

Electoral Rules and Descriptive Representation: A Comprehensive View Across Multiple Identities*

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Abstract

This study develops and tests a theory of how electoral rules shape descriptive representation across 9 identity dimensions: gender, sexual and gender minority status, age, immigrant and native ethnicity, disability, education, class background, and rural origin. The theory predicts an MMD advantage for affinity-voting blocs that are large enough to clear representational thresholds yet too geographically dispersed to form local pluralities. Concentrated blocs can convert local strength into SMD seats, narrowing the tier difference.

We evaluate these expectations in 15 countries, 44 country-elections, and 13,246 legislator-election records, comparing the SMD and MMD rule bundles used within the same election. The clearest evidence is an MMD advantage for women. Estimates for sexual and gender minorities and youth point in the same direction. Immigrant and disabled estimates are imprecise, while less-educated, working-class, native-ethnic, and rural estimates reveal no clear tier advantage.

Keywords: Descriptive representation; Political institutions; Electoral systems; Minorities; Ethnicity; Sex; Educational attainment; Social class; Urban/rural; Age; Sexual orientation; Disability

Word count (2026-07-24): 35,428 (with references); target: 20–30,000 words

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Acknowledgments

For helpful comments, we are grateful to Fayed Ali, Yuki Atsusaka, Shiro Kuriwaki, Stephanie Rickard, Didier Ruedin, participants in a seminar at IE University, and participants of the 2024 MPSA panel, “Ethnicity, Identity, and Politics,” and especially to our discussant, Filiz Tutku Aydın. We also thank Berk Akgün, Nilüfer Gürel, Ken Lohatepanont, Juan Rivas Sorto, Nicole Pabon Pabon, Ceren Sağdıç, Rob Salmond, and Dide Sezer for assistance in data coding, and Mars Halvaksz, Madison Summers, and Silas Tautz for excellent research assistance.

Why it is important that gay people run for office and that gay people get elected ... You see there is a major difference – and it remains a vital difference – between a friend and a gay person, a friend in office and a gay person in office. Gay people have been slandered nationwide. We’ve been tarred and we’ve been brushed with the picture of pornography. In Dade County, we were accused of child molestation. It’s not enough anymore just to have friends represent us ... A gay person in office can set a tone, can command respect not only from the larger community, but from the young people in our own community who need both examples and hope ... The anger and the frustrations that some of us feel is because we are misunderstood, and friends can’t feel that anger and frustration. They can sense it in us, but they can’t feel it. Because a friend has never gone through what is known as coming out. I will never forget what it was like coming out and having nobody to look up toward. I remember the lack of hope – and our friends can’t fulfill that ... I use the word “I” because I’m proud. I stand here tonight in front of my gay sisters, brothers and friends because I’m proud of you. I think it’s time that we have many legislators who are gay and proud of that fact and do not have to remain in the closet.

—Harvey Milk, *Hope Speech* (Tremblay, 2019)

Glossary

Affinity voting

A vote cast for a candidate because the candidate shares the voter's demographic characteristics. For further discussion, see Chapter 3.

Aversion voting

A vote withheld from a candidate because of his/her demographic characteristic. For further discussion, see Chapter 3.

Concentrated/Dispersed

The spatial distribution of a social group across a country. A group is *concentrated* when its district-level population shares vary substantially across districts and *dispersed* when those shares are comparatively even. Concentration and dispersion are matters of degree. Whether the group becomes a local plurality depends jointly on this spatial distribution and the size of its affinity-voting bloc. For further discussion, see Chapter 3.

Descriptive representation

Where the demographic composition of a decision-making body reflects the demographic composition of the population it is intended to represent.

Disabled

Publicly identified as disabled in some respect (specialized definition). For further discussion, see Chapter 4.

District magnitude

Number of seats within a district, symbolized by M , ranging from 1 (an SMD) to the size of the legislature.

Gender

Gender identity as publicly presented: male, female, or non-binary (specialized definition). The coded sample contains 0 elites identified as non-binary, so the variable is rendered binary in practice. For further discussion, see Chapter 4.

Immigrant minority groups

Where a majority immigrated or descended from immigrants who arrived in a country within the past century (specialized definition). For further discussion, see Chapter 4.

Intersectionality

The combination of multiple minority characteristics in a single individual (e.g., a working-class woman or a young member of an ethnic minority). For further discussion, see Chapter 4.

Less educated

Lacking a university (BA) degree (specialized definition). For further discussion, see Chapter 4.

Majoritarian

An electoral system, usually centered on SMDs, in which seats are allocated to parties in a

winner-take-all fashion.

Malapportionment

An electoral imbalance where the ratio of voters (or total population) to elected representatives is unequal across districts or constituencies, resulting in some voters having disproportionately more influence than others. For further discussion, see Chapter 6.

Minority group

A social group whose voting bloc falls short of a plurality (specialized definition). For further discussion, see Chapter 3.

Mixed electoral system

An electoral system with two tiers, one for SMDs and the other for MMDs.

MMD

Multimember district, where more than one member is elected from a single district. Since most MMDs are allocated to parties in proportion to the votes they receive, MMD and PR are often employed as synonyms.

MMD aggregation unit

MMD votes may be aggregated at national or regional levels. The latter provides multiple within-country units within which MMD and SMD results may be compared.

MMM

Mixed electoral system with parallel tiers (no compensation). Contrast MMP.

MMP

Mixed electoral system where the number of MMD seats is adjusted to assure that each party's total seat share is roughly proportional to its vote share on the MMD ballot.

Native minority groups

Where a majority descend from ancestors who arrived in a country more than a century ago (specialized definition). For further discussion see Chapter 4.

Plurality

The largest group among a set of groups, which may constitute less than a majority.

Proportional representation (PR)

An electoral system with MMDs in which seats are distributed across parties in proportion to the votes they receive.

Quotas, statutory

Laws designed to enhance descriptive representation through reserved seats, race-conscious redistricting, or the restriction of candidacies to members of a particular group. For further discussion see Chapter 1.

Quotas, voluntary

Rules adopted by parties to achieve descriptive representation, for example, by requiring a

specified share of nominations to go to members of a particular group. For further discussion see Chapter 1.

Representation index

A bespoke index measuring the degree to which descriptive representation is achieved for a particular demographic cleavage, such as gender, ethnicity, or class. For further discussion see Appendix XII.

Reserved seats

Seats reserved for members of a particular social group—by districting, vote eligibility, or candidate eligibility.

Ruralite

Born in a location with fewer than 300 persons per square kilometer (specialized definition). For further discussion see Chapter 4.

Sexual and gender minority (SGM)

Any non-mainstream gender or sexual identity, aka LGBTQ+, if openly acknowledged. For further discussion see Chapter 4.

SMD

Single-member district, where only one member is elected from a district. Since SMD seats are allocated in a winner-take-all fashion, SMD and majoritarian are often employed as synonyms.

Social group

A segment of a population defined by a common identity and, presumably, a distinct set of interests and values. For further discussion, see Chapter 4.

Substantive representation

Where representatives act for (in the interests of) their constituents, whether or not they share their constituents' demographic characteristics. Contrast descriptive representation, which substantive representation may nonetheless presuppose.

Tier

In a mixed electoral system, there is one voting tier for SMD seats and another for MMD seats.

Voting bloc

Voters who exercise affinity voting for a party or candidate based on their demographic characteristics. Smaller than a group's population since not all members of a group are likely to be affinity voters. For further discussion see Chapter 3.

Working class

Determined by occupation prior to entering politics and any additional class-background information (specialized definition). For further discussion see Chapter 4.

Youth

Under the age of 35 (specialized definition). For further discussion see Chapter 4.

1 Introduction

Descriptive representation is achieved when the composition of a decision-making body reflects the composition of the population it is intended to represent. It is an open question how to identify social groups deserving of descriptive representation. But the general principle is clear: groups that have distinct values, interests, and identities should be represented by one of their own.¹

Descriptive representation is not the be-all and end-all of democracy. Substantive representation—acting for (in the interests of) one’s constituents—is surely more important. However, the latter is difficult to ascertain. It may also be impossible to achieve without some representation by the affected persons, as Harvey Milk argues in the epigraph to this book.

For social scientists as well as for many citizens, descriptive representation offers an important signal. Wherever a sizeable group is excluded from direct participation in decision-making bodies, there is *prima facie* evidence that they might not be well represented (substantively). By the same token, where a social group monopolizes positions of power, one might reasonably conclude that they are running things to suit their own interests or are simply unaware of problems lying outside their narrow range of experience.

Insofar as descriptive representation affects perceptions of representation, it may also affect participation and trust in politics and the overall legitimacy of government. To the extent that elites serve as role models and form networks for recruitment, patterns of descriptive representation may influence who enters politics as a career. Finally, where descriptive representation serves to integrate diverse groups, it may enhance deliberation in policymaking and mitigate social conflict. While these are complex issues, it seems fair to say that descriptive representation is important to the overall quality of democracy and governance.²

1.1 Achieving descriptive representation

This book focuses on the achievement of descriptive representation. Why have women and minorities been more successful in reaching high office in some polities than in others? Why are some social groups better represented than others?

Extant work offers a litany of potential answers. These center on constitutional structures (e.g., regime-type and federalism), informal institutions (e.g., party recruitment and the availability of candidates), compositional factors (the size of political bodies and the size and number of social groups), along with a host of background factors (e.g., violence, social exclusion, spatial segregation, poverty, inequality, economic development, and political culture).³

Of particular interest are laws explicitly designed to enhance descriptive representation

¹For theoretical work, see Goodin (2004), Mansbridge (1999), Phillips (1995), Pitkin (1967), Saward (2010), M. S. Williams (2000), and Young (2002).

²Wide-ranging studies of these subjects include Banducci, T. Donovan, and Karp (2004), Burden (2007), Htun (2004, 2016), Hughes (2013), Norris and Lovenduski (1995), Swers and Rouse (2013), and Tate (2023). See also work focused on particular social groups reviewed in Chapter 2 and on ways in which responsiveness is channeled through identity relationships (Lieberman, 2016; McClendon, 2016). Most work suggests that descriptive representation matters, though a few demur (Homola, 2019) or offer qualifications (Mackay, 2008).

³See previously cited work as well as Gerring, Jerzak, and Öncel (2024).

through *statutory quotas*, a category that includes reserved seats and race-conscious redistricting or the restriction of candidacies to a particular group. Typically, quotas are employed for women (Barnes and Holman, 2020; Tripp and Kang, 2008) and reserved seats or candidacies for ethnic/racial minorities (Bird, 2014; Handley, 2022; Htun and Jones, 2002; Reynolds, 2005). Occasionally, these approaches have been applied to disabled persons (Krook, 2025). Racial gerrymandering, i.e., majority-minority districts, has been used primarily in the U.S. (Grofman, Handley, and Niemi, 1992; Lublin, 1997). The general conclusion from these and other studies is that quotas are effective in enhancing representation.

However, improving descriptive representation by diktat is problematic in several respects. Targeted groups must be defined categorically and permanently: who is in and who is out. Such fixed boundaries are at odds with the nuanced, evolving, intersecting, and “constructed” nature of most social identities.⁴ Distinctions are necessarily arbitrary: some group or groups are selected for special treatment while others are excluded, which means they may be disadvantaged, relatively speaking (Htun, 2016). This, in turn, reinforces certain identities by making them official, and may engender stigma and backlash.⁵ All of the problems commonly associated with affirmative action in other settings may be anticipated with respect to powerful political positions.⁶ In addition, strict eligibility rules infringe upon two basic democratic rights—“the right of citizens to run for office, and the right of voters to choose whomever they wish to rule them” (Rehfeld, 2009, p. 237). Insofar as quotas require increasing the size of committees and legislatures, they may impair their capacity to deliberate (Goodin, 2004). Finally, the imposition of statutory quotas may impair electoral competition, limit the formation of cross-group coalitions, and thereby undermine substantive representation.⁷

For these reasons, we view stipulative approaches to descriptive representation as potentially problematic. They are, in any case, limited in purview. There is no way that all groups in society who view themselves as deserving can be guaranteed descriptive representation through statutory quotas.

1.2 District magnitude

A less direct approach to descriptive representation centers on *district magnitude*—the number of seats within an electoral constituency. In principle, multimember districts (MMDs), allocated proportionally, provide more space for the representation of diverse interests and identities than single-member districts (SMDs), allocated in a majoritarian fashion. If so, adjustments to district magnitude may offer a flexible, non-intrusive solution to descriptive representation. And since this feature of election law does not usually face constitutional obstacles, it may provide a practical vehicle for reform.

Instead of mandating which categories to privilege and locking in that mandate in perpetuity, the choice is left to voters. Through the exercise of affinity voting, they decide which

⁴This critique is encapsulated in the concept of “essentialism” (Mansbridge, 1999; Phillips, 2010; Young, 2002). Saward (2010, p. 1) writes: “Representative claims are unstable and highly variable. They encompass and implicate many different groups and individuals; they show us that representation is dynamic, shifting and elusive, and crucial to the very constitution of politics.”

⁵See Haider-Markel (2007), Kanthak and Krause (2012), and Kim and Kweon (2022).

⁶See Galanter (1984) and Holzer and Neumark (2006).

⁷See Auerbach and Ziegfeld (2020), Hassim (2009), Lublin (1997), and Swain (1995).

social groups to recognize and reward, to what degree, and how to balance the demographic features of a candidate with other desiderata. This cue is communicated to political parties, which adjust their nominees accordingly—including through the adoption of voluntary party quotas.⁸ In this fashion, descriptive representation is treated as a matter of politics, to be hashed out and eternally rehashed through democratic procedures.

The question addressed in this book is whether, or to what degree, the assumed relationship between district magnitude and descriptive representation is borne out in practice. Are less privileged social groups more likely to gain representation in MMDs than in SMDs? Which social groups are most likely to benefit, and to what extent? Do advantages extend to social groups that are generally excluded from statutory quotas, such as the working class, the young, ruralites, sexual and gender minorities, and the disabled? Which system—SMD or MMD—generates more faithful representation overall across different identity cleavages?

We are not the first to address such questions, and our efforts build upon a substantial literature (see Chapter 2). However, extant work is limited in several respects. First, it focuses mostly on women, and to a lesser extent on key minorities; other groups are generally ignored. Second, most work is centered on the U.S. and Europe, raising questions about generalizability. Finally, most studies are subject to a serious problem of inference: lots of factors impact descriptive representation, and these may be correlated with electoral law, impairing causal identification.

In this study, we take advantage of a research design centered on “mixed” electoral systems.⁹ This unique way of choosing representatives combines SMDs and MMDs in separate tiers of the same election, providing something close to a natural experiment in which the two tiers can be directly compared in order to reveal the influence of electoral rules on descriptive representation, net of other factors.

With this design, and with data painstakingly gathered for this project, we are able to study the impact of electoral rules in 15 countries across diverse regions of the world. Legislatures in these countries are observed across 44 elections, providing a global sample of 13,246 legislator-election records—the largest dataset of its kind.

To ascertain how electoral rules affect descriptive representation across different social identities, we code the sex, ethnicity, education, class background, urban/rural background, age, sexual orientation and gender identity, and disability status of each MP. Coding is conducted by experts assisted by an agent-based LLM protocol developed for this project. We are thus able to examine the impact of electoral law across a much wider range of identities than any previous study.

The breadth of the present study, both substantively and geographically, opens up an opportunity to theorize about the subject in an encompassing fashion. To that end, we offer a general framework, supplemented by formal derivations and simulations, to explain how electoral rules condition descriptive representation across a wide range of demographic features that may be relevant for politics.

⁸There is evidence to suggest that quotas are more likely to be adopted and to be successful in MMDs than in SMDs (Dahlerup, 2003).

⁹For overviews see Blais and Massicotte (1996), Flis, Grofman, and Kaminski (2025), Herron, Nemoto, and Nishikawa (2017), and Shugart and Wattenberg (2001).

1.3 Outline

The book proceeds in a succession of short chapters. Chapter 2 surveys the literature on electoral systems and descriptive representation. Chapter 3 presents our theoretical framework, centered on the size and dispersion of social groups. Chapter 4 introduces the data, data gathering techniques, and the overall design of the project. Chapter 5 presents the results, first in a simple bivariate format, then in a multivariate analysis, and finally with a study of "pure" electoral systems (either SMD or MMD). Chapter 6 delves into the mechanisms that may be responsible for the discovered relationships. A short conclusion (Chapter 7) summarizes our findings.

Online appendices provide simulation robustness checks (Appendix I), additional empirical results and full regression tables (Appendices II and IV), ethnicity coding details (Appendix III), formal derivations (Appendix V), inclusion/exclusion and missingness robustness analyses (Appendices VI and XI), Russia case-study extensions (Appendices VII and VIII), a party-as-social-groups extension (Appendix IX), details on agent-assisted coding and validation (Appendix X), and an analysis of the representation of demographic cleavages (Appendix XII).

2 Prior Work

Scholarly work on our subject extends back to Victor Considerant (1842), Thomas Hare (1865), J.S. Mill (1861), and other early champions of PR electoral reform.¹⁰ To these reformers, proportional representation was a method for representing diverse segments of the electorate, the goal being a parliament that is a “mirror of the nation” (Conti, 2019, p. 241). In this light, notes Stein Rokkan (1970, p. 157), it is no accident that “the earliest moves toward proportional representation came in the ethnically most heterogeneous European countries.”

Early reformers also saw PR as a mechanism for selecting the best sort of candidates, e.g., the well-educated. This, in turn, would presumably skew the legislature toward the middle and upper classes. In keeping with this goal, the second wave of PR reform in Europe was motivated by the goal of limiting the power of socialist parties (Rokkan, 1970). In this respect, the heritage of PR reform may be viewed as exclusive rather than inclusive.

Among contemporary scholars, the assumption is usually that MMDs are superior to SMDs for purposes of representing heterogeneity—of parties, perspectives, and people. Maurice Duverger (1984, p. 36), a pioneer in the study of parties and electoral systems, claimed that the “advantage of PR is that it permits a delicately differentiated representation which expresses all of a country’s diversity.” Most recent work on electoral systems and representation adopts this general theme.¹¹

Yet, the subject is not as settled as it might seem. In the sections that follow, we examine recent studies focused on gender (binary), sexual and gender minorities (SGM), youth, ethnicity, disability, education, the working class, and ruralites. As we will see, some topics are better studied than others. For most, there is uncertainty over the actual role of PR in achieving descriptive representation.

2.1 Gender (binary)

The representation of women, its sources, and its effects, is one of the most studied topics in political science and political sociology.¹² The impact of electoral rules on female representation has also received considerable attention (Tremblay, 2012). Indeed, this was the empirical touchstone for Duverger’s ruminations, quoted above.

Most work on the subject confirms the conventional wisdom: MMDs do a better job of representing women than SMDs.¹³ However, estimating the size of this effect is tricky as there are many potential confounders in a typical cross-sectional analysis. These confounding factors may account for widely varying estimates across studies.

To overcome this issue, mixed electoral systems have been employed to examine representation by gender. Here, studies generally find MMD seats to be more welcoming to female legislators than SMD seats.¹⁴ Even so, there are some notable exceptions to the general pat-

¹⁰See Barber (2000), Conti (2019), and Hart (1992).

¹¹See Amy (2002), Barber (2000), Lakeman (1982), Lijphart (1999), and Rule and Zimmerman (1994).

¹²For overviews, see Celis and Erzeel (2020), Escobar-Lemmon and Taylor-Robinson (2014), Krook and O’Brien (2012), Norris and Inglehart (2004), Paxton and Kunovich (2003), and Wängnerud (2009).

¹³See Högström (2025), Kostadinova (2007), Rule (1987), and Salmond (2006), along with work cited above.

¹⁴See Coffé and Davidson-Schmich (2020), Davidson-Schmich (2010), Johnson-Myers (2016), Kostadinova (2007), Matland and Montgomery (2003), and Vengroff, Creevey, and Krisch (2000).

tern, particularly in post-communist states (Moser and Scheiner, 2012). In New Zealand, initial differences in representation across tiers appear to be disappearing, as SMD representation catches up to MMD representation (Johnson-Myers, 2016, p. 42).

2.2 Sexuality and gender (non-binary)

The representation of sexual and gender minorities (SGM), aka LGBTQ+, has received considerable attention from scholars in recent years (Haider-Markel, 2010; Prearo and Trastulli, 2024). Although political representation has increased, there is general agreement that SGM are under-represented, though it is difficult to say by how much since the community is not well-defined and many presumed members are undeclared (Reynolds, 2013). There are doubtless many reasons for this, not the least of which is resistance from socially conservative voters.

With respect to the role of electoral systems, authors note that SGM candidates have achieved local success in single-member districts where their supporters are highly concentrated (Pilon, 2019). However, because most sexual and gender minorities are dispersed across districts, the usual thinking is that MMDs would offer a more viable mode of representation (Pilon, 2019). Empirically, the relationship appears to be weak (Reynolds, 2013), though many confounders lurk, so the matter is far from settled.

2.3 Youth

The representation of younger citizens is an increasingly important question in politics as so many issues bear differently on those who are young and old—global warming, government debt, social security, and so forth. Some empirical work suggests that the age of a politician may affect their policy orientation (Alesina, Cassidy, and Troiano, 2019; Curry and Haydon, 2018). Yet, from a descriptive perspective, younger citizens are woefully under-represented in parliaments around the world (Stockemer and Sundström, 2022, 2025). No doubt, this is partly because young voters turn out to vote at lower rates, because few politicians are in a position to run for higher office before middle age, and perhaps because voters are more trusting of older candidates. However, there may also be other, institutionally grounded explanations.

Joshi (2013) finds that youthful constituents are better represented in MMDs than in SMDs in fourteen Asian parliaments, suggesting that electoral rules play a key role. Stockemer and Sundström (2018) show that PR is associated with a higher rate of youth representation in a crossnational sample. However, both studies are subject to potential confounders.

2.4 Ethnicity

The representation of ethnic/racial minority groups is not as well studied as gender, perhaps because ethnicity is typically more multidimensional and more constructed, and thus harder to measure. Even so, the topic has attracted considerable attention from scholars.¹⁵

With respect to electoral law, Horiuchi, Smith, and Yamamoto (2020, p. 76) declare, “Perhaps the most consistent finding is that proportional representation (PR) electoral systems tend to elect more women and ethnic minorities than variations of single-member district

¹⁵For overviews, see Bird, Saalfeld, and Wüst (2011), Hänni and Saalfeld (2020), Lublin (2014), and Ruedin (2020).

(SMD) systems” (see also Hänni and Saalfeld (2020, p. 226)). Our reading of the literature suggests, however, that there is little consensus on the matter.¹⁶ In a cross-national analysis, Reynolds (2006) reports that MMDs offer better representation for minority groups, though the differences are not dramatic. Ruedin (2009) concludes that there is no relationship at all between electoral law and ethnic representation.

Electoral reform offers a special angle on the question. Examining shifts in electoral law within North Macedonia from two-round majority (1990, 1994), to mixed (1998), to pure proportional (2002-11), Wagner (2014) finds that these changes had little impact on ethnic representation. Of course, election-to-election comparisons may understate the long-term impact of electoral rules, which presumably takes time to materialize. Moreover, changes to electoral law tend to be motivated by partisan goals or accompanied by other disruptions that may serve as confounders. Contexts must be carefully considered.

Mixed electoral systems have also been used to study ethnicity. Here, too, there appears to be no settled opinion. In Germany (B. Donovan, 2007; Fonseca, 2010) and New Zealand (Barker and Coffé, 2018), studies report better representation of minorities in MMDs relative to SMDs. In Lithuania, results vary across elections (Jastramskis, 2019). In Georgia, minorities fare better in SMDs, though this may be a product of the low quality of democracy in that country (Zollinger and Bochsler, 2012). In the most wide-ranging study to date, Kostadinova (2007) finds stronger representation for minorities along the SMD tier in Macedonia, but concludes that idiosyncratic factors may be at work. Elsewhere in Eastern Europe, she finds little difference in minority representation across tiers. However, some of these cases feature very small minorities who struggle to gain representation in either tier and thus might not offer a very conclusive test.

