition of context variables does improve model fit, but also that there are no substantial changes in the estimated coefficients.[9] As for the technical details, six variables enter the models: the mean district magnitude[10] of an electoral system as well as the squared mean district magnitude (following the argument in Carey and Hix, 2011; also see Lijphart, 1994), the height of the legal threshold, the share of seats contested in SMDs, and two dummy variables signaling the level of compensation, with one indicating whether there is a compensatory PR tier in a mixed-member system and a second indicating whether there is a small-sized tier of national top-up (PR) seats that is meant to

[9] We also ran random effects models and different jackknife models. While many variables ceased to be statistically significant in the jackknife models – where whole country clusters were dropped one at a time – the substantial effects importantly remained stable.

[10] In mixed-member systems, the calculation of the mean district magnitude is sensitive to the type of mixed-member system. In MMM systems, the mean district magnitude is calculated based on all electoral districts (whether PR or SMD) as all are equally relevant to the overall seat distribution. In MMP systems, the mean district magnitude is calculated based on all PR electoral districts.

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Table 3. Ordinary least squares regression models

	LSI		ENP	
Variables	Model 1	Model 2	Model 3	Model 4
Mean district magnitude	– 0.0193 (0.0052)***	–0.0229 (0.0054)***	0.0135 (0.0027)***	0.0136 (0.0027)***
Squared mean district magnitude	1.81e–05 (1.05e–05)*	2.62e–05 (1.03e–05)**	–2.34e–05 (4.68e–06)***	–2.47e–05 (4.59e–06)***
Legal threshold	0.332 (0.118)***	0.266 (0.130)**	–0.105 (0.0331)***	–0.0835 (0.0413)**
Share of SMD seats	7.206 (0.579)***	7.387 (0.623)***	–1.265 (0.143)***	–1.543 (0.178)***
Compensatory PR tier	–1.114 (1.148)	–0.918 (1.131)	–0.0766 (0.276)	–0.0834 (0.273)
National top-up tier	–1.393 (0.368)***	–1.287 (0.399)***	0.484 (0.163)***	0.317 (0.170)*
Level of democracy		–0.123 (0.145)		–0.0109 (0.0366)
Age of democracy		–0.00425 (0.0090)		0.00729 (0.0031)**
Presidential power		–0.165 (1.654)		0.408 (0.567)
Political decentralization		–0.971 (0.428)**		0.447 (0.147)***
Constant	4.619 (0.196)***	6.440 (1.565)***	3.700 (0.117)***	3.458 (0.447)***
Observations	585	561	585	561
R^2	0.372	0.387	0.217	0.249

LSI = least squares index; ENP = effective number of parties; SMD = single-member district; PR = proportional representation.
Robust standard errors in parentheses.
$^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

compensate for remaining disproportionalities arising in PR or mixed-member systems after the allocation in the main tiers has concluded.[11] Importantly, using all these technical details as independent variables is not meant to dispute the importance of general designs as reference points, but includes these general designs into a more flexible framework of technical details that allows for carefully assessing the effects of single elements and various detail combinations. Our detail-based models thus include general design types as specific combinations of technical details.

Turning to the results, the effects of different technical variables on disproportionality and concentration largely are as expected. First, increasing district magnitude means lowering disproportionality while increasing the ENP – however, both effects are diminishing as district magnitude grows larger.[12] Second, raising the legal threshold increases disproportionality and has a reductive impact on party system fragmentation. Third, as the share of SMDs increases, so does disproportionality while the ENP shrinks. Fourth, the presence of a compensatory PR tier does not exert significant effects on either dimension. And finally, the presence of a small tier of national top-up seats reduces disproportionality while increasing the ENP. While all these individual effects are hardly surprising, the key message of Table 3 is that all technical details, except for the presence of a compensatory PR tier, are significant factors in explaining both disproportionality and concentration – a simple type differentiation of electoral systems thus runs the risk of neglecting critical technical details. Furthermore, while the dummy variable indicating that a compensatory PR tier is being used is not statistically significant, it is the only variable whose estimates suggest an effect that is in line with a doubly good performance regarding proportionality and concentration – the presence of a compensatory PR tier is estimated to have a negative effect on both LSI and ENP. The other technical details trade-off proportionality and concentration in the commonly expected way. In the following, it will be critical to further assess the technical details to see whether these potentially function as useful tools in fulfilling competing demands successfully, for example, because they exert a strong positive impact on one dimension but merely a small negative effect in the other.