2.5 Disability

The WHO estimates that around fifteen percent of the world’s population is disabled. Yet, an infinitesimal proportion of the world’s elected officials has some sort of recognized disability.¹⁷ It follows that, from a descriptive perspective, disabled citizens may be less well represented than any of the other social groups reviewed in this chapter (Evans and Reher, 2022).

As with other social groups, many reasons might be cited for this shortfall.¹⁸ We are not aware of any study focused explicitly on the role of electoral systems, though Okura (2021) observes that Japanese politicians with disabilities in the Diet were more likely to be elected from large multi-member districts.

2.6 Less educated

Those with less education are substantially underrepresented in national legislatures and cabinets across Western democracies relative to their share of the population. Bovens and Wille (2010) show that ninety percent of legislators in the post-war Netherlands held higher education credentials, leaving the less educated almost entirely absent from political office, a pattern they argue is representative of Western Europe more generally. This skew in the

¹⁶See also Lublin and Bowler (2018).

¹⁷See Evans and Reher (2024) and Okura (2021, p. 3).

¹⁸See Evans and Reher (2024), Prince (2009), and Waltz and Schippers (2021).

composition of political elites may bear directly on whose preferences are reflected in policy outcomes. Drawing on Dutch election data from 1994 to 2010, Aaldering (2017) finds that the policy preferences of the less educated are systematically underrepresented.

There are many reasons why the less educated are excluded from legislatures throughout the world, and work on the possible role of electoral institutions is surprisingly limited. Joshi (2020) examines mixed electoral systems across Germany, Japan, and South Korea, showing that SMDs produce a higher share of lawyers and law graduates than MMDs. Whether this extends to education more broadly, and in particular to the representation of non-college-educated, remains untested.

2.7 Working class

The working class, however defined, probably constitutes over half the adult population in most countries. Yet, it constitutes less than five percent of most national legislatures in the OECD (Carnes and Lupu, 2023b, p. 177). Even parties ostensibly representing working-class constituents are generally led by those with privileged (middle- or upper-class) upbringing. A signal of this is the dominance of advanced educational credentials among political elites. These days, not just bureaucrats but also elected officials can be expected to have advanced degrees (Bovens and Wille, 2017). Since most legislation bears differentially on those at the top and bottom of the economic ladder, this may be the most policy-relevant dimension of descriptive representation.¹⁹

There are doubtless many reasons why members of the working class are under-represented in legislatures throughout the world (Carnes and Lupu, 2023b). Our concern is with the possible role of electoral institutions. Work on the subject is surprisingly limited, given general interest in the topic.

Pilotti (2015) finds that the 1918 shift to a PR electoral system in Switzerland led to a modest increase in working-class MPs. However, because the pre-1918 system mixed SMDs and small MMDs instead of using a pure majoritarian baseline, direct comparisons between the two district types are difficult. Additionally, World War One was an era of intense mobilization on the left, and thus open to confounding from social movements and party organizations. A recent analysis across OECD countries finds no apparent association between electoral law and working-class representation (Carnes and Lupu, 2023b, p. 189). But it is important to stress again that the question has not been widely studied.

2.8 Rural

Although rurality is difficult to define in a succinct, generalizable fashion, there is widespread agreement that rural and urban dwellers have different perspectives on many things, a fact that is presumably linked to their geography.²⁰ A growing literature attests to the importance of urban/rural divisions in contemporary politics (Huijsmans and Rodden, 2025; Taylor et al., 2024). Rural discontent is thought to be linked to the resurgence of populism, resentment of elites, distrust of politics, and democratic backsliding.²¹

¹⁹See Carnes (2024), Carnes and Lupu (2023a), and Elsässer and Schäfer (2022).

²⁰See Cloke (2006), Nelson et al. (2021), and Nemerever and Rogers (2021).

²¹See Ballard-Rosa, Carnegie, and Schonfeld (2023), Cramer (2022), Strijker, Voerman, and Terluin (2023), and Zumbrunn and Freitag (2023).

For our purposes, what is important is that ruralites are grossly under-represented in legislatures around the world, a feature that may exacerbate urban/rural tensions.²² Electoral rules may have something to do with this. In a study of two countries with single, nationwide PR systems (Israel and the Netherlands), Latner and McGann (2005) find that urban *and* rural areas are over-represented, with suburban areas being the least well represented. In a cross-sectional study of twenty-eight European countries, Rico, Horno, and Hernández (2025) find that MMDs have higher proportions of MPs who hail from rural areas, though the relationship is not statistically significant.²³

2.9 Summary

In sum, the predominant finding across prior work, summarized in the $N=47$ entries of Table 2.1, might be summarized thus: minority groups are represented as well, or better, in MMDs relative to SMDs. However, there is a lot of variability across social groups. Existing studies rarely explain that heterogeneity across identities within a common theoretical and empirical design. In particular, they seldom ask how a group’s affinity-voting-bloc size and spatial distribution condition the effect of electoral rules, broadly. Those moderators organize the framework developed next.

²²For overviews, see Rico, Horno, and Hernández (2025).

²³Carella and Eggers (2024) examine a related issue—whether SMDs or MMDs are more likely to select an MP who is locally sourced, i.e., born in the district. They find little difference between countries with one or the other electoral system, though they indicate that mixed electoral systems may produce the most local politicians. This research question is orthogonal to our own, where we distinguish ruralites from all others.

Table 2.1: *Literature Review: Electoral Systems and Descriptive Representation*

Study	Design	N	Location	Finding
WOMEN				
Coffé and Davidson-Schmich, 2020	Cross-country	2	Germany, New Zealand	SMD<MMD
Davidson-Schmich, 2010	Mixed system	1	Germany	SMD<MMD
Högström, 2025	Cross-country	94	Global	SMD<MMD
Johnson-Myers, 2016	Electoral reform	1	New Zealand	SMD≈MMD
Joshi and Kingma, 2013	Cross-country	34	Asia	SMD<MMD
Kenworthy and Malami, 1999	Cross-country	146	Global	SMD<MMD
Kerevel, Matthews, and Seki, 2019	Mixed system	3	Mexico, Germany, Japan	SMD≈MMD
Kostadinova, 2007	Mixed system	15	Eastern Europe	SMD<MMD
Matland, 1998	Cross-country	24	Developed	SMD<MMD
Matland, 1998	Cross-country	16	Developing	SMD≈MMD
Matland and Montgomery, 2003	Cross-country	12	Post-Communist Europe	SMD<MMD
Matland and Studlar, 1996	Cross-country	2	Canada, Norway	SMD<MMD
Moser and Scheiner, 2012	Mixed system	5	Old democracies	SMD<MMD
Moser and Scheiner, 2012	Mixed system	8	New democracies	SMD≈MMD
Norris, 2004	Cross-country	32	Global	SMD<MMD
Paxton, Hughes, and Painter, 2010	Cross-country	110	Global	SMD<MMD
Rule, 1987	Cross-country	23	Global	SMD<MMD
Salmond, 2006	Cross-country	21	Global	SMD≈MMD
Thames, 2018	Electoral reform	1	Ukraine	SMD<MMD
Thames and M. Williams, 2010	Cross-country	57	Global	SMD<MMD
Vengroff, Creevey, and Krisch, 2000	Cross-country	7	Global	SMD<MMD
Vengroff, Nyiri, and Fugiero, 2003	Subnational	29	Global	SMD<MMD
Welch and Studlar, 1990	Subnational	2	Britain, United States	SMD≈MMD
SEXUAL AND GENDER MINORITIES				
Haider-Markel, 2010	Subnational	1	United States	SMD≈MMD
Reynolds, 2013	Cross-country	96	Global	SMD≈MMD
YOUTH				
Joshi, 2013	Cross-country	14	Asia	SMD<MMD
Stockemer and Sundström, 2018	Cross-country	107	Global	SMD<MMD
Stockemer and Sundström, 2022	Cross-country	4	Europe	SMD<MMD
ETHNIC MINORITIES				
Barker and Coffé, 2018	Mixed system	1	New Zealand	SMD<MMD
Fonseca, 2010	Mixed system	1	Germany	SMD<MMD
Jastramskis, 2019	Electoral reform	1	Lithuania	SMD<MMD
Kostadinova, 2007	Mixed system	1	Macedonia	SMD>MMD
Kostadinova, 2007	Mixed system	14	Europe	SMD≈MMD
Norris, 2004	Cross-country	32	Global	SMD<MMD
Reynolds, 2006	Cross-country	31	Global	SMD<MMD

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Study	Design	N	Location	Finding
Ruedin, 2009	Cross-country	95	Global	SMD $\approx$ MMD
Wagner, 2014	Electoral reform	1	Macedonia	SMD $\approx$ MMD
Zollinger and Bochsler, 2012	Electoral reform	1	Georgia	SMD>MMD
DISABILITY				
Okura, 2021	Cross-country	16	EU, Japan	SMD<MMD
LESS EDUCATED				
—	—	—	—	—
WORKING CLASS				
Carnes and Lupu, 2023b	Cross-country	37	OECD	SMD $\approx$ MMD
Joshi, 2020	Mixed system	3	Germany, Japan, S Korea	SMD<MMD
Pilotti, 2015	Electoral reform	1	Switzerland	SMD<MMD
RURAL				
Rico, Horno, and Hernández, 2025	Cross-country	28	Europe	SMD $\approx$ MMD
INTERSECTIONALITY				
Darcy, Hadley, and Kirksey, 1993 (Black women)	Subnational	1	United States	SMD<MMD
Hughes, 2011 (Minority women)	Cross-country	81	Global	SMD $\approx$ MMD
Hughes, 2016 (Muslim women)	Cross-country	20	West Europe, N America	SMD<MMD
Stockemer and Sundström, 2021 (Young women)	Cross-country	100	Global	SMD<MMD

Note: **Study:** listed multiple times if multiple topics addressed. **Design:** cross-country (primarily cross-sectional comparison), electoral reform (comparison before/after reform), mixed system (comparison across SMD and MMD tiers), subnational (comparison across regions or municipalities). **N:** number of countries. **Location:** geographic scope of the study. **Finding:** which electoral system offers better representation for the group in question.

3 Theoretical Framework

Descriptive representation centers on *social groups*, understood as segments of a population defined by a common identity and, presumably, also a distinct set of interests and values. These identities are usually measurable through a demographic characteristic—sex, age, ethnicity, class, and so forth. Hence, the equation of descriptive representation with “demographic” representation.

The size of a social group is understood as its share of the population, or more specifically as the size of its voting bloc, given affinity voting (explained below). In this manner, groups may be classified as *majority*, *plurality*, or *minority* (non-plurality). We take up the question of how to define and operationalize social groups in Chapter 4. As the present chapter is theoretical, it seems permissible to postpone this discussion.

The setting for our theory is elective offices subject to multiparty competition. We do not assume that the playing field is entirely even. Incumbents may enjoy considerable advantages, media coverage and campaign finance may be biased, and electoral administration may be flawed. The important point is that political parties must compete with one another to win votes and thus gain political power.²⁴

With this as background, we turn to the components of our theoretical framework: affinity voting, electoral dynamics in multi-member districts (MMDs), electoral dynamics in single-member districts (SMDs), the size and location of social groups, logical derivations of the theory, and simulations of the theory. The chapter concludes with a series of hypotheses to be tested in subsequent chapters.

3.1 Affinity voting

The core assumption behind descriptive representation is that where a social group has a distinct identity and a distinct set of interests, members of that group will prefer to be represented by one of their own, other things equal. This may be especially true for minority groups (Blumenau, Wolkenstein, and Wratil, 2025). One can think of this as the demand side of descriptive representation.

In an electoral context, this demand should become manifest in *affinity voting*—ballots cast for candidates who are perceived to be part of one’s own group.²⁵ Extant work suggests that affinity voting exists for race and ethnicity (Adida, 2015; Besco, 2019; Ferree, 2006; Goodyear-Grant and Tolley, 2019; Van Oosten, Mügge, and Van Der Pas, 2024), gender (Badas and Stauffer, 2018, 2019; Ortega, Recuero, and Oñate, 2025), age (Sevi, 2021), social class (Robison et al., 2021; Vivyan et al., 2020; Wüest and Pontusson, 2022), and locality (Munis, 2021).²⁶

If affinity voting were perfect—each group supporting only candidates from their own group—women and the working class would constitute a majority of representatives in vir-

²⁴In a one-party or no-party state, rulers may seek to achieve descriptive representation, but whatever patterns exist are unlikely to be responsive to electoral rules.

²⁵For work on the factors, including electoral institutions, that shape the propensity for affinity voting, see Adida, Davenport, and McClendon (2016), Ferree (2006), Huber (2012), Huber and Suryanarayan (2016), Ichino and Nathan (2013), Kinder and Mendelberg (1995), Mendelberg (2001), and Posner (2005).

²⁶For a general treatment, see McDermott (2009).

tually every elected legislature. That this is not the case confirms that affinity voting is a matter of degree. The tie between identity and vote choice is weaker for some groups than for others and varies across contexts. At any given time and place, some cleavages are salient, and others are latent. And there is always slippage—some members of Group *A* who vote for non-*A* candidates, and some non-*A* voters who choose *A* candidates.

The size of a *voting bloc* may be defined as the number of affinity voters within a demographic group. In this sense, all of the social groups reviewed here are minorities. Women and the working class are thus demographic majorities but voting-bloc minorities in most countries. This is how we employ the term *minority* in the remainder of the book.

Although affinity voting is only one cue among many, and rarely the most important, it nonetheless plays a key role in our theory. To see why this might be so, consider the vote-choice decision along two dimensions—ideology and demography. Under normal circumstances, the first trumps the second. Voters care more about what a candidate stands for than about their social background. However, a few voters are different; for them, demography trumps ideology. These are the affinity voters; they want, most of all, to be represented by someone like them.

Many voters, especially those on the left, are likely to favor the representation of minorities and women. However, male voters on the left are unlikely to vote for right-wing female candidates, despite their devotion to gender equality. Likewise, members of a minority ethnic group are unlikely to support candidates from their group if their ideology is repugnant. Affinity voters are different, and this places them in a pivotal position even if they are few in number. Parties must choose the right candidates, demographically speaking, if they are to win the allegiance of affinity voters.

Bear in mind that ideology and demography are not in opposition to each other. Any party should be capable of recruiting someone from Group *A* who espouses its ideology and is willing to stand as its candidate. Since partisanship is usually a stronger cue than demography, affinity voting may be more prevalent within parties (i.e., during the candidate selection process or in preferential-vote systems) than across parties (i.e., during a general election without preferential-vote options) (Badas and Stauffer, 2018, 2019).

In any case, so long as *some* members of Group *A* prefer candidates from Group *A* and are willing to cast their votes on this basis alone, parties should be incentivized to nominate candidates from Group *A*.²⁷ By tapping into affinity voting, parties are thus able to maximize vote-share without sacrificing their principles.

A final point to note is that affinity voting is often reciprocal, as groups are defined by reference to other groups. If Group *A* prefers candidates of Type *A* to candidates of Type *B*, Group *B* is likely to prefer candidates of Type *B* to candidates of Type *A*. In-group affinity voting and out-group *aversion voting* go hand in hand. The stronger in-group affinities are, the stronger out-group hostilities are likely to be.

This is the basic mechanism at work in descriptive representation within a democratic context (without statutory quotas). We turn now to the matter of interest: how is the

²⁷For evidence that they do so, see Bird (2005) and Dancygier (2017). As Besco (2019) notes, in Europe parties across the ideological spectrum place minority candidates on their lists to attract diverse voters. Party gatekeepers mediate this linkage (Mugge, 2016).

dynamic between parties and voters conditioned by electoral rules? By common assent, the most important distinction is between single-member and multi-member districts—SMDs and MMDs.

3.2 MMDs

We begin with MMDs, as it presents a simpler context with respect to descriptive representation. A multi-member district offers a supply of seats (M) varying from 2 to N , where N equals the size of the legislature. (A few countries, such as Israel and the Netherlands, have only one national district.) The larger the district, the lower the threshold for representation.²⁸

In a MMD, we assume that parties nominate lists. Lists may be open (allowing electors to choose candidates within the list) or closed (controlled by the party).²⁹ In either case, votes must be allocated to parties in a proportional or semi-proportional fashion. (Some allocation rules are slightly more proportional than others, but these differences are insufficient to affect the outcomes of interest.) This is what most people understand by *proportional representation*, i.e., “PR.”

All social groups that are large enough to pass the (de jure or de facto) threshold for electoral representation in a MMD should achieve representation in rough proportion to the size of their voting bloc. How this occurs depends upon which social cleavages are politicized, and hence how parties define themselves before the electorate.

Where party cleavages and social cleavages *align*, we expect parties to adopt homogeneous lists centered on specific social groups. Each group gravitates to its own party, or to a party designed to capture the votes of a variety of out-groups, a role often played by parties on the left. While a candidate’s demographic characteristics may alienate some voters, those same characteristics should attract others. In this manner, out-group aversion voting and affinity voting balance each other. If out-groups end up in smaller parties, this is because they are smaller in numbers.

Where party cleavages and social cleavages *cross-cut*, we expect parties to adopt balanced lists that mirror the composition of the electorate in each MMD. Here, each party is catch-all with respect to social identity. This is the expected pattern where hostility and mistrust across social groups are limited and comity prevails.

Both mechanisms should lead to the same result, as the dynamic of affinity voting offers a corrective wherever patterns of misrepresentation appear. If a social group is excluded or grievously under-represented by all parties representing a district, there is an opening for a new party. We can expect political entrepreneurs to take advantage of that opportunity.³⁰

²⁸Statutory thresholds interrupt this monotonic relationship only at the upper end. For example, a five percent threshold means that increases in (M) lower thresholds for representation until $M = 20$.

²⁹In a survey experiment conducted in British Columbia, Dhima et al. (2021) find that the allocation of votes to women candidates is slightly diminished in an open-list setting relative to a closed-list setting. However, the differences are not great, justifying our expectation that the main electoral distinction of importance is between MMDs and SMDs. Because all of the cases in our sample are closed-list, we cannot directly test this assumption.

³⁰Dennis Pilon (2019, p. 161) offers several examples: “When a small left-wing party decided to establish quotas on its list to increase women’s representation, it influenced the larger Norwegian Labour Party to follow suit. In Sweden, prominent women’s organizations threatened to start their own party if the Social Democrats did

Under conditions of multi-party competition with low entry costs, electoral competition in MMDs should rectify any serious problems of mis-representation that arise.

3.3 SMDs

In a single-member district, things are more complicated. Here, the dynamics of party competition and affinity voting do not always work towards the proportional representation of social groups.

Although a variety of methods may be employed to translate votes into seats in an SMD (e.g., simple plurality, two rounds of ballots, or single transferable vote), supply is limited to exactly one seat. This sets up a winner-take-all dynamic. And this, in turn, means that vote-maximizing parties are likely to nominate candidates from whatever group claims a plurality within that district. Why this is so rests on the logic of affinity voting.

Let us say that Group *A* is dominant in a district. If, by chance, a party nominates a candidate from Group *B*, they should be at a disadvantage relative to candidates from Group *A* (Zingher and Farrer, 2016). Accordingly, the winning candidate is likely to be from Group *A*, generating representation for *A*—but not for other groups inhabiting the district.

The demographic size of a group at national levels is, in principle, irrelevant. Median-voter theory suggests convergence on the district center, not the national. Moreover, since the descriptive characteristics of a candidate are compatible with almost any set of issue positions, there is not necessarily a trade-off between demographics and other characteristics of potential candidates. Whoever is responsible for nominating candidates should be able to find someone from Group *A* who subscribes to the party’s policies, as discussed.

Occasionally, a party’s national image and ideology may hinder its search for candidates and votes among members of Group *A*, as one might anticipate if the party’s policies are perceived to be hostile to that group. However, this failure should favor parties with more credible claims to represent Group *A*, leading to the same result: the election of candidates from the locally dominant social group.

3.4 Size and location

Our review of the dynamics of descriptive representation in MMD and SMD contexts suggests that the impact of electoral rules on descriptive representation rests upon the *size* and *location* of a social group across a country.³¹

In a proportional electoral system, the only issue is whether a voting bloc is large enough to beat the de facto threshold. In a majoritarian system, the plurality group within each SMD enjoys a significant advantage. How the group is distributed across SMDs thus affects its overall representation. Differences in descriptive representation across MMD and SMD systems are therefore a product of a group’s size and spatial distribution across a country.

not show more leadership in electing women – a threat that moved the party to action, again due to the competitiveness of the voting system (a women’s party might not have won any seats, but it could have put a dent in Social Democrat support). Leadership from the left eventually prompted other parties across the ideological spectrum to offer more female candidates or risk losing support.”

³¹This point is not disputed, though the details are complicated. See, e.g., Bloemraad (2013), Bochsler (2011), Bochsler, Grofman, and Hänni (2023), Dancygier (2014), Geese and Schacht (2019), Grofman (2001), Lublin (2014), Norris (2004), Ruedin (2009), Taagepera (1994), Wagner (2014), and Wagner and Dreef (2014).

Under conditions of geographic *concentration*, there should be no (or very minimal) difference in performance across electoral system types. National minorities, if concentrated in specific districts, constitute local majorities (or at least pluralities) and thus profit from the geographically constrained nature of SMDs.

Under conditions of geographic *dispersion*, minority groups can be expected to attain better representation in MMDs than in SMDs. This is because the dispersion of electoral power across numerous SMDs means the group may constitute a plurality in none, leading to under-representation. By the same token, a dispersed majority group may be able to win most of the SMD contests, leading to over-representation. Geographic dispersion advantages large groups in SMD systems.

Before concluding, it is important to note limiting conditions on either end of the size spectrum (considered nationally). Very small groups that do not pass the threshold of representation in either MMDs or SMDs may be wholly unaffected by electoral law, as there is little incentive for parties to chase these votes or to risk alienating other social groups by including them. Likewise, as group size approaches 100% of the population nationally, that group is likely to dominate both tiers. Accordingly, electoral systems matter for social groups lying in between the lower and upper bounds.

By the same logic, electoral rules matter most for near-majority, geographically dispersed groups. A national minority constituting just less than fifty percent of the population has the most to lose from an SMD system. A national majority constituting just over fifty percent of the population has the most to gain.

These arguments are summarized in Table 3.1. In this stylized depiction, minority groups are understood to constitute a voting bloc greater than the lower threshold for representation and less than fifty percent, while the majority is understood to constitute greater than fifty percent and less than one hundred percent of the population. The outcomes in each quadrant show how the group’s descriptive representation is likely to be affected by different electoral laws, contingent upon size and geography.

Table 3.1: *Theoretical Expectations*

		Size	
		<i>Minority</i>	<i>Majority</i>
Geography	<i>Dispersed</i>	SMD < MMD	SMD > MMD
	<i>Concentrated</i>	SMD $\approx$ MMD	

Note: Size refers to the size of a group’s voting bloc. Inequalities denote the expected level of descriptive representation across electoral systems.

3.5 Derivations

Having presented our framework informally, we turn to a series of derivations that capture these features with greater precision. This idealized model considers an electoral system with

multiple districts. In the model, the population fractions of different social groups in each district are drawn from a Dirichlet distribution.

The Dirichlet distribution models the generation of distributional data, as we see when studying group proportions across countries. A draw from a Dirichlet distribution is constrained to the standard simplex; therefore, its individual components are strictly positive and sum to unity. Let $\alpha_0 = \sum_k \alpha_k$ and $\tilde{\alpha}_k = \alpha_k/\alpha_0$. Holding the mean shares $\tilde{\alpha}_k$ fixed, α_0 is the Dirichlet concentration parameter: smaller α_0 produces more extreme district compositions, while larger α_0 produces district shares closer to the national mean vector. This setup allows us to analyze how group size and spatial concentration affect representation under different electoral rules.³² For details, see Appendix V, where we provide full derivations along with a Lean script that mechanically verifies our core propositions using type theory, specifically, the Calculus of Inductive Constructions (Moura and Ullrich, 2021).