Table 4 presents the results of logit regressions that highlight the different technical elements' effects on the probability of a successful balance (below-median performance in both dimensions; models 1 and 2) and on a doubly bad performance (above-median

[11] We also tested models where we entered interaction terms between the presence of a compensatory PR tier and the legal threshold, the mean district magnitude, or the share of SMDs in order to be more precise about the level of compensation that is possible. However, as the inclusion of such interactions did not improve model fit, we decided to present leaner models without interaction terms. Furthermore, we applied variance inflation tests for all estimated models which suggest that there is only very limited multicollinearity among the independent variables.

[12] If we also include ethnic heterogeneity into the models, there is a significant interaction between ethnic heterogeneity and district magnitude as suggested by the literature (see Ordeshook and Shvetsova, 1994; Amorim Neto and Cox, 1997; Clark and Golder, 2006), yet the structure of the effect of district magnitude remains unchanged.

Table 4. Logit regression models

	Doubly good		Doubly bad	
Variables	Model 1	Model 2	Model 3	Model 4
Mean district magnitude	−0.0120 (0.00373)***	−0.0100 (0.00388)***	0.00159 (0.00389)	0.00202 (0.00403)
Squared mean district magnitude	2.56e−05 (8.28e−06)***	2.20e−05 (8.29e−06)***	−1.08e−05 (7.83e−06)	−1.06e−05 (8.35e−06)
Legal threshold	0.109 (0.0483)**	0.0906 (0.0608)	0.207 (0.0596)***	0.132 (0.0591)**
Share of SMD seats	−1.300 (0.400)***	−1.610 (0.473)***	−0.889 (0.374)**	−0.968 (0.447)**
Compensatory PR tier	1.048 (0.443)**	1.159 (0.469)**	0.172 (0.603)	0.254 (0.540)
National top-up tier	−0.652 (0.297)**	−0.506 (0.290)*	−0.896 (0.326)***	−0.907 (0.341)***
Level of democracy		−0.0455 (0.0715)		0.00586 (0.0439)
Age of democracy		−0.0200 (0.00755)***		−0.0133 (0.00769)*
Presidential power		−1.430 (0.962)		1.047 (0.789)
Political decentralization		0.602 (0.271)**		−0.0737 (0.293)
Constant	−1.353 (0.218)***	−0.564 (0.728)	−1.632 (0.235)***	−1.247 (0.585)**
Observations	585	561	585	561
Pseudo R^2	0.079	0.116	0.056	0.077

SMD = single-member district; PR = proportional representation.
Robust standard errors in parentheses.
***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

performance in both dimensions; models 3 and 4).[13] Turning first to good performance in both dimensions, models 1 and 2 show that while the presence of a compensatory PR tier did not exert significant effects on the individual dimensions, it does make a doubly good performance more likely and thus stands out as one technical element prone to provide for high levels of both proportionality and concentration. However, this positive effect could be negated in a mixed-member electoral system employing a large share of SMDs, since increasing the latter makes a doubly good performance less likely by boosting disproportionality. The same negative effect is estimated for the presence of an additional tier with national top-up seats, likely because – for the overall election outcome – the additional proportionality comes with the cost of increased levels of party system fragmentation as small parties are encouraged to contest all districts in order to gain votes for the top-up allocation.

The negative linear effect of district magnitude needs to be understood alongside the effect of the share of SMDs which signals which types of districts are at all possible: assuming we are in a PR or mixed-member system, it is thus best to go with small-to-moderate districts as increasing district magnitude would render reaching the best of both worlds less likely (as suggested by Carey and Hix, 2011). However, if district magnitude was to be lowered so far that a plurality electoral system would have to be used, there would actually be a strong overall decrease of the probability of a doubly good performance due to the related change from zero (or, say, 50%) SMDs to a share of 100% SMDs. We will further discuss such combination-based effects below. The – unexpected when it comes to the direction – significant curvilinear effect that kicks in at very high mean district magnitudes (above 300) should be neglected as it derives solely from the inclusion of German elections into the data set.[14] Finally, the legal threshold exerts a positive effect on the probability of a doubly good performance.