The formal model considers two SMD allocation rules and a proportional MMD benchmark. For MMDs, we model seat shares as proportional to aggregate group shares. With finite seats, allocation-rule rounding error is $O(1/D)$, meaning the gap between each group’s ideal proportional seat share and its realized integer seat share shrinks as district magnitude D grows. Thus, elite proportions converge to group proportions as district size increases. For SMDs, we first assume random sampling, where the probability that a group wins a district seat equals its population fraction in that district. We then incorporate affinity voting through a plurality-wins rule, where the largest group in a district deterministically captures the seat.

We consider an electoral system with D districts. For each district $d \in \{1, \dots, D\}$, let $\mathbf{P}_d = (P_{1d}, \dots, P_{Kd})$ denote the vector of group population fractions. We assume that these vectors are drawn independently from Dirichlet($\boldsymbol{\alpha}$), where $\boldsymbol{\alpha} = (\alpha_1, \dots, \alpha_K)$. Here P_{kd} is a random district share, $P_k = D^{-1} \sum_{d=1}^D P_{kd}$ is the realized aggregate share, and $\mathbb{E}[P_k] = p_k = \tilde{\alpha}_k$. Our preferred representation index is:

$$R^{\text{SMD}} = 1 - \frac{1}{2} \sum_{k=1}^K |P_k - G_k^{\text{SMD}}|.$$

For tractability, we analyze an analytically convenient squared-deviation surrogate:

$$\tilde{R}^{\text{SMD}} = 1 - \frac{1}{2} \sum_{k=1}^K (P_k - G_k^{\text{SMD}})^2.$$

³²The derivations below are intended as benchmarks for districts with large electorates (not as a literal sequence in which a fixed electorate is divided until each voter becomes a district). A finite-electorate version can be obtained by drawing latent district share vectors $\mathbf{P}_d \sim \text{Dirichlet}(\boldsymbol{\alpha})$ and then drawing voter-count vectors $\mathbf{N}_d = (N_{1d}, \dots, N_{Kd}) \mid \mathbf{P}_d \sim \text{Multi}(n_d, \mathbf{P}_d)$, so that $\mathbf{N}_d$ is marginally Dirichlet-multinomial. The observed district shares are $\hat{P}_{kd} = N_{kd}/n_d$, with $\hat{\mathbf{P}}_d = (\hat{P}_{1d}, \dots, \hat{P}_{Kd})$. As $n_d \rightarrow \infty$, $\hat{\mathbf{P}}_d \rightarrow \mathbf{P}_d$ in probability, and the additional finite-count variance terms are $O(1/n_d)$. Thus, the continuous model is not an assumption that voters are infinitely divisible; it is the large- n_d approximation to the corresponding finite-count model that yields simpler analytical results. The degenerate limit $n_d = 1$ occurs where every voter is their own district. If everyone eligible to vote is also eligible to hold office, descriptive representation is tautologically perfect. This possibility is outside the institutional comparison considered here. For more details, see Appendix V.

Since $|x| \geq x^2$ for $x \in [-1, 1]$, this surrogate upper-bounds the original index (because P_k and G_k^{SMD} are proportions in $[0, 1]$). For $K = 2$, it preserves the ordering of representation gaps; for $K > 2$ we treat it as a tractable diagnostic and compare its implications to simulations and empirical calculations using the original index.

Under random sampling, the expected value averages over (a) sampling of group shares into districts and (b) sampling of citizens into the body. The finite- D expectation has a simple form:

$$\mathbb{E}[(P_k - G_k^{\text{SMD}})^2] = \frac{\alpha_k(\alpha_0 - \alpha_k)}{D \alpha_0(\alpha_0 + 1)}.$$

Therefore, for fixed K ,

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2D} \sum_{k=1}^K \frac{\alpha_k(\alpha_0 - \alpha_k)}{\alpha_0(\alpha_0 + 1)} \rightarrow 1.$$

In other words, under random sampling, SMD representation converges to that of MMD with a large number of districts. Both achieve perfect match between the political body with the population.

Now, when we move from pure random sampling to the arguably more realistic affinity voting scenario, the situation differs markedly. In this second scenario, we simplify the problem by assuming a model with two social groups, in which the majority social group in each district secures the seat (this assumption is relaxed in Appendix V). Under plurality-wins affinity voting, the large- D limit need not equal 1. Define the plurality probability generally as

$$\pi_k = \Pr(P_{kd} > \max_{j \neq k} P_{jd}).$$

For $K = 2$, this becomes

$$\pi_k = \Pr(P_{kd} > 1/2) = 1 - F_{\alpha_k, \alpha_{k'}}(1/2),$$

where $F_{a,b}(x) \equiv \Pr(X \leq x)$ for $X \sim \text{Beta}(a, b)$, k' denotes the other group, and $\tilde{\alpha}_k = \alpha_k/\alpha_0$. Then

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] \rightarrow 1 - \frac{1}{2} \sum_{k=1}^2 (\tilde{\alpha}_k - \pi_k)^2.$$

The limit equals 1 only when each group's probability of being the district majority matches its mean population share; otherwise plurality-wins SMD representation falls below the proportional MMD benchmark.

Overall, the analytical findings here explain why we might observe significant differences in representation for women (a dispersed group) under different electoral rules but minimal differences for ethnic groups (which can be more geographically concentrated). For $K > 2$, Appendix V gives the analogous large- D expression,

$$1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k)^2, \quad \pi_k = \Pr(P_{kd} > \max_{j \neq k} P_{jd}).$$

Thus, the SMD–MMD gap is governed by the mismatch between a group’s mean population share and its probability of being the largest local group. This provides a mechanism by which geographically concentrated groups can secure local pluralities, while dispersed groups may be disadvantaged under largest-group-wins rules. General monotonic claims about α_0 in the $K > 2$ case should be interpreted as numerical patterns unless separately proved. A graphical interface explores $K > 2$ dynamics:

`HuggingFace.co/spaces/C8C9EA/LargestGroupWins`

To conclude this subsection, we note that these convergence results parallel Taagepera’s law of minority attrition. Using Taagepera’s notation, the seat-vote relationship can be written as

$$s_k = \frac{v_k^n}{\sum_{j=1}^K v_j^n}.$$

Here, s_k is group or party k ’s share of seats or slots, and v_k is its vote share—or, in our setting, its voting-bloc or population share. The exponent is $n = \log V / \log S$, where V denotes voters and S denotes constituencies or representational slots at the relevant stage (Taagepera, 2007, pp. 201–223); see also (Taagepera, 2008, pp. 148–151). As S approaches V , n approaches one, and s_k approaches v_k .

Our no-affinity random-sampling benchmark reaches an analogous proportionality result for a different reason: as the number of districts grows, stochastic district- and seat-sampling error vanishes, so SMD representation converges to the proportional MMD benchmark. By contrast, once affinity voting is modeled through a largest-group-wins SMD rule, group k ’s seat share converges to

$$\pi_k = \Pr(P_{kd} > \max_{j \neq k} P_{jd}),$$

which generally need not equal the group’s mean population share $\tilde{\alpha}_k$. Consequently, the SMD–MMD gap in our model is governed by the geographic mismatch $\pi_k - \tilde{\alpha}_k$ (not by seat availability alone). This makes spatial concentration explicit, whereas classic attrition models typically treat geographic agglomeration more implicitly or in average terms.

3.6 Simulations

The preceding derivations clarify how group size and dispersion shape descriptive representation across electoral systems. As stylized results that employ a tractable modification of our index, they cannot capture the full variability or potential non-monotonicities. We therefore turn to simulations to chart the broader parameter space and refine the theory.

The design of our simulations mirrors the idealized political institutions from our derivations. In particular, our simulations center on a hypothetical geographic region with D equal-sized SMDs allocated by plurality and D MMD seats allocated proportionally to parties, a typical mixed system of the *parallel* sort. In the simulations, the number of MMD seats is set equal to the number of SMD districts, D .

In our initial setup, we make several simplifying assumptions. We stipulate that all citizens within the region belong to one of 2 social groups, A or B . The size of these groups varies across the full range of possible values. Because these groups are inclusive and exhaustive, their relative size is symmetrical; as one group gets relatively larger, the other gets smaller.

We further stipulate that each social group is represented by a political party, and voters only support candidates from their own party, ensuring a one-to-one correspondence between social groups A and B and parties $\mathcal{P}_A$ and $\mathcal{P}_B$. There are no statutory thresholds, which means that fifty percent +1 of the vote within a district is required for a group to win an SMD seat, and $1/D$ of the region-wide vote is required to win an MMD seat.

Social groups vary in spatial concentration across districts in complex and evolving ways (given internal migration). We abstract from these complexities in order to focus on quantities of interest, namely, the population share of A and B and their degree of concentration or dispersion.

We vary the population share of groups A and B across a hypothetical country. We characterize these averages as $\mathbf{p} = (p_A, p_B)$, where p_A and p_B denote the average overall proportion of A and B . We then vary the spatial concentration of these groups throughout the country using the Dirichlet’s α_0 parameter. Low α_0 values generate high spatial concentration, with sampled district group proportions near $(0, 1)$ or $(1, 0)$. High α_0 values yield low concentration, with proportions near (p_A, p_B) . Here, we vary α_0 over $10^{-1.25}$ – 10^2 . For each value of α_0 , we set $\alpha_k = \alpha_0 p_k$, holding the mean vector fixed while varying spatial dispersion. In the ensuing analysis, we analyze results using the highest averages rule for translating votes to MMD seats; in Appendix I, we report results for the largest remainder and divisor floor rules.

With these assumptions in place, we can play out the impact of electoral rules with changing size and spatial distribution of A (and by extension B). Figure 3.1 shows how these factors affect the representation of A under SMD and MMD rules. In this figure, the outcome is defined as

$$\Delta_{G_A} = G_A^{\text{MMD}} - G_A^{\text{SMD}}, \quad (3.1)$$

where G_A^I represents group A ’s seat share in institution $I \in \{\text{MMD}, \text{SMD}\}$. In the figure, yellow indicates that MMD outperforms SMD (i.e., A gains more seats in MMDs than in SMDs), with orange marking more modest MMD advantages; purple and dark blue indicate that SMD outperforms MMD; and red represents the midpoint where electoral system rules bring no advantage to either group.

These results suggest that electoral rules have little impact on descriptive representation where A is very small, very large, or half of the population. Electoral rules also have little impact where A is spatially concentrated (along the bottom part of Figure 3.1). By contrast, where A is dispersed and comprises a sizeable minority (e.g., 30–45% of the population), MMDs outperform SMDs by a substantial margin (e.g., a 20–40 percentage points boost in representation). Likewise, where A is dispersed and comprises a sizeable majority (e.g., 55–70% of the population), SMDs render a much more favorable outcome (e.g., another 20–40 percentage points boost in representation). This pattern follows known features of first-past-the-post electoral systems, where narrow vote pluralities translate into large seat majorities (Taagepera and Shugart, 1989).

3.7 Hypotheses

Having laid out our theoretical framework in prose, in derivations, and in simulations, let us consider how it might map onto the real world of descriptive representation. Recall that expectations about the impact of electoral rules on representation rest on two characteristics

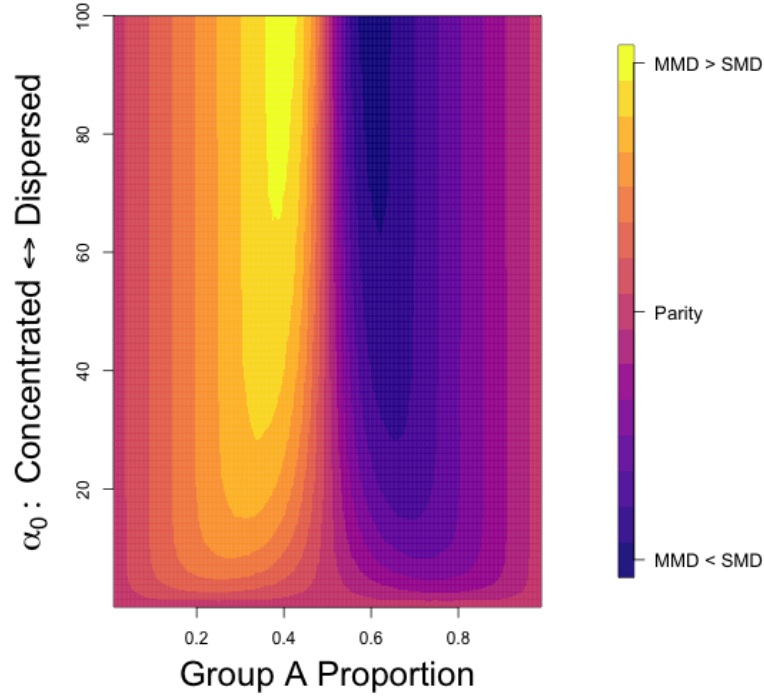


Figure 3.1: Outcome: *MMD-minus-SMD seat-share difference for group A (Δ_{G_A}).* Yellow and orange indicate $MMD > SMD$; purple and dark blue indicate $SMD > MMD$; red indicates approximate parity between *MMD* and *SMD*.

of a social group: their size relative to the general population and their geographic distribution across SMDs.

Since no two groups are exactly the same, and no group is entirely stable through time, the strongest predictions should arise from detailed knowledge of particular settings. Nonetheless, for any social group there are common tendencies that allow us to formulate a general hypothesis about how electoral rules are likely to impact their representation. Here, we consider 9 social groups: women, sexual and gender minorities (SGM), youth, immigrant ethnic groups, the disabled, the less educated (those without college degrees), the working class, native ethnic groups, and ruralites (those born in rural areas).

A few of these groups have been extensively researched in the context of electoral law and descriptive representation, as discussed in Chapter 2. Others are less studied but nonetheless worthy of attention. All will be formally defined and operationalized in the next chapter. For now, we focus on their expected representation under different electoral rules, laid out in Table 3.2.

All groups are understood as voting bloc minorities. This means that those members of each group who prefer candidates of their own kind constitute less than fifty percent of the general population. For example, women, working classes, and the less educated are demographic majorities but voting bloc minorities.

The decision to focus on minority groups is in some sense arbitrary. We might have

Table 3.2: *Hypotheses about group representation.*

Minority group	Geography	Expectation
<i>Women</i>	Dispersed	$SMD < MMD$
<i>SGM</i>	Dispersed	$SMD < MMD$
<i>Youth</i>	Dispersed	$SMD < MMD$
<i>Immigrant ethnic</i>	Dispersed	$SMD < MMD$
<i>Disabled</i>	Dispersed	$SMD < MMD$
<i>Less educated</i>	Concentrated	$SMD \approx MMD$
<i>Working class</i>	Concentrated	$SMD \approx MMD$
<i>Native ethnic</i>	Concentrated	$SMD \approx MMD$
<i>Rural</i>	Concentrated	$SMD \approx MMD$

Note: All groups are understood as voting bloc minorities. Inequalities denote expected levels of descriptive representation across electoral systems.

articulated each hypothesis in terms of *majority* groups, in which case the expected direction of each prediction in the final column of Table 3.2 would be reversed. However, this would break with tradition and generate needless confusion. People talk about the problem of minority *under*-representation rather than the problem of majority *over*-representation, even though they amount to the same thing.

In addition to size, we make assumptions about the typical spatial distribution of each social group. This is classified as *concentrated* if a group is spread unevenly across the land and is likely to constitute a plurality in at least some SMDs. It is classified as *dispersed* if it is evenly distributed, or if it is insufficiently numerous in any given district to become the local plurality. In the two-group simulations above, plurality and majority coincide; in the multi-group settings that motivate our empirical analysis, however, the relevant SMD threshold is local plurality. For example, immigrants tend to congregate in cities (Astruc-Le Souder et al., 2024); however, because cities are populous and therefore contain a multitude of SMDs, immigrant groups are rarely the plurality group in a district.

With this in mind, we classify women, SGM, youth, immigrants, and the disabled as dispersed, and the less educated, the working class, natives, and ruralites as concentrated—as indicated in the second column of Table 3.2.³³ It is worth underlining, once again, that concentration and dispersion are matters of degree and, like identity itself, highly contextual. It may also be the case that there is an affinity between concentration and political identity: where groups are geographically concentrated, they are more apt to cultivate a distinctive political consciousness.

The key point is that dispersed minorities should find MMDs more congenial while concentrated minorities should experience little difference in representation across electoral system

³³Studies of geographic concentration may be found for working classes (Jusko, 2017; Rodden, 2010) and native ethnic groups (Van Ham and Tammaru, 2016; Wagner and Dreef, 2014; Wucherpfennig et al., 2011). For other groups, patterns of concentration or dispersion are apparent enough to obviate statistical analysis.

types. These expectations, registered in the final column of Table 3.2, set the stage for the empirical investigation that follows.

4 Research Design

Having laid out our theory and a set of hypotheses, we turn to the research design. Recall from Chapter 2 that scholarly work about the impact of electoral rules on descriptive representation is abundant for women but limited for other social groups. Extant studies are also often subject to problems of causal inference stemming from non-random treatment assignment or from small samples that are subject to stochastic error.

Our approach to this complex subject is laid out in the sections that follow—focused on criteria of selection, the chosen countries and elections, the definition of social groups, coding procedures, the sample of MPs, within-group design, electoral system adoption, identity as a moderator, and finally, some technical notes on estimands and counterfactuals. We cover this ground slowly and carefully because the details are complicated and we want to be clear about our choices and their underlying assumptions.

4.1 Criteria of selection

Our sample is limited by design to recent elections to the lower or unicameral chamber of a national legislature where four criteria are satisfied. First, some degree of multiparty competition exists, setting the stage for the electoral dynamics sketched in Chapter 3. Second, a mixed electoral system combines SMDs allocated by plurality or majority along with MMDs allocated proportionally across closed lists.³⁴ Third, multiple consecutive elections are held under these rules. This is important because our theoretical interest lies in the equilibrium resulting from a given set of electoral rules. A lone election might say more about the novelty of the format (which neither citizens nor parties have had a chance to adjust to) than about the institutions of theoretical interest.

The fourth and most complicated issue concerns quotas. Most quotas are tier-neutral, preserving the contrast of theoretical interest. A few apply asymmetrically. For example, in Georgia (2020) and Taiwan (throughout the period of observation), statutory gender quotas apply only to the MMD tier. Cases such as South Korea and Panama are also asymmetric, but since the quotas are non-binding and largely ignored, they do not introduce any special concerns. Occasionally, SMD boundaries are drawn with the explicit purpose of representing a particular ethnic group, generating “majority-minority seats” in Panama (throughout) and Ukraine (in 1998). Finally, we note that voluntary party quotas are often implemented in MMDs rather than SMDs.

We view these adaptations as downstream from electoral system type. Quotas are much easier to implement in MMDs than in SMDs, and majority-minority districts are impossible to implement in SMDs. This suggests that the direction of causation runs from electoral law to quota type rather than the reverse. Asymmetric quotas may therefore be regarded as mediators.

If, however, quotas apply to an entirely separate tier of *reserved seats* – reserved for voters and/or candidates from a particular group, as in Bolivia and New Zealand – those seats are

³⁴This definition eliminates bloc-vote electoral systems and preferential-vote systems but admits a variety of more or less proportional rules for allocating votes to seats. For overviews of mixed electoral systems see Blais and Massicotte (1996), Flis, Grofman, and Kaminski (2025), Herron, Nemoto, and Nishikawa (2017), and Shugart and Wattenberg (2001).

removed. Because reserved seats operate in an entirely separate tier, they should not interfere with the comparison of theoretical interest – between the regular SMD/MMD tiers.³⁵

To ensure that these assumptions are not biasing results, we replicate the benchmark models after excluding Georgia’s 2020 and Taiwan’s 2016 and 2020 elections, where statutory gender quotas apply asymmetrically across tiers, and after excluding every sampled election in Bolivia, New Zealand, and Taiwan, which use reserved-seat tiers. The estimated MMD advantage for women remains positive throughout: 4 of 4 estimates remain statistically significant after excluding the asymmetric-quota elections, while 3 of 4 do so after excluding the reserved-seat elections and the positive aggregation-unit estimate becomes less precise (Appendix Tables A.VI.3 and A.VI.4).

4.2 Countries and elections

Applying these criteria to the universe of possible cases, we arrive at a sample that encompasses 15 countries, 44 country-elections, and 13,246 legislator-election records. Compared with prior work on mixed systems, this sample (i) is larger and more globally diverse; (ii) covers a much wider array of social groups; (iii) contrasts tiers at the actual MMD aggregation unit (national or subnational), allowing assessment of aggregation effects and a sharper view of how rules structure representation; and (iv) is coded at the individual level, enabling flexible multilevel analyses of candidates, districts, groups, and countries.

With this sample, we are able to achieve ample statistical power for testing the relationships of interest as well as fodder for generalizing beyond the sample. Of particular note is the ability to compare across social groups—defined by gender, ethnicity, class, and so forth—in order to discern the varying impact of electoral rules, holding all else constant. Now, let us consider the characteristics of this sample, summarized in Table 4.1.³⁶

The sample includes highly democratic countries as well as several where elections are less than free and fair. Weak democratic institutions may constrain descriptive representation — though regime-type is not usually identified as a strong predictor (Tremblay, 2007). Recall as well that our interest is not in representation per se but rather in the impact that electoral law might have on that outcome.

The period of observation for each country varies according to stipulated criteria, as discussed, and data availability. Most are represented by two or three elections while a few, such as New Zealand and Russia, offer longer periods. (In all but a few cases, chosen elections are consecutive. Since most of the variability of theoretical interest is cross-country rather than within-country, we needn’t worry too much about the temporal component of the sample. Several elections are sufficient to capture quantities of interest.

SMD and MMD tiers are balanced in size in most elections, though a few countries in Asia are slanted toward SMDs and a few countries in Europe are slanted toward MMDs. In most

³⁵In one special case – the 2018 Mexican election – only minority candidates were allowed to compete in SMDs with populations of at least 60 percent indigenous population. This is like reserved seats except that it occurred within MMD aggregation units and thus cannot be removed without confounding the contrast of theoretical interest. This case is therefore not included in our sample.

³⁶These are just some of the ways mixed member systems may vary—ways that are most germane for our interest in representation. For a discussion of other types of variation, see Flis, Grofman, and Kaminski (2025).

Table 4.1: *A global sample.*

Country	Election	Electoral system	MMD aggreg. units	SMD seats	MMD seats	Reserved seats (excluded)	Gender quota	Statutory threshold (%)
Bolivia	2009	MMP	9	63	60	7	Statutory	3
	2014	MMP	9	63	60	7	Statutory	3
Georgia	2016	MMM	1	73	77	0	No	5
	2020	MMM	1	30	120	0	Statutory	5
Germany	2009	MMP	16	278	384	0	Party	5
	2017	MMP	16	316	445	0	Party	5
Hungary	2018	MMP	1	113	86	0	Party	5
	2022	MMP	1	106	93	0	Party	5
Italy	2018	MMM	1	233	397	0	Statutory	3
	2022	MMM	1	146	253	0	Statutory	3
Japan	2009	MMM	1	300	180	0	No	0
	2014	MMM	1	295	180	0	No	0
Lithuania	2016	MMM	1	71	70	0	Party	5
	2020	MMM	1	71	70	0	Party	5
Mexico	2012	MMM	5	299	199	0	Statutory	2
	2015	MMM	5	300	200	0	Statutory	3
New Zealand	1996	MMP	1	60	55	5	Party	5
	1999	MMP	1	61	53	6	Party	5
	2002	MMP	1	62	51	7	Party	5
	2005	MMP	1	62	52	7	Party	5
	2008	MMP	1	63	52	7	Party	5
	2011	MMP	1	63	51	7	Party	5
	2014	MMP	1	63	50	7	Party	5
	2017	MMP	1	64	49	7	Party	5
	2020	MMP	1	65	48	7	Party	5
Panama	2009	MMM	11	26	45	0	Statutory	0
	2014	MMM	11	26	45	0	Statutory	0
	2019	MMM	12	26	45	0	Statutory	0
Russia	1993	MMM	1	224	225	0	No	0
	1995	MMM	1	225	225	0	No	5
	1999	MMM	1	225	225	0	No	5
	2003	MMM	1	222	220	0	No	5
	2016	MMM	1	225	225	0	No	7
	2021	MMM	1	225	225	0	No	5
South Korea	2012	MMM	1	253	47	0	Statutory	7
	2016	MMM	1	253	47	0	Statutory	8
Taiwan	2016	MMM	1	73	34	6	Statutory	5
	2020	MMM	1	73	34	6	Statutory	5
Thailand	2001	MMM	1	400	100	0	Party	5
	2005	MMM	1	400	100	0	Party	5
	2011	MMM	1	375	125	0	Party	0
Ukraine	2019	MMP	1	350	147	0	Party	0
	1998	MMM	1	225	225	0	No	4
	2019	MMM	1	199	225	0	Statutory	5

cases, electors cast separate votes across tiers, allowing for split ballots. The exceptions are Italy since 2017 and Thailand in 2019, where ballots are fused.

In some countries, candidates may be nominated in both tiers. In the event they are selected for both single and multi-member seats, they must concede one position (usually the MMD) in order to accept the other.

Both parallel (MMM) and compensatory (MMP) rules for allocating MMDs are represented in our sample, with MMM elections more common (28 versus 16). (In an MMP system, the number of MMD seats is adjusted to assure that each party’s total seat share is roughly proportional to its vote share on the MMD ballot. MMM systems do not adjust.)

Statutory thresholds for MMD representation are common. However, they are usually modest, surpassing five percent only in a few cases – Russia (2016 and 2021) and South Korea (2012 and 2016).

Votes for the MMD tier are aggregated at national levels except in Bolivia, Germany, Mexico, and Panama, where they are aggregated at regional levels, providing multiple aggregation units for those countries.

Gender quotas are present in most cases, either statutory (applying to the entire legislature) or voluntary (by party). A party quota refers to an election in which any of the major parties employs a gender quota.

Reserved seats for ethnic minorities exist in Bolivia, New Zealand, and Taiwan. These seats are excluded from our analyses, as explained.

4.3 Social groups

To ascertain the representation of different social groups one must arrive at definitions for the latter that are reasonably consistent in meaning and also operational—so that the identity of MPs across our global sample can be coded. This is not an easy task when dealing with categories that are fluid, contested, and often stigmatized.

We realize that the definition of a social group may change from one context to another, from one time period to another, and even from one person to another. Multiple categories may coexist and overlap (generating intersectionality), and some categories may be nested within others. Needless to say, different social group definitions will result in a somewhat different calculation of group size and group representation.

In the face of these difficulties, our approach is pragmatic and constructivist. We aim to capture social identities in ways that are most commonly understood in the countries under examination during the period of observation. Where categories suggest no objective metric we rely on MPs’ presentation of self, their declared identity.

Gender refers here to gender identity as publicly presented: male, female, or non-binary. The coded sample contains 0 non-binary legislator-election records; so effectively, this variable is rendered binary in our analysis. This is consistent with a large literature on gender and political representation, reviewed in Chapter 2.

Sexual and gender minority (SGM) denotes a publicly disclosed minority sexual orientation or gender identity. This is consistent with a small but growing literature on SGM representation, reviewed in Chapter 2. SGM status is coded independently of gender and may overlap with it; for example, a legislator may be both a woman and openly lesbian or bisexual. We therefore analyze gender and SGM as distinct identity dimensions.

Youth is defined as someone under age 35 as of election day. This threshold is admittedly arbitrary, as youth is a matter of degree and there is no demographic norm to fall back upon. In this setting, it is important to set the threshold higher than one might for other purposes since the achievement of a position in a country’s national legislature requires some experience and some countries erect minimum-age requirements. In any case, the sensitivity specifications at ages 30, 35, and 40 do not substantially affect results reported in subsequent chapters (see Table A.II.1).

Ethnicity is understood according to the most salient ascriptive cleavage in a society at the time of coding—which might be based on customs, language, race, religion, region, or some combination of the foregoing (see Appendix III for details).³⁷ *Ethnic minorities* are those groups comprising less than a plurality in a country. These are divided into two categories. *Immigrant* ethnic groups arrived mostly within the past century. *Native* minority groups descend mostly from ancestors who arrived more than a century ago.

Disability refers here to MPs who identify publicly as disabled. Following Evans and Reher (2024), we do not impose a particular definition. This seems important since some politicians do not see themselves as disabled even if they might qualify by some objective standard. Nonetheless, for those who self-identify as disabled this identity may enhance their capacity to represent the constituency in question, as discussed in Chapter 2.

Less educated is defined as someone without a university (BA) degree. In the contemporary era, this distinction in educational attainment appears to be the most consequential. The diploma divide operates at many levels—social, economic, and political—and is understood similarly across the world.³⁸

Working class is determined by each MP’s publicly reported occupation (prior to entering politics) and information about class background. This follows a large body of literature (reviewed in Chapter 2), though it should be noted that there is no standard metric for coding working-class politicians. Our approach begins with a multi-category class variable: working class, middle-class/professional, upper/elite, or unknown when evidence is insufficient. Manual labor, service work, agriculture, trades, transport, factory work, clerical work, peasant, union, and craft occupations are classified as working class. Professional, managerial, civil-service, legal, educational, medical, journalistic, military/officer, and consulting careers are classified as non-working-class professional backgrounds, while major business owners, top executives, aristocrats, major landowners, wealthy heirs, oligarchs, and similar elite backgrounds are classified as upper/elite. For the main analyses, middle-class/professional and upper/elite are collapsed into a non-working-class category, yielding a binary working-class indicator.

Ruralite refers to someone who was born in a rural part of the country. A sizeable literature attests to the social, political, and economic significance of the rural/urban divide.³⁹ Operationally, we recover each MP’s reported birthplace from the agent workflow, clean and geocode the place name, and link the matched coordinates to the nearest available WorldPop 1 km population raster for the election year (Tatem, 2017). MPs are coded as ruralites when the matched birthplace cell contains fewer than 300 persons per square kilometer, and as

³⁷Regarding the conceptualization of ethnicity, see Chandra (2006) and Stoll (2008).

³⁸See Apfeld et al. (2024), Bovens and Wille (2017), Hout (2012), and Zajacova and Lawrence (2018).

³⁹See Belanche, Casaló, and Rubio (2021), Cramer (2022), Jacobs and Munis (2023), and Rodden (2010, 2019).

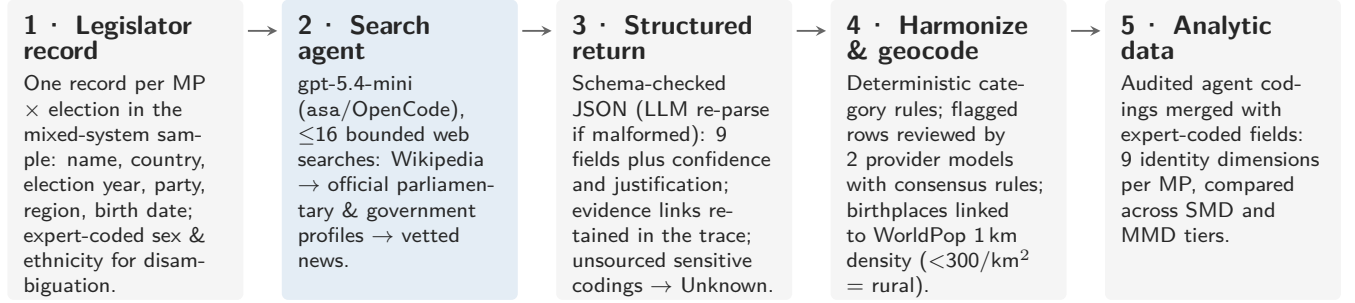
non-rural otherwise, following a standard definition used by the UN and European Commission (European Commission, Eurostat et al., 2020). Unresolved or ambiguous birthplaces are treated as missing.

4.4 Coding

Having defined our categories, let us discuss how these concepts are mapped on to empirical realities, i.e., *coding*.

The names of legislators, their sex, and their ethnicity are coded by country experts, building on original coding from the Global Leadership Project (Gerring, Oncel, et al., 2019). Experts draw on parliamentary websites and a variety of country-specific sources. These variables are coded comprehensively, including all MPs in each legislature (except those holding reserved seats, which are excluded from our sample, as noted).

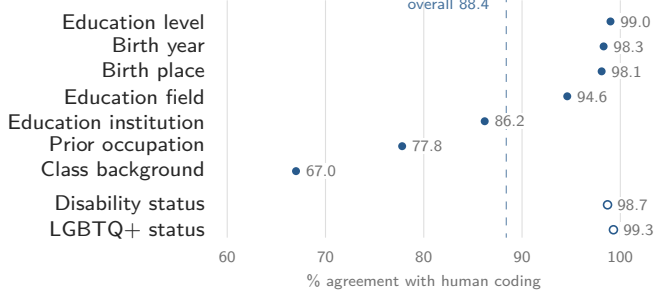
Additional MP characteristics are coded with a structured, search-enabled LLM protocol developed for this project (see Appendix X). We first construct one legislator-election record for each observation and provide the agent with identifying information used for disambiguation: name, country, election year, party, region, birth date when available, and the expert-coded sex and ethnicity fields. The agent is then asked to recover educational attainment, prior occupation and class background, birth year and birthplace, disability status, and publicly disclosed LGBTQ identity. Operationally, the agent conducts bounded web searches for each legislator, beginning with general biographical sources and then checking official parliamentary, government, party, or credible news sources. It returns a structured JSON record with field-specific evidence links, confidence scores, and justifications. Across features, overall agreement with human coders is 88.4%. Table A.X.1 reports results by feature. Agreement is highest for education level (99.0%) and birth year (98.3%), and lowest for class (67.0%). Figure 4.1 summarizes the workflow.



Decision rules: disability and LGBTQ+ status coded only when publicly disclosed (otherwise abstain) · no inference from names, appearance, or stereotypes · class assigned from primary pre-politics occupation · people-search sites excluded.

Human audit

150 elites, 10 per country



Open circles: share of agent abstentions consistent with the human “not disclosed” coding.

Scale & compute

13,860 records searched

one task per legislator–election record: 44 elections · 15 countries · 9 features each

2.41 billion tokens

0.57B mixed-system run ($\approx 41k$ per record, 98.4% search input) + 1.76B cross-sectional extension + 78M ensemble harmonization

$\approx \$175,000$

human-coding equivalent for 13,246 analytic records (≈ 40 min per elite at \$20/hr)

Figure 4.1: Agent-based biographical coding pipeline. Top: each legislator–election record is processed by a search-enabled LLM agent that consults public sources, returns schema-validated JSON with evidence links and confidence scores, and passes through ensemble harmonization and geocoding before entering the analytic dataset; the decision rules beneath the brace constrain the agent throughout. Bottom left: agreement with human coders on a country-stratified audit sample of 150 elites (closed circles; the dashed line marks the pooled rate of 88.4%); for the 2 disclosure features the agent abstains unless status is public, and open circles report the share of abstentions consistent with human “not disclosed” codings. Bottom right: scale of the coding exercise; token totals aggregate metered usage across the mixed-system run, the cross-sectional extension, and the harmonization ensemble (validation-judge calls were not metered). Search-agent usage is input-dominated (98.4%) because the agent re-reads retrieved sources at each reasoning step.

4.5 Members of parliament

Descriptive statistics for the entire sample of MPs are presented in Table 4.2. For each social group, we show the number of MPs coded into that category and their share (%) of the total in the first column. (Because MPs may serve in multiple parliaments, N is somewhat larger than the actual number of MPs.) In the second column, these statistics are aggregated by country.

Table 4.2: *Demographic characteristics of the sample*

Identity	MPs		MPs by country			Citizens by country		Under-representation	
	N	%	Mean	%	SD	Mean %	SD	Shortfall	Share
Women	2,838	21.4	189.2	23.7	11.9	51.4	1.4	27.8	0.54
SGM	66	0.5	4.4	0.4	0.9	2.5	0.4	2.0	0.83
Youth	904	6.8	60.3	7.0	4.4	27.8	7.3	20.8	0.75
Immigrant ethnic groups	319	2.4	21.3	1.3	2.7	2.8	5.9	1.5	0.53
Disabled	23	0.2	1.5	0.2	0.2	8.2	2.4	8.1	0.98
Less educated	521	3.9	34.7	3.6	3.7	71.3	9.5	67.7	0.95
Working class	1,295	9.8	86.3	9.4	5.5	40.3	11.6	30.9	0.77
Native ethnic groups	890	6.7	59.3	8.3	11.4	10.9	9.7	2.5	0.23
Ruralites	1,635	12.3	109.0	11.5	11.1	25.8	8.8	14.3	0.55

MPs reports total N and %; MPs by country reports country-level mean N , mean %, and SD. Citizens by country reports the across-country mean and SD of country-level population %, where each country's population shares are first averaged across its elections. Under-representation = citizen % - MP %; Share = shortfall / citizen %. Percent denominators use non-missing rows for Women and mapped ethnic-origin indicators; SGM and Disabled use the full sample; other AI-derived features use the post-imputation sample.

For pooled imputation output, MP N is rounded to whole MPs; by-country count and SD columns are pooled means and may be fractional.

The third column reports the distribution of minority groups across citizens in each country. Population figures are drawn from multiple sources. Women, rural, and youth shares come from United Nations Statistics Division (2025), with Bolivia, Thailand, and Taiwan drawing on national statistics offices where full age breakdowns were unavailable. Working class shares employ International Labour Organization (2025) ISCO-08 categories 6 through 9, covering skilled agricultural workers, craft and related trades workers, plant and machine operators, and elementary occupations. Less educated shares are defined as the proportion of the adult population without tertiary education, drawn from United Nations Statistics Division (2025). Disability statistics are drawn from national census and survey sources. Because consistent cross-national estimates of the openly SGM population are unavailable, the generated population inputs use a documented 1–3 percent proxy across 44 country-election observations.

The final column estimates the degree to which each minority group is under-represented. This may be calculated as the raw difference in percentages between the share of MPs from a group and the share of citizens from that group—“Shortfall” in Table 4.2. Alternatively, this difference may be calculated as a ratio of the group's size—“Share” in Table 4.2. The first accentuates the plight of large minority groups such as women, youth, and the working class. The second accentuates the plight of small minority groups such as SGM and the

disabled. The less educated score highly on both measures, suggesting that this may be the most under-represented group of all.

We turn next to *intersectionality*, the combination of different minority characteristics. Figure 4.2 displays the number of minority characteristics possessed by each MP among the 13,226 records complete on all 9 indicators. Of these records, 52.0 percent are in the majority across all dimensions, 34.6 percent possess one minority characteristic, and 11.2 percent possess two. Another 2.3 percent register three or more, and the observed maximum is 5. In short, most MPs are in the majority, and most minority MPs exhibit just one minority characteristic. Only 13.4 percent possess two or more minority characteristics, qualifying as intersectional.

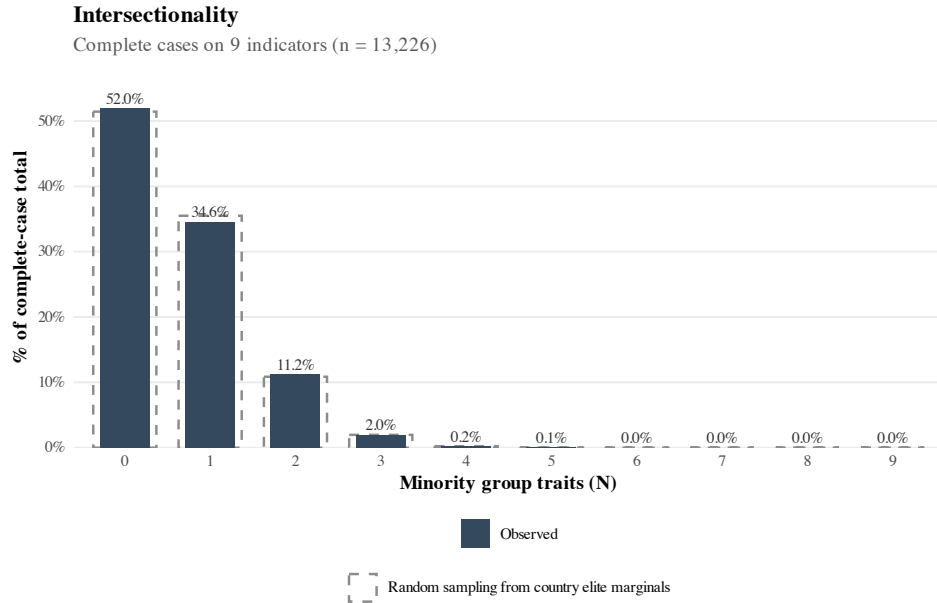


Figure 4.2: *Elites by disadvantaged identity status.* The dashed outline reports a random-sampling benchmark based on the elite pool in each country. For each country, we calculate the marginal prevalence of each disadvantaged identity among legislators with complete information, then compute the exact distribution that would arise if those identities were independently assigned according to the country-specific probabilities. The benchmark is aggregated across countries on the same complete-case scale as the observed bars. Non-degree education is counted as the disadvantaged education category.

Among those MPs who possess more than one minority characteristic, it is helpful to know which features are most commonly combined. One must bear in mind that these relationships are context-specific. They are likely to vary in different samples, and our sample is by no means representative of the world’s legislatures. With this caveat in mind, Table 4.3 reports the intercorrelations. Women MPs are more likely to be young and less likely to be without a college degree, working class, or born in a rural area. A fairly strong inter-relationship exists across class, education, and rural birth, as one might expect. SGM are found more often among youthful MPs. Other relationships are too slight to speculate upon.

Table 4.3: *Intercorrelations among feature indicators.*

Identity	1	2	3	4	5	6	7	8	9
1. Women	1.00								
2. SGM	0.00	1.00							
3. Youth	0.07	0.03	1.00						
4. Imm. eth.	0.02	-0.03	0.00	1.00					
5. Disabled	0.00	0.00	-0.01	-0.01	1.00				
6. Less educated	-0.02	-0.01	-0.02	-0.01	0.00	1.00			
7. W. class	-0.04	-0.02	-0.01	0.02	0.04	0.14	1.00		
8. Native eth.	0.01	0.01	-0.01	-0.07	-0.01	0.02	0.04	1.00	
9. Ruralites	-0.04	-0.03	-0.04	0.02	-0.01	0.03	0.06	0.04	1.00

Column numbers correspond to the numbered identities in the first column. Entries are unweighted means of within-country Pearson correlations between binary focal-feature indicators, computed with pairwise-complete observations within country. Undefined country-pair correlations are omitted. The upper triangle is omitted because the matrix is symmetric.

4.6 Within-group design

Background factors affecting descriptive representation are numerous and diverse, so much so that they may be impossible to identify, much less to measure systematically. Normally, this would impede causal inference. However, in a mixed electoral system, SMDs are nested within MMDs. This means that all factors characterizing that aggregation unit—a region or an entire country—are held constant. This includes the party system, leadership, ethnocultural composition, population, economic development, political culture, and unique histories. These and other background factors cannot account for varying levels of descriptive representation across tiers because they are identical across the two tiers of a mixed electoral system.

From this perspective, our setup may be regarded as a within-group experiment in which aggregation units (regions or entire countries) are exposed to simultaneous elections carried out under different rules.⁴⁰ The imagined counterfactual is that electoral rules change from SMD to MMD, or vice versa.

We do not presume that *individual electors* respond differently to the same candidate if presented in different tiers. This might be true at the margins and in some circumstances, but it is insufficient to drive sizeable differences in descriptive representation across tiers.⁴¹ In any case, split-ticket voting is relatively rare and in a few cases under study ballots are fused, preventing voters from differentiating across tiers.

We suppose, rather, that voters respond to parties, and affinity voters respond to the demographic composition of each party’s candidate(s) within their district. Accordingly, parties are incentivized to provide descriptive representation in order to win votes.⁴² Since opportunity structures differ across tiers, parties are sometimes prompted to select different sorts of candidates, as theorized in Chapter 3. Mechanisms of candidate selection may also differ across tiers, being more decentralized for SMDs and more centralized for MMDs—a question we leave for future research.

This is not a true experiment, as there are features we cannot control. In particular, electoral behavior across tiers in a mixed system is never entirely independent, which can lead to contamination across tiers. Studies suggest that this occurs for some outcomes such as party system size (Cox and Schoppa, 2002; Ferrara, Herron, and Nishikawa, 2005).

However, our theory rests on incentives for parties to select candidates who reflect the demographic characteristics of a district. There is little reason to suppose that this feature is affected by the existence of multiple tiers. Moreover, variation across social group types (gender, ethnicity, class, et al.) cannot be explained by contamination: there is no reason to suppose contamination in the placement of women across MMD and SMD tiers but not ethnic minorities, for example.

Nonetheless, to address the potential problem of contamination—and to generalize the findings—we repeat our main analysis with a cross-country comparison of “pure” MMD and

⁴⁰See Moser and Scheiner (2004) and Stratmann and Baur (2002).

⁴¹Horiuchi, Smith, and Yamamoto (2020) study this question in Japan using a conjoint (forced choice) experimental design. They find no differences across SMD and MMD contexts. This suggests that variations in candidates and MPs that arise across tiers are not due to varying preferences across settings.

⁴²A party, for present purposes, includes all those who influence the selection of candidates. This may be limited to a small elite (party leaders) or may be widely dispersed (as in party primaries).

SMD electoral systems (Section 5.3). Here, contamination is ruled out—though this design is of course open to many other confounders, and thus would not be plausible as a benchmark analysis.

4.7 Electoral system adoption

The within-group design laid out in the previous section is established by a prior constitutional choice—to adopt a mixed electoral system. The latter is certainly not a random event, so we must consider its import for the study.

Motives for adopting new electoral systems usually hinge on perceptions about the overall quality of governance in a country. This, in turn, may be colored by past performance and anticipation of party advantage under new rules. In the case of mixed systems, the goal is usually to achieve a satisfactory compromise between pure proportionality and pure majoritarianism (Shugart and Wattenberg, 2001). As such, the decision to adopt a mixed system might be considered as-if random with respect to the outcomes of interest.

However, we cannot entirely discount the importance of representational concerns. When a country moves from majoritarian to mixed, as New Zealand did through a referendum in 1993, it seems plausible that they also intend to improve descriptive representation. Likewise, when a country moves from proportional to mixed, as Italy did in 1993, it may indicate a desire to narrow the range of representation.

For this reason, analyses that compare descriptive representation before and after adoption of a mixed design are hard to interpret causally (Högström, 2025). They may reflect trends already in motion within a country combined with the perturbation of a new electoral system, rather than district magnitude per se.

Helpfully, trends and selection effects do not undermine our within-group design, centered on a comparison of descriptive representation across SMD and MMD tiers in the same election. This design is viable so long as there is no (or little) contamination, as discussed.

Because mixed electoral designs are chosen purposefully, the sample of countries that opt in may differ from those that opt out in ways that are consequential for representation. This raises questions about generalizability. To address this concern, we conduct a cross-country analysis of “pure” cases in Chapter 5, as discussed.

4.8 Conceptualizing identity as a moderator

Our theory centers on the interaction between electoral rules and social group identities. Each has quite different characteristics when treated as a cause.

Electoral rules offer a discrete, manipulable feature of social reality. One can make changes in electoral law without changing other aspects of politics and society. Insofar as background conditions are constant, it is possible to interpret X - Y covariation as evidence of causation (assuming the absence of confounding). As such, electoral rules fit neatly into the potential-outcomes model of causation.⁴³

By contrast, social identity is a relatively fixed, often inherited, characteristic. Gender, sexuality, race/ethnicity, class, and other social group identities bundle lots of characteristics

⁴³See Holland (1986) and Rubin (1975).

together under a single label, none of which is manipulable. As such, identity falls outside the purview of the potential-outcomes model of causation.⁴⁴

Non-manipulability is a common feature of moderators. In many experiments, the impact of a randomly assigned X on Y is contingent upon Z , which measures a fixed characteristic of research subjects.