Moving our attention to models 3 and 4 which estimate the effects of different elements on the probability of an especially bad performance, we can see that while the legal threshold improves the chances of a good performance in both dimensions, increasing it also means a higher risk of the electoral system failing both to provide sufficient proportionality *and* to foster sufficient concentration. The legal threshold thus emerges as a useful but risky tool when aiming for a superior balance. The addition of a compensatory PR tier as well as increasing district magnitude, on the

[13] The same technical problems, our respective solutions and robustness checks that were discussed with respect to the linear regressions presented in Table 3 also apply for the logit regressions presented in Table 4. We also ran the same models based on overall means as performance benchmarks and retained the same substantial results.

[14] Once we either exclude the German cases (with an exceptionally high district magnitude) from the model or treat all mean district magnitudes above 100 as all being of the same magnitude, the squared term ceases to be anywhere close to statistical significance. If, next to the German cases, the share of SMDs is excluded, the effect of district magnitude picks up the effect of plurality/majority systems and is estimated to be curvilinear in that single-member districts and districts of especially high magnitude are less likely to perform well in both dimensions compared to moderate district magnitudes (as in Carey and Hix, 2011).

Table 5. Marginal effects of changes in technical details

Technical change	Doubly good performance	Doubly bad performance
Lowering district magnitude from 100 to 5	+7	−1
Raising the legal threshold from 0 to 5	+5	+9
Lowering the percentage of SMDs from 60 to 40%	+3	+2
Addition of a compensatory PR tier	+17	+4
Adding national top-up seats	−5	−10

PR = proportional representation.
Differences in predicted probabilities were calculated based on models 2 and 4 in Table 4; other variables were held at their means.

contrary, do not appear to be risky tools since they do not render a bad performance more likely. The addition of a small tier of national top-up seats as well as an increase in the share of SMDs both decrease the likelihood of a doubly bad performance, most likely because they move electoral system design closer to pure PR or plurality and thus almost guarantee the electoral system performing well either with respect to proportionality or concentration. For both dependent variables, the addition of the context variables does improve model fit but leaves the estimated coefficients for the technical variables basically unchanged (the same is true for a model also including the level of ethnic heterogeneity). An interesting finding for the context variables is that the older (i.e. more experienced) the political system, the less likely are extremely good or extremely bad performances, notwithstanding the design of the electoral system. The positive effect of political decentralization is not robust to including region effects. While the continuous measure of presidential power applied in our models does not exert significant effects on either dimension, it is noteworthy that using dummies for different regime types suggests that presidential regimes experience significantly lower levels of disproportionality (especially if presidential elections are not concurrent).

Table 5 further illustrates the key results, showing how meaningful changes in the technical details of an electoral system affect the predicted probability of performing well or badly in both dimensions.[15] Here, the difference between safer and riskier tools for reaching the best of both worlds as well as the impact of the combination of different details is clearly visible. Lowering district magnitude to moderate levels leads to a clear increase in the likelihood of a doubly good performance, while even slightly reducing the likelihood of a particularly bad performance. Another fairly safe tool is the addition of a compensatory PR tier which boosts the probability of a doubly good performance by 17 percentage points, while increasing the risk of a

[15] The marginal effects of specific technical changes presented here would look very similar if computed at other values of the respective independent variables (e.g. lowering the share of SMDs, for example, from 80 to 60% or raising a legal threshold from 2 to 7%).

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doubly bad performance by a comparatively meager 4 percentage points. However, although both these elements appear as safe tools to reach a superior balance, the combination of technical elements is critical to consider. Countries such as Denmark, Estonia, or Norway do each pair moderate district magnitudes with a small top-up tier of additional PR seats and all never reach a doubly good performance. While the presence of such an additional top-up tier does render failure in both dimensions very unlikely, it also clearly lowers the chances of performing well with respect to both proportionality and concentration. Similarly, MMP systems may still have a lower likelihood of reaching a superior balance if they come with a very high share of SMDs, the latter having a negative impact on the probability of a successful performance in both dimensions. These results also partly vindicate MMM systems which, while preventing a superior balance, render a total performance failure unlikely via employing fairly high proportions of SMDs without having a compensatory PR tier. Finally, Table 5 highlights the risky nature of the legal threshold – employing a legal threshold of 5% does raise the probability of a doubly good performance by 5 percentage points but at the same time also adds 9 percentage points to the probability of a doubly bad performance. Thus, even if an electoral system has the 'right' district magnitude and mixed-member structure, a high legal threshold may tip the system's performance clearly in an undesirable direction or, in a more positive light, provide the final piece for a well-functioning electoral system. Overall, promises and risks clearly rest in the technical details of electoral systems. Reaching the best of both worlds with respect to proportionality and concentration appears not to be a question of general system type but one of careful design and the right combination of electoral hurdles as well as compensation mechanisms.