In our analysis, the moderator is not social identity per se. We assume that citizens form group identities for a wide variety of reasons that fall outside the scope of our framework. What matters, for present purposes, is the size and geographic location of a minority group (concentrated or dispersed). It is these characteristics that, according to our framework, determine whether electoral rules are likely to affect descriptive representation, and if so, whether the group will fare better in SMDs or MMDs.

Accordingly, the imaginary experiment implied by our framework does not require changing women into men or members of one ethnicity into another ethnicity. Instead, it requires increasing or decreasing the size of a group or repositioning its members so they are more or less geographically concentrated.

Consider a policy intervention that consists of steering one set of immigrants toward a single location within the host country while another group is steered toward multiple locations. If the two groups are similar along background conditions that might affect representation, we can consider this a natural experiment testing the geographic aspect of our theory. Of course, this sort of natural experiment would be hard to find, and there would be inevitable questions about confounding. (Are the two groups really the same on background factors relevant to representation?) The point is, we have found a way to express the argument as an as-if random experiment, bringing it into the purview of the potential outcomes model of causation.

A final issue to consider is the possible impact of electoral institutions on social identities. If the adoption of a mixed design changes the way people think of themselves, at least for political purposes, then electoral systems might still structure representation, but the mechanisms would be quite different from those outlined in Chapter 3.

Our supposition is that electoral designs are likely to be overwhelmed by all the other factors that influence the formation of social identity. Even if one doubts this conclusion, one may accept that to the extent that electoral laws matter, a mixed system produces countervailing effects—through SMDs on the one hand and MMDs on the other. Under the circumstances, it seems reasonable to treat identity as exogenous within the context of a design that compares the representation of the same groups across two electoral tiers.

To clarify the causal logic underpinning these theoretical expectations, Figure 4.3 maps the relationship between electoral rules, social identity, and descriptive representation. We distinguish between two possible mechanisms. Model A depicts our primary theoretical framework: the geographic concentration and relative size of a social group act as exogenous moderators. In this view, identities and spatial distributions are relatively fixed, conditioning how effectively proportional or majoritarian electoral rules translate votes into descriptive representation.

Alternatively, Model B illustrates a more complex, endogenous mechanism where electoral rules themselves shape the construction, politicization, and fluidity of social identities. Pro-

⁴⁴For further discussion see Gerring (2027).

portional rules may encourage distinct group identities to form over time, making identity an endogenous mediator of representation. Our derivations and empirical design nevertheless use Model A’s exogenous-moderation framework as the baseline for mapping demography onto political power.

A: Identity as Exogenous Moderator B: Identity as Endogenous Mediator

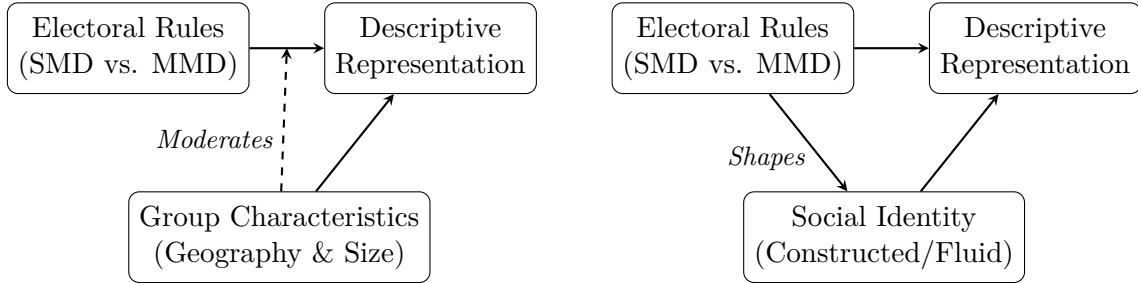


Figure 4.3: Causal logic linking electoral rules, social identity, and descriptive representation. Model A visualizes our core theoretical assumption: social group characteristics (varying by geographic concentration and size) are exogenous factors that moderate the impact of electoral rules on descriptive representation. Model B illustrates an alternative perspective where electoral institutions endogenously shape how social identities are formed and mobilized politically. Solid arrows indicate direct causal relationships; the dotted arrow in Model A represents a moderation effect, signifying that group characteristics condition the impact of electoral rules on representation.

4.9 Estimands and implied counterfactuals

Before presenting main results (in Chapter 5), we distinguish two ways to condition the joint distribution of identity and electoral tier empirically. The first, a rule-as-exposure model, $\Pr(\text{identity} \mid \text{tier})$, treats the institutional rule as the exposure and asks who occupies seats filled under each rule. The second, a tier-as-exposure model, $\Pr(\text{tier} \mid \text{identity})$, treats a legislator's identity as the exposure and asks how otherwise comparable members of the realized legislative roster are distributed across tiers. These two frameworks imply different counterfactuals and have different natural support (that is, they are not defined for the same set of elections).

Legislators, seats, and the two conditional contrasts

To formalize this distinction, index countries by $c = 1, \dots, C$ and the observed mixed-system elections in country c by $e = 1, \dots, K_c$. Election ce fills N_{ce} seats: n_{0ce} in the SMD tier and n_{1ce} in the MMD tier, where $N_{ce} = n_{0ce} + n_{1ce}$. For legislator-seat i , let $T_i \in \{0, 1\}$ indicate its tier, with $T_i = 1$ for an MMD-tier seat. For a focal identity group g , let $G_{ig} \in \{0, 1\}$ indicate whether its occupant belongs to g . The observed share of tier- t seats held by group g is then:

$$\hat{\theta}_{tge} = \frac{1}{n_{tce}} \sum_{i \in ce} \underbrace{G_{ig} \mathbb{1}\{T_i = t\}}_{\substack{\text{1 only if seat } i \text{ is in tier } t \\ \text{and held by a member of } g}}, \quad t \in \{0, 1\}. \quad (4.1)$$

Next, define the number of members inside ($q = 1$) and outside ($q = 0$) group g by

$$n_{qce}^g = \sum_{i \in ce: G_{ig} \text{ observed}} \mathbb{1}\{G_{ig} = q\}, \quad q \in \{0, 1\}, \quad (4.2)$$

so that $n_{1ce}^g + n_{0ce}^g = N_{ce}^g$, the number of legislator-seats in election ce with an observed value of identity g (equal to N_{ce} when the identity is observed for all members). The observed share of identity- g members located in the MMD tier is

$$\hat{\pi}_{qge} = \frac{1}{n_{qce}^g} \sum_{i \in ce} T_i \mathbb{1}\{G_{ig} = q\}. \quad (4.3)$$

The two key empirical election-level contrasts are therefore:

$$\hat{\Delta}_{gce}^C = \underbrace{\Pr_n(G_g = 1 \mid T = 1, ce) - \Pr_n(G_g = 1 \mid T = 0, ce)}_{\text{fix the tier, compare group prevalence}} = \hat{\theta}_{1gce} - \hat{\theta}_{0gce}, \quad (4.4)$$

$$\hat{\Delta}_{gce}^L = \underbrace{\Pr_n(T = 1 \mid G_g = 1, ce) - \Pr_n(T = 1 \mid G_g = 0, ce)}_{\text{fix the identity, compare tier placement}} = \hat{\pi}_{1gce} - \hat{\pi}_{0gce}. \quad (4.5)$$

The superscripts C and L denote composition and location contrast type, and $\Pr_n$ denotes an empirical probability in the realized legislature. This notation uses the country-election as the comparison stratum. When we instead compare tiers within regional MMD aggregation units, the comparison stratum becomes the country-election-region; the notation and algebra

are otherwise unchanged.

Counterfactual interpretation of the composition contrast

With this notation in hand, what are the implied counterfactuals? The composition contrast is meant to answer a what-if question:

If the seats filled under one set of rules had instead been filled under the other set, how would the identity makeup of their occupants have differed?

The “treatment” in this thought experiment is not a single rule but the bundle of rules attached to a tier: district magnitude, ballot structure, and the seat-allocation formula. (In some systems, the bundle also includes thresholds, compensatory linkages, or rules governing dual candidacy.)

To make this precise, think of each election ce as filling two blocks of seats, indexed by $b \in \{0, 1\}$: the block actually governed by SMD rules and the block actually governed by MMD rules. Suppose initially that what happens in one block does not spill over into the other—each block’s outcome depends only on its own rule. For each block, imagine running the election twice, once under each rule bundle, and write $\theta_{bgce}(t) \in [0, 1]$ for the share of block b ’s seats that group g would win if rule $t \in \{0, 1\}$ governed that block. These are *potential outcomes*: only one of the two is ever observed for a given block, while the other describes the road not taken.

It is worth being clear about what this imagined re-run of the election holds fixed and what it lets vary. Everything already in place before the rules take effect stays the same: the date, the electorate, the party system, and the broader social environment. Everything downstream of the rules is free to adjust: parties may nominate different candidates, campaigns may follow different strategies, voters may cast different ballots, and seats are allocated by the new formula. In other words, the counterfactual does not merely re-tally the same votes under a different formula; it imagines the full electoral process unfolding under the other rule. Standard consistency reasoning then links the imagined quantities to the data: the block actually run under MMD rules reveals $\theta_{1gce}(1)$, and the block actually run under SMD rules reveals $\theta_{0gce}(0)$. The other two quantities—what the MMD block would have looked like under SMD rules, and vice versa—remain unobserved.

In what follows, $\mathbb{E}$ averages over the candidate-selection and voting processes generated by a rule, conditional on the stated pre-rule election context. Because each block reveals its outcome under only one rule, comparing the two observed blocks is informative about the effect of the rules only if the blocks are comparable—that is, only if they would have looked alike had they been governed by the same rule. The next assumption states this requirement.

ASSUMPTION 1 (WITHIN-ELECTION BLOCK COMPARABILITY) *For every mixed-system election ce and both rules $t \in \{0, 1\}$,*

$$\mathbb{E}[\theta_{1gce}(t)] = \mathbb{E}[\theta_{0gce}(t)] \equiv \psi_{gce}(t). \quad (4.6)$$

In expectation, the two seat blocks would have the same identity composition if the same rule governed both.

Assumption 1 states the natural-experiment logic of the mixed-system design. Both tiers are filled on the same day and share a party system and national political environment. The assumption does not claim that the blocks are identical. Instead, it requires their remaining differences—including geography and the composition of the constituencies assigned to each block—to have no expected effect on representation under a common rule.

Under consistency, limited cross-tier interference, and Assumption 1, the election-specific estimand is

$$\tau_{gce}^C = \psi_{gce}(1) - \psi_{gce}(0) = \mathbb{E}[\hat{\Delta}_{gce}^C]. \quad (4.7)$$

Thus, τ_{gce}^C is the expected effect of using the MMD rather than the SMD rule bundle to fill a comparable seat block in election ce .

Counterfactual interpretation of the location contrast

The reverse conditional relies on a different thought experiment. Instead of asking what would happen if a block of seats were governed by different rules, it asks:

For a person who actually serves in the legislature, through which tier would that same person have entered if their identity had been different?

The what-if now attaches to the legislator, not to the institution.

To make this question precise, let $\mathcal{R}_{ce}$ be the realized roster—the set of legislators actually serving after election ce . For each member $i \in \mathcal{R}_{ce}$, let $T_{ice}(q) \in \{0, 1\}$ denote the tier through which that same person would have entered the legislature if their focal identity status were $q \in \{0, 1\}$, holding everything else about them fixed: the same career, the same party, the same constituency ties, with only the single identity marker switched. As before, these are potential outcomes, and only one of the two is ever observed: for each legislator, we see the entry tier under their actual identity, $T_i = T_{ice}(G_{ig})$, while the entry tier under the counterfactual identity remains imagined.

Notice what this thought experiment assumes. Under both identity states, every person on the roster still makes it into the legislature; the only thing allowed to change is the door through which they enter. We call this the fixed-roster, or always-serves, premise. It is a strong assumption: in reality, changing a politician’s identity might change whether they are nominated or elected at all, not merely which tier they arrive through.

Nevertheless, the corresponding fixed-roster contrast is

$$\tau_{gce}^L = \frac{1}{N_{ce}^g} \sum_{i \in \mathcal{R}_{ce}} [T_{ice}(1) - T_{ice}(0)]. \quad (4.8)$$

Connecting this counterfactual contrast to $\hat{\Delta}_{gce}^L$ requires both identity categories to occur in the election. It also requires an all-else-equal comparability condition: members observed inside and outside group g would have the same average potential tier under either identity state. In notation,

$$\mathbb{E}[T_{ice}(q) \mid G_{ig} = 1, ce] = \mathbb{E}[T_{ice}(q) \mid G_{ig} = 0, ce], \quad q \in \{0, 1\}. \quad (4.9)$$

Table 4.4: Two counterfactual readings of the identity–tier relationship.

	Identity-as-exposure model	Rule-as-exposure model
Panel A: Question and conditioning		
Question & conditional	Who occupies the seats filled under each rule? $\Pr(G_g = 1 \mid T = t, ce)$: fix the tier, compare group prevalence.	Through which tier do serving members enter? $\Pr(T = 1 \mid G_g = q, ce)$: fix the identity, compare tier placement.
Election-level contrast	$\hat{\Delta}_{gce}^C = \hat{\theta}_{1gce} - \hat{\theta}_{0gce}$ (Eq. 4.4).	$\hat{\Delta}_{gce}^L = \hat{\pi}_{1gce} - \hat{\pi}_{0gce}$ (Eq. 4.5).
Panel B: Counterfactual thought experiment		
Exposure & what-if	The tier’s rule bundle (magnitude, ballot, formula): had the block been filled under the other rule, how would occupants’ identity makeup differ? Potential outcomes $\theta_{bgce}(t)$.	A serving legislator’s focal identity: had it been different, through which tier would the same person have entered? Potential outcomes $T_{ice}(q)$.
Held fixed vs. free to vary	Pre-rule context fixed; nominations, campaigns, votes, and allocation adjust.	Roster fixed (“always serves”): all members still enter; only the entry door may change.
Panel C: Identification		
Key assumptions	Consistency; limited cross-tier interference; within-election block comparability (Assumption 1).	Consistency; fixed-roster premise; identity–location comparability (Eq. 4.9).
Estimand & support	$\tau_{gce}^C = \psi_{gce}(1) - \psi_{gce}(0)$: rule-bundle effect on a comparable seat block (Eq. 4.7); defined in every mixed-system election.	τ_{gce}^L : average entry-tier shift on the fixed roster (Eq. 4.8); defined only where both identity cells are populated ($e \in \mathcal{E}_{cg}^+$).
Panel D: Estimation and interpretation		
Regression	LPM of G_{ig} on T_i with country-election fixed effects and weights w_i^C (Eq. 4.11; Proposition 1); recovers $\hat{\Delta}_g^{C,eq}$ (Eq. 4.10).	LPM of T_i on G_{ig} with country-election fixed effects and weights w_{ig}^L (Eq. 4.12; Proposition 2); recovers $\hat{\Delta}_g^{L,eq}$ (Eq. A.V.4).
Interpretation	Positive: the group holds a larger share of MMD than SMD seats; causal under Panel C conditions.	Positive: group members more likely to serve via the MMD tier; a sorting contrast, not a causal effect of identity.

Note: T_i indicates an MMD-tier seat, G_{ig} membership in focal group g ; $\hat{\theta}_{tgce}$ and $\hat{\pi}_{ggce}$ are the tier-composition and identity-location shares in election ce (Eqs. 4.1, 4.3). Within an election both slopes share the sign of $\text{Cov}(G_g, T)$ (Eq. A.V.20) but answer different counterfactual questions on different supports, so they are generally not equal (Appendix V).

Under consistency and this condition, the observed location difference is the sample analogue of equation 4.8.

Effects may vary across elections and countries, so each aggregate contrast must specify both its support and its weights. The composition contrast is defined in every mixed-system election. Its equal-country, equal-election estimator is

$$\hat{\Delta}_g^{C,\text{eq}} = \frac{1}{C} \sum_{c=1}^C \frac{1}{K_c} \sum_{e=1}^{K_c} \hat{\Delta}_{gce}^C. \quad (4.10)$$

Under the institutional identification conditions above, replacing each observed contrast with its expectation, τ_{gce}^C , yields the corresponding causal average, under the outlined assumptions.

Under their respective identifying assumptions, the composition and location values can be numerically equal under either of two sufficient conditions. First, $\text{Cov}(G_g, T \mid ce) = 0$, as when both contrasts are zero and group prevalence does not differ across tiers. Second, $\text{Var}(G_g \mid ce) = \text{Var}(T \mid ce)$, as when group and tier prevalences are identical.

Regressions as aggregate estimators

For each focal identity, we estimate the two linear probability models:

$$G_{ig} = \alpha_{ce(i)}^C + \delta_g^C T_i + \varepsilon_{ig}^C, \quad (\text{composition model}) \quad (4.11)$$

$$T_i = \alpha_{ce(i)}^L + \delta_g^L G_{ig} + \varepsilon_{ig}^L, \quad (\text{location model}) \quad (4.12)$$

where G_{ig} denotes the focal group outcome, T_i the tier outcome, the α 's denote country-election fixed effects, the δ 's the coefficients of interest, and the ϵ 's random shocks.

With appropriately chosen weights, these two regressions reproduce the equal-country, equal-election averages of the election-level contrasts defined above. Assigning each legislator-seat a weight that balances the two-tier cells within an election and downweights countries observed in many elections makes a WLS estimate of δ_g^C in Equation 4.11 numerically identical to $\hat{\Delta}_g^{C,\text{eq}}$ in Equation 4.10. An analogous weighting—defined only over the elections and countries in which both identity cells are populated—makes the WLS estimate of δ_g^L in Equation 4.12 equal to the corresponding equal-weighted average of location contrasts. Propositions 1 and 2 in Appendix V state these equivalences precisely; a practical payoff is that legislator-level, cell-level, and contrast-then-average computations all yield exactly the same point estimates, so no individual-level computation is required.

Appendix V also defines two composition variants reported alongside the benchmark models: a district-balanced specification that counts each SMD constituency and each MMD aggregation unit once, and an MMD aggregation-unit fixed-effects specification that makes the same comparison within regional aggregation units containing seats from both tiers. There, we also provide explanation of the assumptions required for a cross-section analysis of institutions to yield causally interpretable.

5 Main Effects

Having presented the theoretical framework (Chapter 3)—including specific hypotheses (Table 3.2)—and the research design (Chapter 4), we turn to the main effects.

Readers should bear in mind that our sample includes minority groups that have gained substantial representation in national legislatures such as women, youth, native ethnic groups, and ruralites, as well as groups that have very minimal representation such as immigrants, SGM, and the disabled (Table 4.2). Across countries in our sample there is also considerable variability. Female representation is close to parity in some countries and closer to zero in others, to take one example. Varying levels of success across groups and societies are presumably explained by myriad factors including the demographic size of the group, the strength of affinity voting, favorable and unfavorable views of the group by other voters, and the supply of candidates.

These factors lie outside our theoretical purview, centered narrowly on the role of electoral law. To sideline potential confounders, our main analysis focuses on settings where the same group in the same country is subject to two electoral rules in the same election. Recall that in a “mixed” electoral system, one tier of candidates runs in SMDs and the other tier in MMDs. Voters normally cast two ballots (occasionally these ballots are fused). The only feature distinguishing these two tiers is the size of the district, its magnitude: $M = 1$ or $M > 1$. In this unique context, we are able to test whether electoral rules affect the representation of a social group while holding other factors (external to the group) constant. Where does PR matter, and whom does it help or hurt?

The chapter begins with a consideration of country aggregates. The next section offers a finely grained statistical analysis in which individual MPs constitute the units of analysis. The third section steps outside the world of mixed electoral systems to explore variability across pure SMD and pure MMD systems. The final section reviews additional robustness tests presented in appendices.

5.1 Country aggregates

As a first cut, we adopt the traditional approach—directly comparing the representation achieved by social groups under different electoral rules. Each graph in Figure 5.1 focuses on a different minority group, and each point represents a different country, averaging results across all elections for that country. The large circle represents the mean value across all countries displayed in the graph.

Note that the scale for each graph depends upon the actual representation of each minority group. Where it is minimal, the scale is compressed toward zero. And where a country is missing entirely from a graph, it signifies that no members of that minority group gained representation in that country’s national legislature during the period of observation.

Panel (a) shows wide variability in female representation across the countries in our sample and demonstrates that female politicians are more likely to achieve representation in the MMD tier. This pattern is apparent in nearly every country in our sample, though more marked in some places (e.g., South Korea) than in others. This is the most expansive test of the impact of electoral rules on representation by gender to be focused on mixed electoral systems, and it confirms a longstanding hypothesis in the literature (Chapter 2). Nonetheless, there are

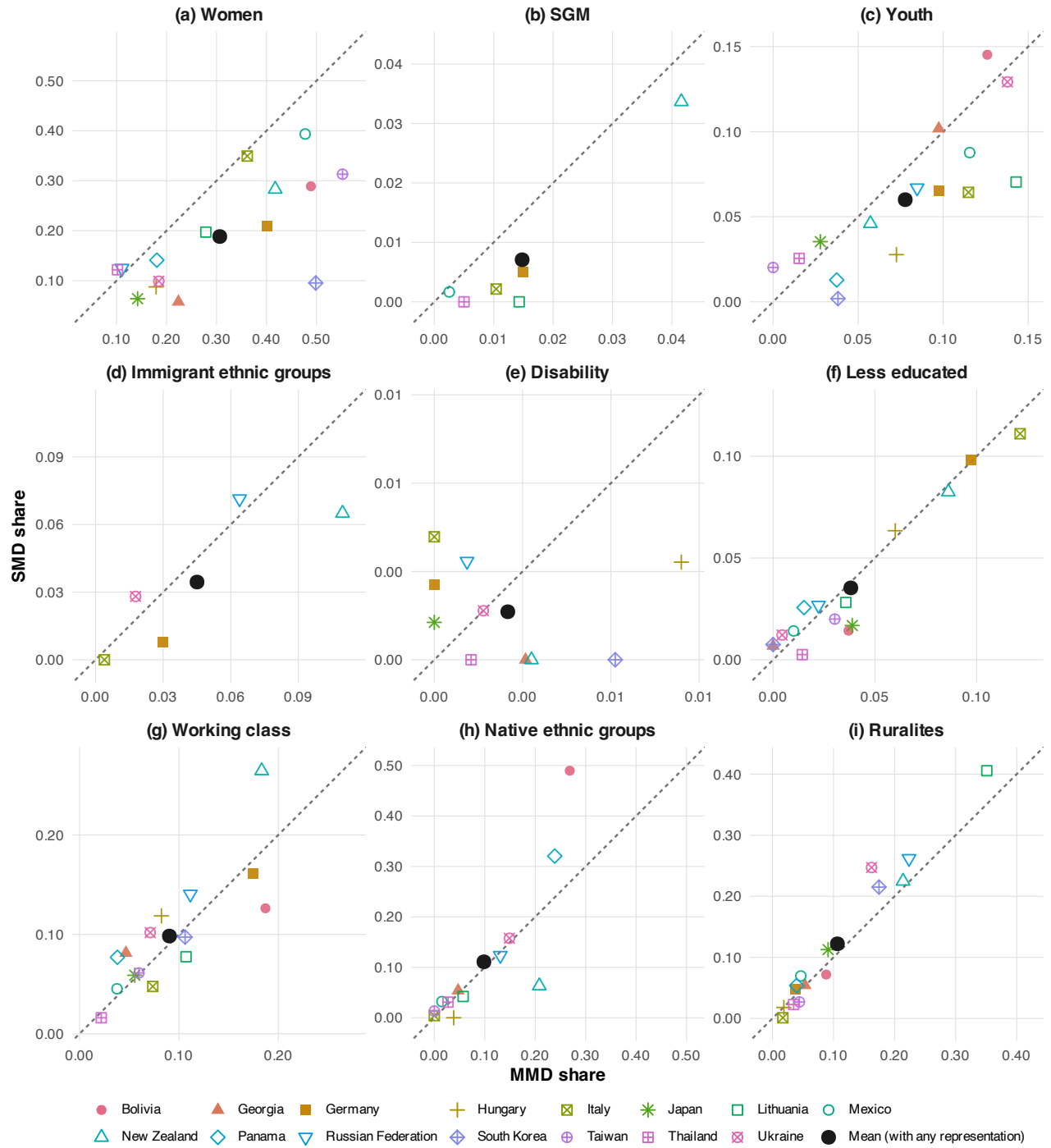


Figure 5.1: Representation of 9 minority groups in 15 countries, averaged across elections for each country. In every panel, the x-axis is the group's seat share in MMD tiers and the y-axis is the group's seat share in SMD tiers. Points below the diagonal indicate greater representation in MMDs; points above the diagonal indicate greater representation in SMDs. Countries offering no representation for a particular group are not listed in that graph.

several countries, including Italy, Russia, and Thailand, where electoral rules have no (or very minimal) impact on women’s representation.

Sexual and gender minorities also tend to achieve more representation in MMDs than in SMDs, as shown in panel (b). Indeed, no country in our sample offers significantly greater SGM representation in the SMD tier, though in a few cases the numbers are near parity. One must bear in mind that members of this minority group achieve no representation in 9 of 15 countries (60 percent), and the numbers who reach office in the remaining 6 are extremely small. This makes it difficult to reach strong conclusions since results may be stochastic.

Youth are also usually better represented in the MMD tier, though there are a few exceptions in our sample, as shown in panel (c). Because all 15 countries offer some representation to youth, and the numbers are non-trivial, this result is unlikely to be stochastic.

Immigrant groups appear to enjoy a slight advantage in the MMD tier, as demonstrated in panel (d). However, the evidence is weak since only 5 countries offer any representation to these groups, and the total number of MPs is very small. In only 2 cases—Germany and New Zealand—is the advantage significant. One must be very hesitant about reaching conclusions upon such scanty evidence.

Disabled members of the general population are not well-represented in our sample of MPs, though they have gained some representation in 10 of 15 country cases (all but Bolivia, Lithuania, Mexico, Panama, and Taiwan). The mean value across countries suggests that disabled representation may be slightly higher in the MMD tier. However, the spread of cases above and below the diagonal appears to the naked eye to be fairly balanced, and any estimate will be liable to influential cases.

Less educated citizens are somewhat better represented in our sample, and all 15 countries offer some representation to this group. However, panel (f) suggests that the cases cluster so closely to the diagonal that electoral rules may be irrelevant.

Working class constituents also achieve some representation in all 15 countries in our sample. Panel (g) shows a scatter of data points on either side of the diagonal, suggesting that electoral rules have little impact on that representation.

Native ethnic minority groups are well represented in some countries, and barely represented in others. This is largely a reflection of the varying size of these groups across the countries in our sample. In some countries, a single group comprises an overwhelming majority of the population; in others, the largest group is a plurality rather than a majority.

In any case, the question of interest is whether the representation of native ethnic minority groups is greater in MMD or SMD constituencies. Panel (h) shows that most countries fall near the diagonal, and those further away from the diagonal fall on both sides, balancing each other out. In Bolivia, Evo Morales’ Movimiento al Socialismo (MAS), which is closely tied to the indigenous population, won 8 of 9 departments, including some SMDs not dominated by indigenous voters. In this instance, winner-take-all rules unexpectedly favored a minority group under charismatic leadership. In New Zealand, aboriginal groups have gained greater representation in MMDs. (Note that reserved seats are not included in our analysis.)

Ruralites are fairly well represented in our sample. If one squints hard, one might discern an advantage for ruralites in SMDs. However, that advantage is so slight as to be indistinguishable from chance. Accordingly, we conclude that there is no meaningful difference in success rates

across the two tiers.

Table 5.1 summarizes these country-level comparisons and the number of countries in which each group receives any representation. As such, it serves as a summary of the complex patterns observed in Figure 5.1.

Table 5.1: *Representation of social groups by electoral tier.*

Social group	Mean SMD share (%)	Mean MMD share (%)	Countries with any representation (N)
Women	18.8	30.6	15
SGM	0.7	1.5	6
Youth	6.0	7.8	15
Immigrant ethnic groups	3.4	4.5	5
Disabled	0.2	0.3	10
Less educated	3.5	3.8	15
Working class	9.8	9.0	15
Native ethnic groups	11.1	9.8	12
Ruralites	12.2	10.6	15

Note: Seat shares are expressed as percentages. Elections are averaged equally within each country, then countries are averaged equally among countries with representation in either tier. N is the number of such countries; countries with zero representation in both tiers are omitted.

5.2 Regression analysis

Scatterplots in Figure 5.1 offer a highly aggregated picture of how electoral rules impact descriptive representation. They are helpful for identifying general patterns and specific cases that may be regarded as typical or deviant. However, by virtue of the high level of aggregation, they obscure much of the information contained in our sample—across elections, across MMD aggregation units (in Bolivia, Germany, Mexico, and Panama), and across MPs. Moreover, they do little to control for potential confounders or to distinguish patterns that might be stochastic from those that are systematic. In this section, we explore statistical models that promise more sensitive tests of the main hypotheses (summarized in Table 3.2).

Table 5.2 reports two complementary ways of conditioning the relationship between identity and electoral tier. The assumptions underlying these models are discussed at the end of Chapter 4; here, we focus on the estimates resulting from these models.

For each identity, the identity-as-exposure model estimates a linear probability model in which identity membership is the dependent variable and the MMD-tier indicator is the predictor of interest. Country-election fixed effects restrict the comparison to SMD and MMD seats filled in the same national election, so the MMD coefficient is the within-election difference in the prevalence of the focal identity. Positive values indicate that the group occupies a larger share of MMD seats, and negative values indicate a larger share of SMD seats. The rule-as-exposure model reverses the conditioning: MMD-tier service is the outcome, and its co-

efficient is the focal-minus-nonfocal difference in the probability of serving through the MMD tier.

Both models use legislator-seat observations with weights that give each country equal influence and, within each country, give each eligible election equal influence. One country therefore cannot dominate the result merely because it has larger legislatures or more observed elections. The table also reports two composition variants. The district-balanced model counts each MMD aggregation unit and each SMD constituency once before applying the equal-country/election weights, while the aggregation-unit fixed-effects model compares tier-level identity shares within paired MMD aggregation units. The final column instead uses logged district magnitude as the outcome in a joint legislator-level model containing all 9 identities, election year, and country fixed effects. Standard errors use the CR2 small-sample correction clustered by country, with coefficient-specific Satterthwaite degrees of freedom (Pustejovsky and Tipton, 2018).⁴⁵

The result for women is the clearest and most stable. The rule-as-exposure model estimates a 14.4 percentage-point MMD tilt (95% CI: 7.6 to 21.2; $p_{\text{Holm}} = 0.012$), while the identity-as-exposure model estimates a 11.8-point MMD advantage (95% CI: 5.3 to 18.3; $p_{\text{Holm}} = 0.031$). The district-balanced and aggregation-unit estimates are similar, at 11.5 and 11.3 points, respectively. Both unadjusted intervals exclude zero, although only the district-balanced result survives the Holm correction ($p_{\text{Holm}} = 0.044$ versus 0.152). In the joint alternative-outcome model, women are also associated with higher logged district magnitude (0.54 log points; 95% CI: 0.30 to 0.78; $p_{\text{Holm}} = 0.011$).

SGM and youth representation also lean toward MMDs. In the identity-as-exposure model, the estimated differences are 0.31 percentage points for SGM (95% CI: 0.03 to 0.60) and 1.75 points for youth (95% CI: 0.11 to 3.39). These intervals exclude zero before multiple-testing adjustment (although neither result survives Holm correction for multiple hypothesis testing ($p_{\text{Holm}} = 0.280$ and $p_{\text{Holm}} = 0.280$, respectively)). Their point estimates remain positive in every displayed model, but the complementary location, aggregation-unit, and logged-magnitude estimates are more imprecise.

For immigrant ethnic groups, disabled legislators, less-educated legislators, working-class legislators, and native ethnic groups, the confidence intervals include zero across the displayed models. Ruralites have a negative composition estimate (−1.60 points), consistent with an SMD tilt, but its interval also includes zero (95% CI: −4.10 to 0.90). Taken together, these results supply clear adjusted evidence for the predicted MMD advantage among women and directional, but specification-sensitive, evidence for SGM and youth, while leaving the other identity contrasts uncertain or close to zero. The appendices report full diagnostics, the converse identity-outcome models using logged district magnitude as the predictor, and the alternative missingness regimes.

⁴⁵For the primary `missForest` multiple imputation analysis, coefficients and CR2 variances are estimated separately in each of 20 completed datasets and combined using Rubin/Barnard–Rubin rules.

Table 5.2: *Identity and electoral-tier sorting among legislators. Probability and log-magnitude models use equal country/election weights.*

(a)		Institution outcome	
		Pr(MMD identity) Eq. 4.12	$\mathbb{E}[\ln(M) \text{identity}]$ country–election FE
Women		14.40 [4.97]***	0.54 [4.79]***
SGM		27.99 [2.62]	1.24 [2.31]
Youth		8.89 [1.54]	0.37 [1.73]
Immigrant ethnic		13.03 [1.54]	0.46 [1.29]
Disabled		7.00 [0.42]	0.51 [0.79]
Less educated		-1.61 [-0.28]	-0.11 [-0.43]
Working class		-4.15 [-1.52]	-0.18 [-1.88]
Native ethnic		-4.80 [-0.57]	-0.04 [-0.12]
Ruralites		-0.78 [-0.23]	-0.05 [-0.44]
<i>Other statistics</i>			
R^2		0.01–0.17	0.02–0.18
Countries		5–15	5–15
Elections		18–44	18–44
Observations		5,226–13,235	5,226–13,234

(b)		Identity outcome: Pr(identity tier), Eq. 4.11							
		Women	SGM	Youth	Immigrant ethnic	Disabled	Less educated	Working class	Native ethnic Ruralites
MMD tier		11.80*** [4.21]	0.31** [2.57]	1.75** [2.48]	0.36 [1.09]	0.08 [0.81]	0.28 [1.02]	-0.82 [-0.92]	-1.12 [-0.59] -1.60 [-1.58]
<i>Other statistics</i>									
R^2		0.10	0.03	0.05	0.07	0.00	0.04	0.04	0.20 0.12
Countries		15	15	15	15	15	15	15	15
Elections		44	44	44	44	44	44	44	44
Observations		13,231	13,235	13,235	13,219	13,235	13,235	13,235	13,219 13,235

Note: Model cells report point estimates [t statistics], followed by significance stars; every cell is a separate identity-specific regression. Panel (a) regresses institution outcomes on the row identity: Pr(MMD | identity) is the focal-minus-nonfocal difference in the probability of serving through MMD (percentage points); $\mathbb{E}[\ln(M) | \text{identity}]$ is the analogous log-point difference in district magnitude (magnitude-complete paired-tier elections). Panel (b) regresses the column identity on the MMD tier: cells give MMD-minus-SMD differences in focal-identity prevalence (percentage points). Panel (a) bottom rows report ranges across the nine identity-specific regressions. Within-completion standard errors use country-clustered CR2 corrections; pooled two-sided tests use Barnard–Rubin degrees of freedom derived from the coefficient-specific Satterthwaite degrees of freedom. Stars use unadjusted two-sided p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$; with finite degrees of freedom, the 5% critical $|t|$ can exceed 1.96. MissForest estimates pool 20 completed datasets using Rubin/Barnard–Rubin rules.

5.3 Pure electoral systems

Thus far, all our analyses have centered on mixed electoral systems, where we compare minority representation across SMD and MMD tiers. Since all other features of society and politics are held constant by this design, it may be regarded as a natural experiment. However, it is subject to problems of contamination since the tiers are not entirely independent of each other. We do not anticipate this as a major obstacle to inference since it seems more applicable to party performance than to descriptive representation. However, the prospect cannot be entirely dismissed. Additionally, our design is limited by definition to countries that employ mixed electoral systems and allow multi-party competition, leaving us with 15 cases—a relatively small sample that may not be representative of the democratic world.

In this section, we explore the relationship between electoral law and descriptive representation among countries that use only MMDs (with any reasonably proportional system of seat allocation) or only SMDs (single or double-ballot), while allowing multi-party competition. We call these “pure” electoral systems since they do not mix rules.

This affords a much larger sample of countries and a research design free of cross-tier contamination. Unfortunately, this design is also subject to myriad confounders since any unmeasured factor correlated with electoral design could also affect descriptive representation. Accordingly, we regard the following analyses as robustness tests rather than benchmark models.

Drawing on the GLP dataset, we identify 244 country-round-house units in 117 countries before the democracy and complete-case restrictions; the final estimation sample contains 179 units in 84 countries. Each unit comprises all legislators observed in one country, during one GLP data-collection round, and in one legislative chamber, so countries observed in multiple rounds or with multiple chambers contribute more than one unit.

As in the individual-level identity-outcome models in panel (b) of Table 5.2, the dependent variable in each model is a binary indicator of whether the legislator belongs to the focal group. The institutional comparison, however, is different: rather than comparing MMD and SMD tiers within the same mixed-system election, these models compare legislators across pure MMD and pure SMD country-round-chamber units. The table’s observation N are legislator-unit records (not independent institutional units); they represent unique people nested in the 179 units described above. The larger record count relative to the 13,219–13,235 legislator-seat observations from 44 mixed-system elections in 15 countries reflects both broader country coverage and repeated observations of some legislators across GLP rounds. For each identity, we report the adjusted coefficient on the pure-MMD indicator together with the unadjusted pure-SMD and pure-MMD means.

For each identity, we report a controlled specification along with raw SMD and MMD tier means. Because these models compare legislators across countries, they cannot hold constant national features correlated with electoral rules. The analysis does, however, offer greater breadth. Using the same 9 identity dimensions as the main analysis, we compare legislators in pure MMD and pure SMD units across a larger set of countries. There is no obviously “correct” specification given the limitless number of potential confounders associated with country-level analyses where the variation of interest is mostly cross-sectional. Not surprisingly, results across different weighting and control choices (not all shown) are not terribly stable.

Table 5.3 reports these controlled cross-sectional results. Each column presents a separate linear probability model. The outcome is whether a legislator belongs to the focal group; the key predictor is whether the legislature is elected by pure MMD, rather than a pure SMD, rules. Positive coefficients indicate that the group is more common in pure MMD systems; negative coefficients indicate greater representation in pure SMD systems. All controlled models include logged GDP per capita, logged population, polyarchy, logged chamber size, and continent fixed effects. The immigrant- and native-ethnicity models additionally control for the combined population share of nonplurality ethnic groups, defined as one minus the plurality group’s population share. We cluster standard errors by country.

Table 5.3: *GLP unit-level cross-sectional comparison of pure MMD and pure SMD systems.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Women	SGM	Youth	Immigrant ethnic	Disability	Less educated	Working class	Native ethnic	Ruralites
Pure MMD system	0.074*** [3.17]	-0.004 [-1.33]	0.018 [1.52]	0.008 [0.78]	0.001 [0.95]	0.017 [0.59]	-0.024 [-1.45]	-0.079 [-1.35]	-0.076 [-1.32]
<i>Other statistics</i>									
SMD mean	0.166	0.006	0.037	0.022	0.001	0.134	0.089	0.694	0.276
MMD mean	0.249	0.004	0.082	0.029	0.002	0.134	0.093	0.276	0.172
Countries	84	84	84	84	84	84	84	84	84
Country–election units	179	179	179	179	179	179	179	179	179
R-squared	0.018	0.005	0.021	0.014–0.017	0.001	0.021–0.024	0.029–0.030	0.520–0.525	0.159–0.173
Observations	34,864	34,864	34,864	34,864	34,864	34,864	34,864	34,864	34,864

Note: Entries are controlled linear probability models pooled across 20 independently seeded missForest completions using Rubin’s rules with Barnard–Rubin finite-sample degrees of freedom; cells report point estimates [pooled t statistics]. Country-clustered HC1 variances are computed within each completion. Equal country–election weights are computed after each model’s complete-case restriction as $1/(U_c N_{cu})$, where U_c is the number of retained country–election units in country c , N_{cu} is the number of retained legislators in unit u , and a unit is country $\times$ GLP round $\times$ chamber. The sample is restricted to democracies (Lexical index > 3). Controls include logged GDP per capita, logged population, polyarchy, logged legislature body size, and continent fixed effects in every column. Legislature size is the natural log of the voting-member count for lower and unicameral chambers and GLP `body_n` for upper chambers. The immigrant and native ethnic-group models additionally control for one minus the plurality ethnic group’s population share. Equal country–election SMD and MMD means are averaged across completed datasets. The R-squared row reports the completion-specific range. R-squared values differ across columns because each column is a separate regression with a distinct identity outcome; columns whose focal indicator is fully observed show a single value, while indicators completed by imputation show the min–max range across completions. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

The correlation between the point estimates in Table 5.3 and the equal-country/election benchmark in Table 5.2 is 0.78. That said, these cross-sectional results are more mixed than the within-election mixed-system estimates. Women are more common in pure MMD systems in the raw means, and the controlled coefficient remains positive and statistically significant (7.4 percentage points). Youth retain a smaller positive point estimate with controls (1.8 points), but it is no longer statistically distinguishable from zero. The controlled estimates for disability, less-educated, working-class, SGM, immigrant, native-ethnic, and rural backgrounds are also statistically indistinguishable from zero.

Overall, representation of women is the only outcome with a statistically significant con-

trolled pure-system estimate. The large raw native-ethnic difference is mainly a cross-national compositional contrast: the equal-country/election estimate shrinks from -41.8 percentage points without controls to -7.9 points with controls and remains imprecise. The remaining identity indicators are statistically indistinguishable from zero.

For that reason, these pure-system results should not be interpreted as overturning the within-election evidence. They show instead that broad cross-national comparisons do not yield a uniform MMD advantage, reinforcing our decision to treat the mixed-system design as the cleaner test of the theory.

5.4 Additional robustness tests

The main analyses of this book, displayed in Table 5.2, involve a variety of assumptions. Not all of these assumptions are empirically testable, but some are.

In this section, we discuss the robustness of the main results to missingness and coding choices, sample composition and modeling choices, and the estimator and comparison set. These tests are described concisely in Table 5.4. Full results are contained in specified appendices.

Across these checks, the central pattern remains stable in sign but not uniformly in adjusted significance. Women show the clearest MMD advantage. SGM and younger legislators generally lean toward MMDs; rural legislators tend to lean toward SMDs, while immigrant, disabled, less educated, working-class, and native ethnic categories are weaker, sparse, or close to null.

With this distinction in mind, the focal-group results themselves remain broadly stable across the robustness checks: their sign pattern is not driven by any single imputation rule, coding threshold, country, estimator, or inclusion rule, although inferential strength varies. The most sensitive results are rare traits, categories with substantial missingness, and constructed measures such as birthplace.

Table 5.4: *Summary of robustness checks for the main results.*

Check	Evidence	Takeaway
Missingness and coding choices		
Missingness regimes	Appendices II and XI report all-feature focal-group comparisons, individual-level models, representation-index summaries, and heatmaps under <code>missForest</code> multiple imputation, no imputation (keep missing values as NA), and mode imputation (Tables A.XI.1 and A.II.2; Figures A.XI.1–A.XI.9).	The main focal-group pattern is preserved across missing-data regimes; focal-group gains do not always translate into higher representation-index scores.
Alternative codings	Youth is re-estimated using age cutoffs of 30, 35, and 40; education, SGM status, class, rurality, and birthplace deprivation are recoded using alternative binary, ordered, deterministic, LLM, threshold, and continuous specifications (Tables A.II.1–A.II.9).	No alternative definition overturns the core conclusions, although rare traits and constructed deprivation measures are more definition-sensitive.
Sample composition and model form		
Group inclusion and zero cases	Appendix VI drops groups below a 1% national population threshold; Appendix II separates zero representation into extensive and intensive margins (Figure A.VI.1; Tables A.II.10–A.II.12).	The interpretation does not depend on very small groups or on pooling different forms of zero representation.
Country leverage and controls	Each country is omitted in turn; country-election share models add electoral thresholds, gender quotas, and reserved-seat controls; moderator interactions test whether these institutions condition the MMD effect (Tables A.II.13–A.II.15).	The results are not driven by a single country, and the institutional controls do not produce a competing explanation for the main pattern.
Estimator and comparison set	Table 5.2 compares seat weighting with equal-country/election weighting; Appendix Table A.II.16 replaces the tier indicator with logged district magnitude; Table 5.3 provides a pure-system comparison.	Within mixed systems, the broad directions are not unique to the benchmark weighting; the pure-system results are more mixed, and the small-cluster correction materially tempers several claims.

6 Mechanisms

Taken together, the analyses in Chapter 5 show that MMDs do not improve descriptive representation uniformly across identities. The MMD advantage is clearest for women and directionally apparent, though not robust, for SGM and youth. Estimates for less-educated, working-class, native-ethnic, and rural legislators do not identify a clear advantage for either tier. In this chapter, we explore some of the mechanisms that may be at work.

First, we delve into the role of party systems, where some might suppose that minority representation is more dispersed across the MMD tier than across the SMD tier, suggesting that larger party systems are conducive to greater minority representation. Second, we delve into gender quotas, which may incentivize political parties to nominate more women in MMDs than they otherwise would. Third, we examine the potential role of malapportionment in SMDs, which may advantage certain groups over others. Fourth, we examine the relationship between group size and SMD representation, which one would expect to follow a logistic curve. Finally, we examine how political parties nominate candidates for public office, which should confirm parties' central role in achieving descriptive representation. The final two analyses focus on ethnic groups in Russia, a country with multiple groups of different sizes.

These hypotheses, and our expectations for them, are summarized in Table 6.1. Subsequent sections in this chapter test these hypotheses empirically.

Table 6.1: *Hypotheses about mechanisms.*

1.	<i>Party systems.</i> Minority representatives may be dispersed across more parties in the MMD tier than in the SMD tier, beyond the difference implied by each tier's party-seat distribution. <i>Expectation:</i> No.
2.	<i>Gender quotas.</i> Party or statutory quotas may interact with the MMD tier to raise female representation, explaining some of the variability across tiers. <i>Expectation:</i> No.
3.	<i>Malapportionment.</i> Differential representation across tiers may be a product of malapportioned SMDs. <i>Expectation:</i> No.
4.	<i>Group size and SMD representation.</i> The probability of minority representation across SMDs rises in a logistic fashion with group size. <i>Expectation:</i> Yes.
5.	<i>Candidates and winners.</i> The nomination of candidates follows the same patterns observed for seat winners, confirming the role of political parties in achieving descriptive representation. <i>Expectation:</i> Yes.

6.1 Parties

In a representative democracy, the vehicle for descriptive representation is nearly always a political party, or parties. (Very few national legislatures have substantial numbers of independent MPs.) A group may be represented by a single party, which aggregates most of their votes and presumably allocates seats in the legislature to members of that group—a niche strategy. Alternatively, a group may be represented by multiple parties, each of which claims a share of their votes and each of which allocates seats accordingly—a catch-all strategy.

Do electoral systems affect the mode of party representation? Does the pathway to representation differ across SMD and MMD tiers? We have established that dispersed minority groups are more likely to be represented in MMDs. Here, we inquire whether the same group is likely to be represented differently across tiers.

Merely counting the parties that contain focal-group legislators would mechanically favor tiers with more parties or more focal-group seats. Within each country-election-tier cell, we generate 9,999 random reallocations of focal-group legislators across party seats. Each reallocation fixes both the complete vector of party seat shares and the total number of focal-group legislators. The primary statistic is the inverse-Herfindahl effective number of organized-party channels; exact rarefied party richness is secondary. We aggregate within-election contrasts so that countries and their elections receive equal weight, combine synchronized randomization draws across the 20 imputations, and adjust across the 9 identities. Independents are excluded in the primary analysis and treated as singleton channels in a sensitivity analysis.