Conclusion

Which electoral systems are able to successfully provide for PR as well as for party system concentration? If we solely look to general design types, the moderate magnitude PR as well as the MMP system both appear as good choices, whereas pure systems and the MMM system are unlikely to achieve aforementioned goals at the same time. While moving to the level of technical details confirms these general propositions, it also becomes clear how nuanced changes in the technical design of electoral systems have rather different implications for performance. Technical elements fulfill various different roles not only in achieving a good performance but also with respect to the risk of a bad performance in both dimensions. The addition of a compensatory PR tier in a mixed-member system and the lowering of the district magnitude in a PR system are both tools with which to make a good performance in both dimensions more likely without (substantially) increasing the risk of a double failure. A riskier tool (often heralded as being responsible for sufficient levels of concentration in MMP or PR systems; e.g. Kostadinova, 2002: 31) is the legal threshold. Increasing this threshold makes extreme – positive or negative –

performances more likely. Finally, there are tools suitable for avoiding extreme performances altogether – a small tier of national top-up seats and lowering the share of SMDs. It is the combination of these details that renders a successful performance regarding both proportionality and concentration more or less likely. Hence, our results confirm Carey and Hix's (2011) key finding of the moderate district magnitude 'sweet spot' but also suggest that there are various 'sweet spots' to be found when considering the detail level carefully. Furthermore, next to looking for 'sweet spots', we provide the first large-n risk assessment with respect to the representativeness – accountability trade-off. The implication for electoral system design is thus to consider the role of (combinations of) technical details and, next to considering the promises of different designs, to be aware of the risks associated with different electoral institutions.

At this point, we also have to discuss one limitation of our analysis. While it is uncontested that electoral systems influence party systems, parties usually also play a major role when it comes to the design or reform of electoral systems. As different parties are expected to support electoral systems which they assume to favor them, party system characteristics can also determine the design of electoral systems (e.g. Colomer, 2005). However, like most of the similar studies before, we treat electoral systems as purely independent variables. Although this might not be completely unproblematic from a technical point, we defend this approach for different reasons. First, election outcomes are only one factor in reform processes, which are typically highly idiosyncratic and unpredictable (e.g. Renwick, 2010). Second, given the many possible design options at the detail level and the difficulty of politicians in calculating what reforms would favor them, it is reasonable to assume that there is no systematic effect of election outcomes on the (incremental) change of electoral institutions (Andrews and Jackman, 2005; Carey and Hix, 2011: 389). Third, at least in established democracies, we expect institutions like Supreme Courts to moderate too egoistic reform plans. And fourth, even if we assume parties to be able to misuse electoral reforms in their own interest, this interest should be to largely conserve the party system. This means that electoral systems, certainly, are not completely exogenous variables but this does not interfere with their effects on party systems. Nevertheless, it is critical that future research maps out more clearly – especially with regard to the theoretical underpinnings – which party system characteristics influence electoral system design and reform systematically as many questions still remain.

Future research should furthermore pay closer attention not only to technical details but to their risk–reward ratio when aiming for a superior electoral system performance. In order to map out the more wide-ranging impact of different performances, it needs to investigate in how far the success and failure of specific design combinations in particular countries function as examples for other countries or even whole regions. These analyses may then assess whether best or worst of both worlds performances lead to a corresponding diffusion of electoral system design – the spread of the German MMP system seems to be one particularly

striking example. Furthermore, empirical analyses such as ours are limited in so far as we have to rely on investigating the performance of electoral system designs that actually exist in practice. However, it would be highly important to investigate how higher legal thresholds or especially low or high (but not full) shares of SMDs affect the propensity to perform well or badly in both dimensions. Here, careful simulation studies could be of use in order to derive more nuanced advice for technical details that lie out of the range of what we see applied in the worlds' electoral systems. Whether based on simulation studies or on district level research designs, future research also has to tackle the challenge of time-invariance in the study of electoral system effects.

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Supplementary material

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