Table 6.2 separates the raw MMD–SMD contrast from the contrast expected under this conditional null (see Figure A.II.1; Figure A.XII.3 provides a step-by-step schematic of the test). Raw effective party counts are higher in MMD tiers for most identities. For women, for example, the observed difference is 1.043 effective parties, but the conditional-null difference is 1.110, producing an excess of -0.067 (95% CI: -0.375 to 0.240). No identity shows multiple-testing-adjusted evidence of positive excess dispersion. Youth and immigrant-group legislators actually show negative excess dispersion at unadjusted thresholds, but neither survives Holm adjustment. The rarefied-richness and independents-as-singletons checks lead to the same conclusion. Thus, the data do not establish that MMD rules uniquely broaden partisan routes beyond the opportunities already implied by the party seat distribution and the number of focal-group representatives.

Table 6.2: *Observed and conditional-null party-dispersion contrasts by identity.*

Identity	Observed MMD–SMD	Conditional-null MMD–SMD	Excess [t]	Randomization <i>p</i>
Women	1.043	1.110	-0.067 [-0.48]	0.591
SGM	0.276	0.359	-0.083 [-1.47]	0.111
Youth	0.417	0.758	-0.342** [-2.35]	0.019
Immigrant ethnic groups	0.256	0.405	-0.150 [-1.46]	0.027
Disabled	–	–	–	–
Less educated	0.306	0.318	-0.012 [-0.09]	0.919
Working class	0.550	0.626	-0.077 [-0.39]	0.613
Native ethnic groups	0.500	0.296	0.204 [1.35]	0.069
Ruralites	0.793	0.731	0.062 [0.43]	0.574

Note: Effective party channels are inverse-Herfindahl counts of organized parties representing each identity, defined as zero when there are no focal seats; observed and null columns are equal-country/equal-election MMD–SMD contrasts. Within each identity, country-election, tier, and completed data set, 9,999 conditional draws fix the set of analyzable organized-party seats, focal-seat count K , and organized-party seat-count vector, then reallocate the K focal labels without replacement. Excess is observed minus conditional-null; excess cells report point estimate [t statistic]. Across 20 completed data sets, excess estimates and their t tests use Rubin/Barnard–Rubin pooling of completion-specific country-CR2 estimates; randomization p-values combine synchronized null draws row-wise. The t-based inference treats each 9,999-draw conditional-null mean as fixed; randomization p-values use the draw distribution directly. Stars use the matching unadjusted two-sided Rubin/Barnard–Rubin p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. The randomization column reports unadjusted two-sided conditional-randomization p-values. The Disabled row is shown as – because each country-election tier contains at most one focal legislator, leaving insufficient data to estimate party dispersion. Independents are excluded here.

6.2 Quotas

MMDs could make it easier for parties to adopt voluntary quotas for women’s representation (Htun and Jones, 2002). They may also interact with statutory system quotas if list-based rules make quota compliance easier or more electorally valuable. Table 6.3 probes both possibilities.

The quota-control model estimates a positive level association for statutory gender quotas (0.145, $p = 0.048$), but this estimate is observational and sensitive to specification. In the interaction model, the MMD-by-statutory-quota estimate is 0.078 ($p = 0.388$).

The MMD-by-party-quota estimate is also positive (0.186), but its CR2/Satterthwaite uncertainty is substantial ($p = 0.195$). The party-quota level estimate is small and imprecise. Thus, neither interaction is estimated precisely enough to distinguish a quota-specific MMD mechanism from sampling variation across the 15 countries.

The positive party-quota interaction is directionally consistent with the intuition that candidate-list rules bind most naturally where parties nominate slates rather than individual district candidates. It should therefore be treated as a suggestive downstream channel, not as established evidence that quotas generate the MMD–SMD difference in women’s representation.

	(1)	(2)	(3)	(4)
	No quota controls (full sample)	No quota controls (quota sample)	Quota controls	Quota interactions
MMD tier	0.09 (2.53)*	0.09 (2.54)*	0.09 (2.27)	0.04 (1.29)
Statutory quota			0.14 (2.34)*	0.11 (1.33)
Party quota			0.07 (0.68)	-0.01 (-0.16)
MMD x statutory quota				0.08 (0.93)
MMD x party quota				0.19 (1.73)
<i>Other variables</i>				
Election year	0.01 (4.50)*	0.01 (4.48)*	0.00 (3.54)*	0.00 (3.58)*
<i>Other statistics</i>				
Countries	15	15	15	15
Observations	13231	13222	13222	13222
Adjusted R-squared	0.03	0.03	0.05	0.05

Table 6.3: Quota mechanism models for women’s representation. Column (1) reports the no-quota-controls baseline on the full estimation sample; columns (2)-(4) are estimated on the identical quota-complete subsample, so column (2) provides the same-sample baseline for the quota columns. No statutory quota and no party quota are the reference categories; all models include election-year controls. The statutory-quota indicator comes from the project’s curated quota file (*Party_quotas.csv*), with V-Dem coding used only for country-elections absent from that file. Party-elections without an explicit quota entry in the curated file are coded as no party quota. 12 legislator rows with unmatched party-quota data are excluded from the quota-complete columns. Inference uses country-clustered CR2 with Satterthwaite degrees of freedom; *t*-statistics are in parentheses; * denotes $p < 0.05$ (two-sided).

6.3 Malapportionment

SMDs are prone to malapportionment—where voters are unequally distributed across seats, giving some electors more power than others. This may occur from the natural ebbs and flows of population growth and migration if districts are not regularly reapportioned. It may occur in an intentional fashion if the governing party uses its redistricting power to favor its own fortunes. It may also occur if a constitutional settlement grants greater representation to some regions of a country (as in India and the UK).

In principle, MMDs can also be malapportioned. However, the practice is less common, perhaps because it is harder to defend and because reapportionment of seats is easier in large districts where the partisan impact is blunted and where longstanding district boundaries can remain in place (Riera and Lago, 2023; Samuels and Snyder, 2001). Accordingly, differences in descriptive representation across electoral systems may arise because one system is more amenable to malapportionment than the other. (So far as we know, this hypothesis has never been systematically tested.)

To probe this possibility, we gather data on the size of SMDs across the cases in our sample, using CLEA eligible-voter counts where district matches can be established (Kollman et al., 2019). We then use log eligible voters, scaled relative to the country-election mean, to predict the representation of each focal group among SMD legislators. This SMD-only analysis probes whether unequally sized districts produce identity patterns that resemble the main SMD–MMD contrast.⁴⁶

Table 6.4 reports the primary models, limited to country-elections where at least 95 percent of SMD districts can be matched.⁴⁷ The analysis suggests that women and SGM are slightly more likely to be represented in large districts, while youth and the other groups are slightly more likely to be represented in smaller districts. This conforms to expectation if we assume that larger districts are generally more urban, more privileged, and more liberal (ideologically). However, these relationships are extremely weak, and none surpass traditional thresholds of statistical significance.

Let us say, for the sake of argument, that these relationships are real (non-stochastic). The question of theoretical interest is whether, or to what extent, malapportionment might account for the overall patterns found in Chapter 5. Recall that a positive (negative) coefficient in Table 6.4 means that groups are under-(over-) represented in SMDs relative to what they would receive if districts were equal-sized. In specific terms, we infer that equal-sized SMDs would offer better representation to women and SGMs and worse representation to the less educated and to native minority groups. These are the counterfactuals to consider.

We estimate these counterfactuals in Table 6.5. The table asks what happens to the mixed-electoral-system (MES) MMD–SMD gaps when the SMD tier is reweighted by the number of eligible voters represented by each district, holding the observed SMD winners fixed. This helps us determine whether unequal SMD district sizes mechanically account for the MMD–

⁴⁶For visualization of this workflow, see Figure A.II.5.

⁴⁷As a sensitivity check in Table A.II.18, we reran the SMD-only malapportionment models using all one-to-one matched district-size rows, including country-elections below the 95 percent matched-district coverage threshold. Results are broadly similar, though some estimates shift: women’s coefficient becomes statistically significant in the larger sample, and the small (insignificant) youth estimate changes sign.

Table 6.4: *SMD malapportionment models of identity indicators on log eligible voters from CLEA eligible-voter counts. Estimator: identity-specific OLS linear probability models with country fixed effects and an election-year covariate; t statistics use country-clustered standard errors. Observations: 2,175.*

Identity	Estimate	t stat.	p -value
Women	0.030	0.858	0.454
SGM	0.002	1.049	0.371
Youth	-0.017	-0.348	0.751
Immigrant ethnic groups	-0.024	-0.835	0.465
Disabled	-0.005	-1.096	0.353
Less educated	-0.044	-1.562	0.216
Working class	-0.050	-0.969	0.403
Native ethnic groups	-0.101	-1.277	0.291
Ruralites	-0.049	-0.762	0.501

Note: Primary sample includes country-elections with at least 95 percent matched SMD districts or reviewed supplemental coverage. CLEA pev1 values less than or equal to zero are treated as missing. The regressor is log eligible voters relative to the country-election mean among matched SMD districts.

SMD representation gaps observed in the main MES analysis. (The analysis does not model how parties or voters would respond to the re-weighting.)

The answer is largely no; the MMD–SMD gaps do not change much when the SMD tier is reweighted to reflect equal apportionment. In the primary matched sample, equalizing SMD district sizes barely changes the focal-group gaps. The women’s MMD advantage changes from 11.7 to 11.7 percentage points. The SGM gap changes from 0.5 to 0.5 points, and the youth gap from 1.5 to 1.6 points. The less-educated gap changes from 0.6 to 0.6 points. Thus, malapportionment is detectable in some SMD patterns, but the equal-sized-district counterfactual does not influence the main MES results much. The main MMD–SMD contrasts survive after mechanically removing the seat-weighting consequences of unequal SMD district sizes. Table A.II.17 summarizes the party-channel, quota, and malapportionment robustness checks.

Table 6.5: *SMD malapportionment counterfactual decomposition for primary matched country-elections.*

Identity	Focal SMD adj.	Obs. focal gap	Equalized focal gap	Rep. SMD adj.	Obs. rep. gap	Equalized rep. gap
Women	0.0	11.7	11.7	0.0	10.9	10.9
SGM	0.0	0.5	0.5	0.0	-0.3	-0.3
Youth	-0.1	1.5	1.6	-0.1	1.5	1.6
Immigrant ethnic groups	-0.1	2.0	2.1	-0.1	1.8	2.0
Disabled	0.0	0.2	0.2	0.0	0.2	0.2
Less educated	0.0	0.6	0.6	0.0	0.6	0.6
Working class	-0.1	-3.3	-3.3	0.2	-1.5	-1.7
Native ethnic groups	-0.7	4.7	5.5	0.3	1.3	1.0
Ruralites	-0.1	-1.8	-1.8	0.0	0.2	0.3

Note: Cells are percentage points. SMD adjustment is equalized SMD minus observed matched SMD; positive values mean the group or representation index improves when SMD seats are weighted by represented electorate. Gaps are MMD minus SMD. The counterfactual holds observed winners fixed and reweights matched SMD districts by eligible-voter counts.

6.4 Case study of ethnicity and representation: Russia

In the final sections of this chapter, we turn to a focused study of the representation of native ethnic groups. Unlike many of our social group categories, which are binary (men/women, abled/disabled), groups defined by ethnicity are often numerous. This is ideal for present purposes since we can track the success of multiple groups of varying sizes across SMDs throughout a country, across tiers, and in candidate nominations as well as seats won. There is a lot of variability to exploit.

Because the fine-grained data required for these sorts of analysis are not available for every country, we focus on one case where ethnic groups are diverse and data is plentiful. Russia offers an especially useful setting because of its size and heterogeneity. Although non-Russian groups are small relative to the general population, most have an ethnic homeland, meaning they typically comprise a majority, or at least a plurality, in at least one electoral district. Over fifty minority ethnic groups have gained representation in the Duma at some point in the post-communist era. All are considered native insofar as they have a long history in Russia.

The 1999 parliamentary election is one of the few genuinely competitive contests occurring in the post-Soviet period (Moser, 2008; Sakwa, 2000), and it is one for which unusually rich background information is available. For each social group, population statistics are drawn from the 2002 Russian census at the Raion (rural precinct) and Gorod (city precinct) levels and merged to provide demographic data for 221 of the 225 Duma districts. Information about candidates (party-nominated and independents) is obtained for the SMD tier ($N=2,194$) and the MMD tier ($N=2,198$) from official results published by the Russian government.⁴⁸

To code ethnicity for the full candidate sample, we follow a protocol developed by Bessudnov et al. (2023), in which a large sample of Cyrillic names from an Internet corpus was coded for ethnicity based on location and language. We use these data to train a supervised model predicting ethnicity probabilities from candidate names, yielding a granular dataset on the ethnic composition of all districts and the electoral candidate pool; where possible, winners' ethnicities in both tiers were also coded from official sources.

6.5 Group size and SMD representation

Our theoretical framework supposes that descriptive representation in SMDs responds to the size of the social group within each district. Specifically, where affinity voting is strong, representation should be accorded to the largest social group. We hypothesize that this relationship follows a logistic curve, though we do not specify where the inflection point might lie or whether the relationship is stronger for candidates or for winners.

Figure 6.1 explores the characteristics of single-member districts and descriptive representation within parties and the legislature.

The left panel examines the probability that at least one candidate from an SMD will be drawn from a given ethnic group as a function of the latter's size. The scatterplot and associated logistic curve show that this probability rises steeply as the population share of a group increases, with the fitted high-probability crossing at 62.0 percent. There are some instances of very small groups attracting candidates, but very few instances of large groups

⁴⁸Candidate information and electoral results were collected from the Russian Central Electoral Commission website cikrf.ru, accessed November 2012.

attracting no candidates to represent their group in a district. In only 9 of 234 observations with group population shares of at least 20.0 percent did a group fail to attract at least one candidate. One may infer that a moderate population share is a sufficient condition for representation among candidates for an SMD in a multi-party system. This is important because, without an ethnic candidate option, it is impossible for members of a social group to exercise affinity voting.

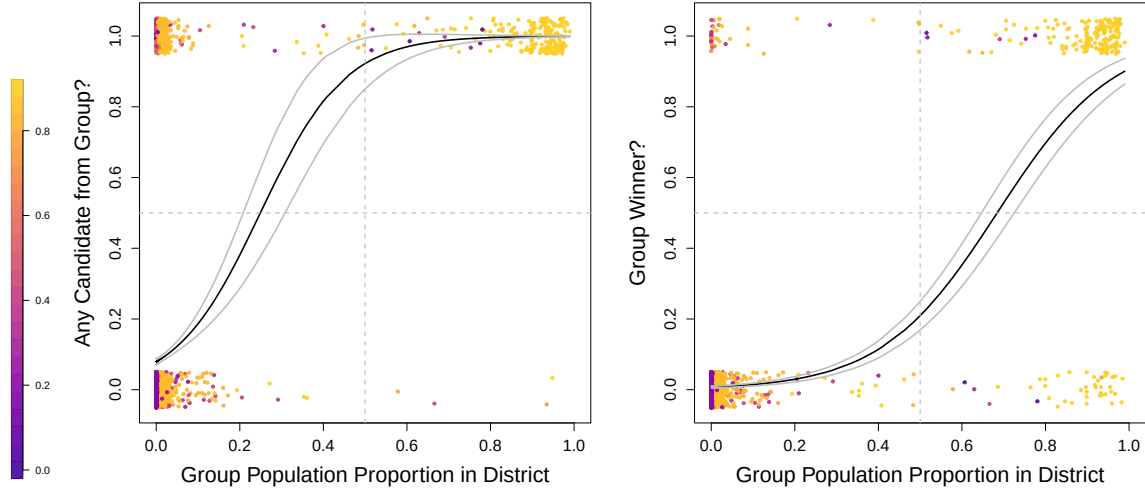


Figure 6.1: *Russia, 1999. Ethnic group population share and SMD representation. Colors indicate group size nationally (yellow > purple). LEFT. Probability of any ethnic group representation in the district candidate pool as a function of group population share. AUC (area under the ROC curve) goodness of fit: 0.88; logistic regression coefficient: 9.87 (s.e. = 1.04); $N=4,945$. RIGHT. Probability of a given ethnic group member winning the district’s seat as a function of group population share. AUC goodness of fit: 0.96; logistic regression coefficient: 7.21 (s.e.=0.29); $N=4,945$.*

The right panel examines the probability that an ethnic group will *win* a seat. Here, the logistic curve rises slowly, reaching a fitted probability of 0.5 at a group population share of 68.4 percent. Evidently, a high share of the SMD population is required for a group to reach a high probability of securing that district. Some considerable number of “errors” can be found in the lower right quadrant—cases where high district population did not eventuate in a seat winner from the largest minority group.

6.6 Candidates and winners

Thus far, most of our attention has been devoted to MPs, i.e., those who have successfully navigated their way into the national legislature. Ultimately, that is what matters. However, to shed light on mechanisms, we must also pay attention to candidacies.

Being nominated for public office is the only way to get elected to office. It is equivalent to a lottery ticket in a lottery: you have to pay to play. This means that descriptive representation

is dependent upon the action of parties, who must nominate the “right” candidates. We argue that parties anticipate voter demand—via affinity voting—by nominating candidates in each tier so as to maximize affinity voting. For concentrated ethnic groups, this means that candidacies for each party should reflect the ethnic composition of a district. Because there are many more candidates than seat winners, we can expect that this relationship will be stronger and less prone to stochastic error.

Figure 6.2 combines four views of this relationship. The top-left panel compares the representation of ethnic groups among candidates in SMD and MMD tiers. The top-right panel does the same for seat winners. Remarkably, there is a nearly perfect fit across candidates and a slightly less perfect fit across winners. The latter might be interpreted as slippage between the intentions of political parties and the realities of competition in SMDs, where candidate quality sometimes outweighs descriptive characteristics.

The bottom row looks further into this issue, comparing the representation of ethnic groups among candidates and winners within each tier—SMDs in the lower-left and MMDs in the lower-right. Both tiers demonstrate an extremely close fit. By this measure, the representation offered to ethnic groups among candidates is equal to the representation they are offered among seat winners. This suggests that parties (and independent candidates—numerous in Russia) are behaving strategically to fill a perceived demand for descriptive representation.

To ensure that our results are not driven by the many very small ethnic groups in Russia, we rerun these analyses in a robustness test, grouping all groups with less than 0.5% of the national population share into an “Other” category; as detailed in Appendix VII, this test yields similar results.

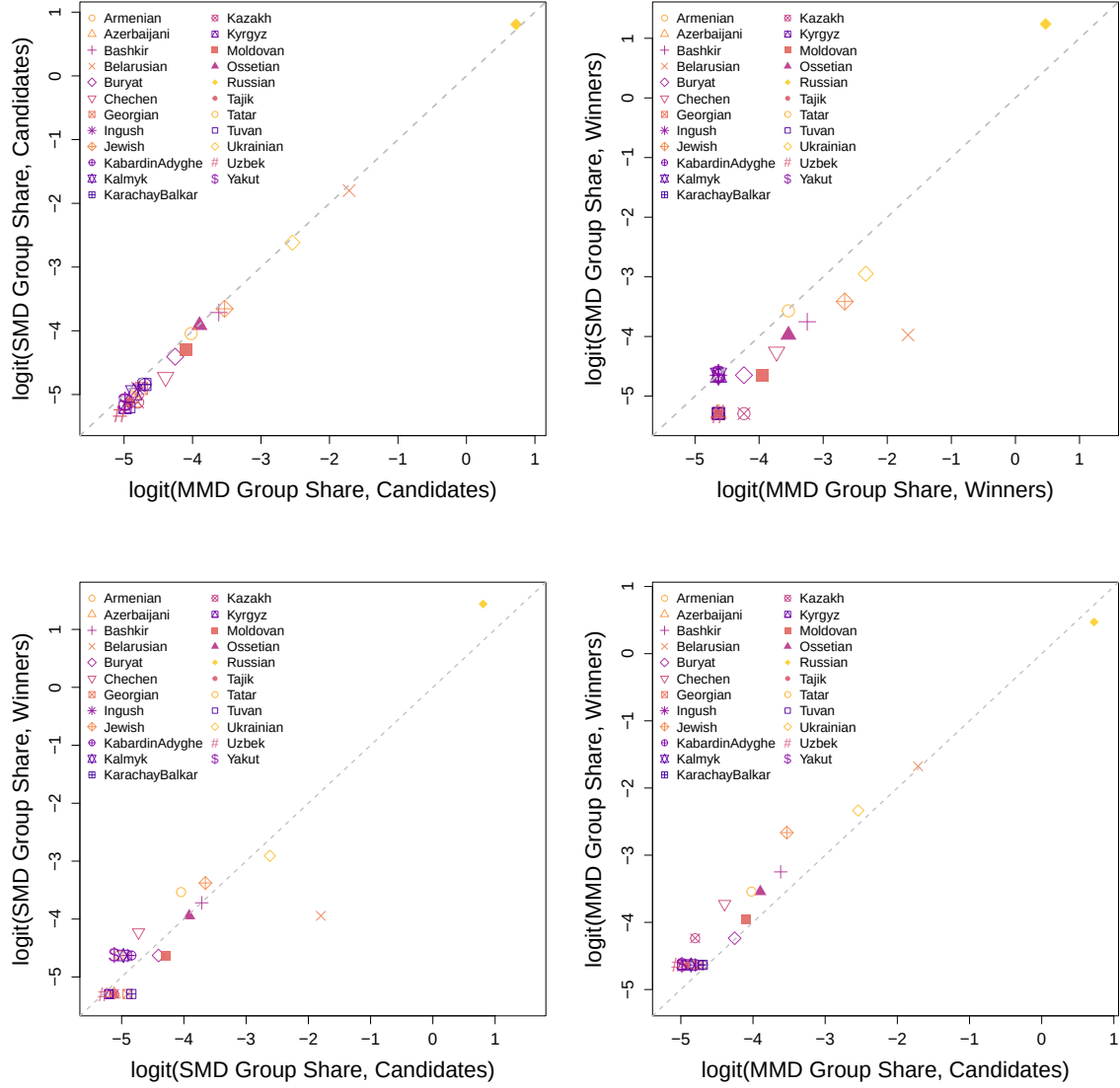


Figure 6.2: Russia, 1999. Ethnic group representation across tiers and stages ($N=23$ groups). TOP LEFT. Representation across SMD and MMD tiers among candidates. TOP RIGHT. Representation across SMD and MMD tiers among winners. BOTTOM LEFT. Ethnic group shares among SMD candidates and SMD winners. BOTTOM RIGHT. Ethnic group shares among MMD candidates and MMD winners.

7 Conclusions

The role of electoral systems in achieving descriptive representation has been a focus of concern since the introduction of proportional representation in the late nineteenth century. Recent work mostly confirms standard wisdom – that MMDs offer better vehicles for minority representation than SMDs. However, results are inconsistent across studies and across social groups. This may be because extant studies are narrow in purview (and hence susceptible to stochastic error) or because they are susceptible to confounding. In any case, attempts to generalize across social groups – defined by gender, ethnicity, class, and so forth – are difficult because different studies employ different samples and methodologies, and because some groups have received little or no attention (Chapter 2).

This study offers a general framework to explain the impact of electoral rules on descriptive representation. We begin with a few assumptions about the behavior of political elites (e.g., that they wish to maximize votes) and voters (e.g., that some wish to maximize representation for their social group). In a setting with multi-party competition, we argue that the representation of a group depends upon its size and location. Geographically concentrated groups should be equally represented in large and small districts. Dispersed groups should be better represented in large districts. More specifically, proportional representation with multimember districts offers better representation than majoritarian single-member districts only for spatially dispersed groups that are large enough to win seats but do not constitute an outright majority.

Derivations confirm this theory in an idealized political system, where we present a parsimonious formula relating group size and concentration to expected representation. Simulations allow us to map out a full set of interactions between group size, spatial distribution, and electoral rules in a pristine setting without confounders (Chapter 3).

To test the framework empirically, we focus on mixed electoral systems. This setting, akin to a within-unit natural experiment, allows for a comparison of representation across SMD and MMD tiers in the same election, holding constant background features that might otherwise confound the analysis. Gathering data from all available sources and enlisting both expert and LLM coding, we arrive at a sample that encompasses 15 countries, 44 country-elections, and 13,246 legislator-election records (Chapter 4).

With this data, we test the main hypotheses (Chapter 5). Graphical comparisons of representation in SMD and MMD tiers are presented first (Figure 5.1). Next, we turn to regression models that implement two designs, one in which electoral institutions predict group membership and the other in which group identity predicts the tier in which an MP gains representation (Table 5.2).

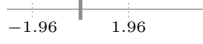
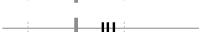
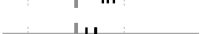
To clarify how these bear upon our theoretical framework, Table 7.1 stipulates the geography of each minority group (dispersed or concentrated), our hypothesis about that group’s expected representation, and the *t* statistics from three regression tests.

These tests provide clear evidence of an MMD advantage for women. SGM and youth estimates point in the same direction and exclude zero before multiple-testing adjustment, but not after it. Immigrant and disabled estimates are imprecise, while less-educated, working-class, native-ethnic, and rural estimates do not reveal a clear tier advantage.

The revised small-cluster inference therefore supports a narrower conclusion than the raw

descriptive patterns: strong evidence for women, suggestive evidence for SGM and youth, and substantial uncertainty for the other identities. Tests centered on representation for the disabled are especially weak as there are very few disabled MPs in the sample.

Table 7.1: *Principal findings summarized*

Minority Group	Geography	Expectation	<i>t</i> statistics
			
<i>Women</i>	Dispersed	SMD < MMD	
<i>SGM</i>	Dispersed	SMD < MMD	
<i>Youth</i>	Dispersed	SMD < MMD	
<i>Immigrant</i>	Dispersed	SMD < MMD	
<i>Disabled</i>	Dispersed	SMD < MMD	
<i>Less educated</i>	Concentrated	SMD ≈ MMD	
<i>Working class</i>	Concentrated	SMD ≈ MMD	
<i>Native</i>	Concentrated	SMD ≈ MMD	
<i>Rural</i>	Concentrated	SMD ≈ MMD	

Note: All groups are understood as constituting a voting bloc minority. Inequalities denote expected levels of descriptive representation across electoral systems. The final column marks the *t* statistics from the three benchmark models displayed in Table 5.2 (the institution-outcome $\Pr(\text{MMD} \mid \text{identity})$ and $\mathbb{E}[\ln(M) \mid \text{identity}]$ models and the identity-outcome $\Pr(\text{identity} \mid \text{tier})$ model) on a common fixed axis; the thick vertical rule marks $t = 0$, and positive values indicate an MMD advantage for the group. Faint dashed rules mark $|t| = 1.96$, the conventional two-sided 5% significance threshold (approximate here, given finite degrees of freedom).

Finally, we explore some of the possible mechanisms underlying these relationships. Although raw counts place focal-group legislators across more party channels in MMD tiers, conditional randomization shows no excess dispersion once party seat shares and focal-group seat counts are accounted for. Quota-adjusted models leave the women’s MMD coefficient positive, but neither the party-quota nor statutory-quota interaction is estimated precisely with small-sample CR2 inference; quotas therefore remain a suggestive rather than established channel. We find no role (or only a very minimal role) for malapportionment in explaining the SMD/MMD differential. None of these channels seem to play a strong role in explaining our results.

We do find that the relationship between group size and representation across SMDs follows a logistic curve. We find, finally, that candidate nominations follow the same general pattern as seat winners, confirming the central role of political parties in the achievement of descriptive representation (Chapter 6).

Thus, the results of this study align with prior work in some respects and diverge in others. In some cases, MMD offers superior representation for minority groups, affirming the conventional finding. In other cases, electoral law is moot. For the most part, we are able to show that varying patterns of descriptive representation across social groups is explainable by their size and geographic distribution. It is not identity per se that matters, but rather the delicate interplay between demography and institutions.

7.1 Reflections

Descriptive representation is one important dimension of the ongoing debate over electoral system design. But it is certainly not the only outcome of interest.⁴⁹ In this final section, we reflect on the broader ramifications of our study.

Insofar as patterns of descriptive representation mirror patterns of substantive representation, our findings lend support to studies that view policymaking as a nexus between electoral rules and geographic concentration. In concordance with our study, SMDs seem to favor interests that are geographically targeted, while MMDs favor interests that are more dispersed (Rickard, 2018).

Our findings also carry implications for debates over institutions in divided societies (Reilly, 2001). We find no clear tier advantage for native ethnic groups, less educated citizens, the working class, or ruralites. Insofar as the under-representation of these groups is deemed problematic, some other vehicle of representation may be needed.

Evidently, MMDs are not a panacea for problems of descriptive representation. In no case do we find perfect alignment between group share of the general population and group share in parliament. Even where electoral law matters, its effect is modest.

What can be said most confidently is that MMDs reduce barriers to women’s representation generated by winner-take-all competition within single-member districts. The estimates for SGM and youth are consistent with the same mechanism but are less secure after accounting for the small number of country clusters and multiple identity tests. For the remaining groups, the results do not justify a claim that either tier is uniformly superior (Table 7.1).

For those in a position to choose electoral rules, these results translate into a few practical conclusions. District magnitude is a demographically contingent instrument: before predicting what a shift from SMDs to MMDs will accomplish, a designer should audit the size and geographic concentration of the groups whose representation is at stake (Figure 3.1 offers a map). Where a group is spatially dispersed and constitutes a sizeable minority—women being the paradigmatic case, with more tentative parallels for SGM and youth—raising district magnitude relaxes the winner-take-all barrier at its source. Our results suggest that for dispersed groups comprising 30–45% of the population the resulting boost in seat share is on the order of up to 20–40 percentage points (per simulations). And because magnitude is set by ordinary election law in most polities, this lever can sidestep the constitutional obstacles that attend other reforms, as discussed in Chapter 1.

By contrast, where a group is geographically concentrated—as is typically the case for native ethnic groups, ruralites, the working class, and the less educated—district magnitude is largely beside the point. Such groups fare no better under MMDs than SMDs, and designers who deem their under-representation problematic must look to more targeted instruments, such as statutory quotas, reserved seats, or party recruitment practices (Htun, 2004; Reilly, 2001).

One may conclude that in MMDs (under conditions of electoral competition), whatever level of representation a group achieves is a reflection of the size of that group and the demand for descriptive representation. If there is great demand – signified by strong affinity voting

⁴⁹For wide-ranging surveys see Colomer (2016), Herron, Pekkanen, and Shugart (2018), Norris (2004), and Powell (2000).

– representation should be achieved in rough proportion to that group’s size in the general population.

That most groups do not achieve this, even in the most proportional systems, suggests that voters are mindful of multiple desiderata when they enter the voting booth. The demographic characteristics of a candidate are just one factor among many. This is not to say that MMD generates outcomes that are “fair.” But it does seem reasonable to propose that they produce outcomes that accord with preferences existing in a given society at a given point in time, taking into account the supply of candidates.

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APPENDICES

Appendix I. Robustness to Electoral Rule & Affinity Voting

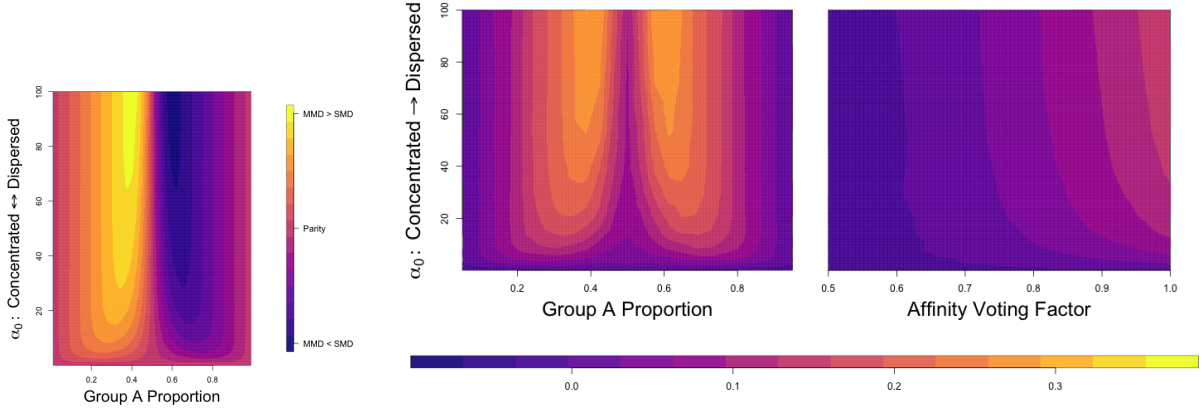


Figure A.I.1: LEFT. Outcome (represented via color): MMD-minus-SMD seat-share difference for group A. RIGHT. Outcome (represented via color): MMD-minus-SMD representation-index difference. Divisor floor MMD allocation rule.

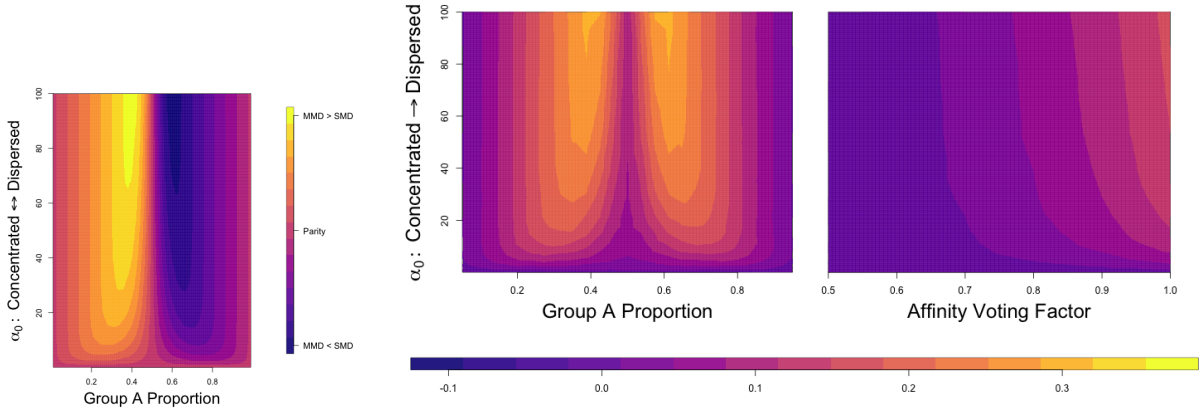


Figure A.I.2: LEFT. Outcome (represented via color): MMD-minus-SMD seat-share difference for group A. RIGHT. Outcome (represented via color): MMD-minus-SMD representation-index difference. Largest remainder MMD allocation rule.

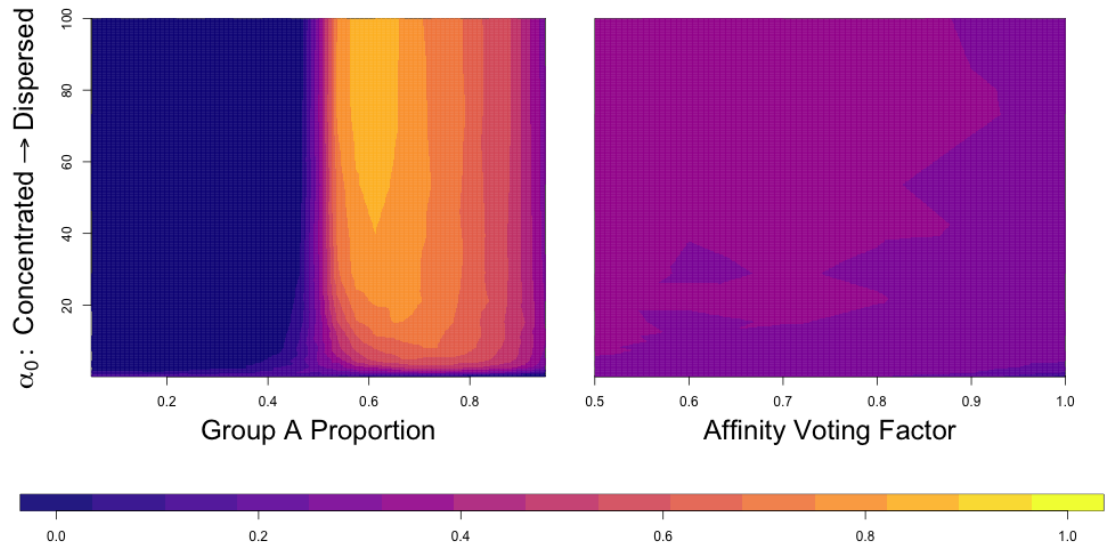


Figure A.I.3: Outcome (represented via color): Difference between MMD and SMD representation for group A in terms of probability that SMD better represents A than MMD.

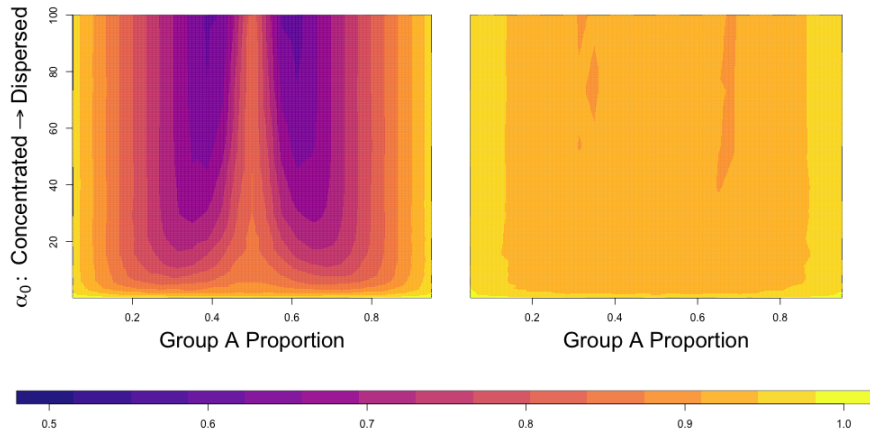


Figure A.I.4: Outcome (represented via color): Representation Index. Left panel shows SMD results, right panel shows MMD results.

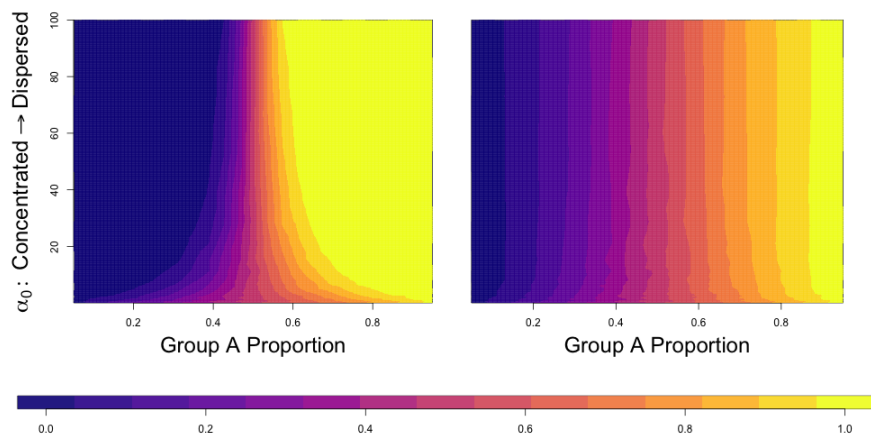


Figure A.I.5: Outcome (represented via color): Party A seat share. Left panel shows SMD results, right panel shows MMD results.

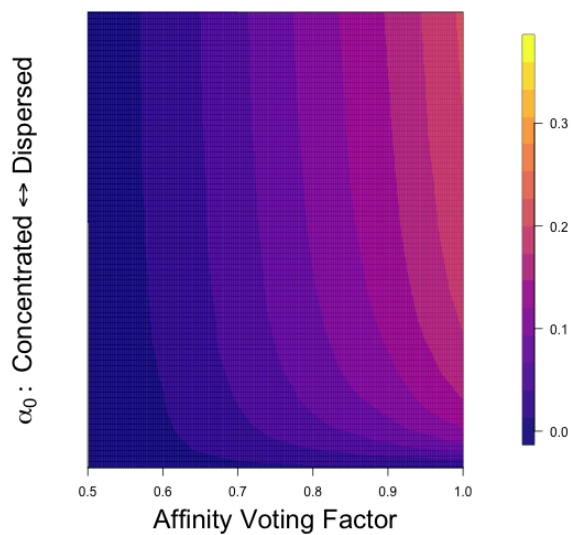


Figure A.I.6: Replicating simulation results as we vary the degree of affinity voting. Outcome (represented via color): Representation Index.

Appendix II. Additional Empirical Results

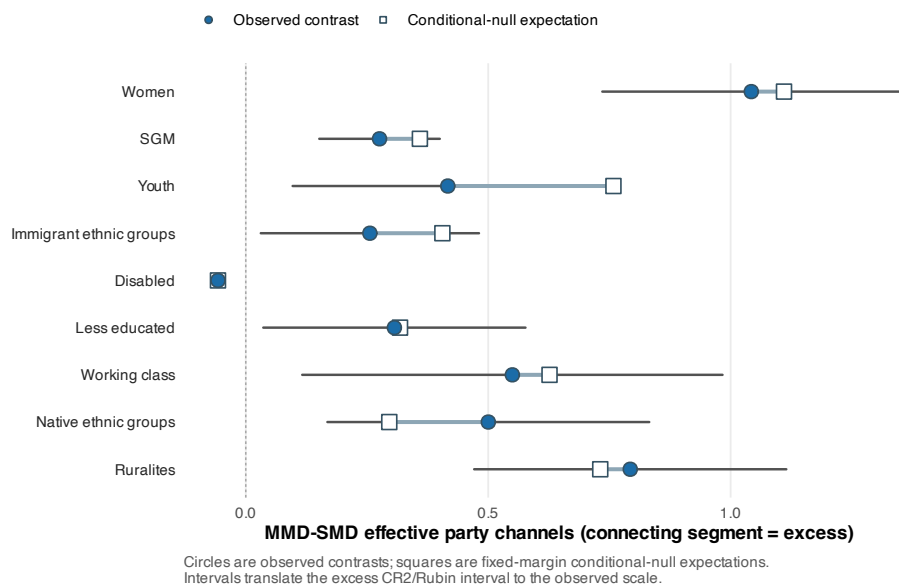


Figure A.II.1: *Conditional party-dispersion test. Points report the observed MMD–SMD difference in inverse-Herfindahl effective party channels minus its conditional-null expectation; bars are 95% confidence intervals using country-clustered CR2 inference. Within each country-election tier, 9,999 allocations hold the complete party-seat vector and focal-group seat count fixed. Zero therefore indicates exactly the dispersion expected from party seat shares and group size. Countries and their elections receive equal weight, results combine 20 cached imputations, and the primary analysis excludes independents.*

Table A.II.1: Youth threshold sensitivity for individual-level MMD representation.

Term	Estimate	t stat.	p-value	Obs.
mmd	0.011	3.011	0.018	10235.000
mmd	0.019	2.203	0.061	10235.000
mmd	0.020	1.442	0.190	10235.000

Note: Rows compare age thresholds using the deterministic continuous-age field. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

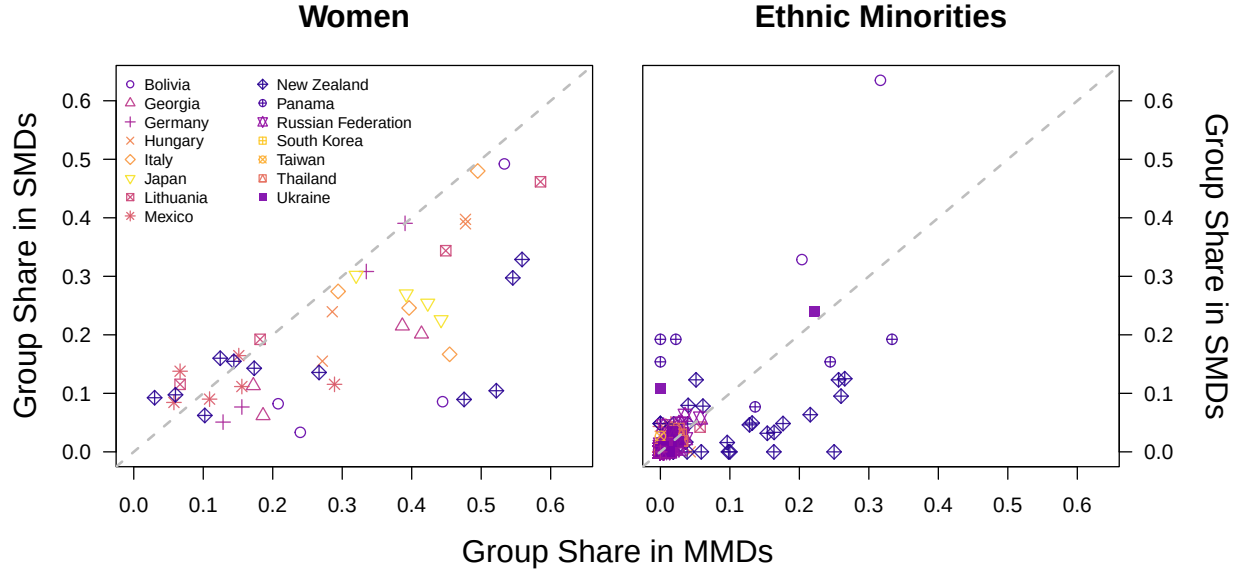


Figure A.II.2: Group-level representation across SMD and MMD tiers in the mixed-system sample of 44 country-elections in 15 countries for women and ethnic minorities. Unlike Figure 5.1, this visualization retains ethnic groups receiving no representation in either tier.

Table A.II.2: Missingness-regime comparison for identity-feature

Regime	Identity	Source	Observed
Status quo	Women	Human-coded	13240
Status quo	SGM	AI-coded	82.0
Status quo	Youth	AI-coded	10240
Status quo	Immigrant ethnic groups	Human-coded	13229
Status quo	Disabled	AI-coded	23.0
Status quo	Less educated	AI-coded	8817
Status quo	Working class	AI-coded	9763
Status quo	Native ethnic groups	Human-coded	13229
Status quo	Generic ethnic minorities	Human-coded	13240
Status quo	Ruralites	AI-coded	8294
Status quo	Low-GDP birthplace areas	AI-coded	8208
missForest-imputed	Women	Human-coded	13240
missForest-imputed	SGM	AI-coded	82.0
missForest-imputed	Youth	AI-coded	10240
missForest-imputed	Immigrant ethnic groups	Human-coded	13229
missForest-imputed	Disabled	AI-coded	23.0
missForest-imputed	Less educated	AI-coded	8817
missForest-imputed	Working class	AI-coded	9763
missForest-imputed	Native ethnic groups	Human-coded	13229
missForest-imputed	Generic ethnic minorities	Human-coded	13240
missForest-imputed	Ruralites	AI-coded	8294
missForest-imputed	Low-GDP birthplace areas	AI-coded	8208
Modal fill (missing coded non-focal; bounding case)	Women	Human-coded	13240
Modal fill (missing coded non-focal; bounding case)	SGM	AI-coded	82.0
Modal fill (missing coded non-focal; bounding case)	Youth	AI-coded	10240
Modal fill (missing coded non-focal; bounding case)	Immigrant ethnic groups	Human-coded	13229
Modal fill (missing coded non-focal; bounding case)	Disabled	AI-coded	23.0
Modal fill (missing coded non-focal; bounding case)	Less educated	AI-coded	8817
Modal fill (missing coded non-focal; bounding case)	Working class	AI-coded	9763
Modal fill (missing coded non-focal; bounding case)	Native ethnic groups	Human-coded	13229
Modal fill (missing coded non-focal; bounding case)	Generic ethnic minorities	Human-coded	13240
Modal fill (missing coded non-focal; bounding case)	Ruralites	AI-coded	8294
Modal fill (missing coded non-focal; bounding case)	Low-GDP birthplace areas	AI-coded	8208

Note: Rows include all AI feature-missingness summary CSV files currently present in the MultiFeatureAnalysis tables directory. The 'Status quo' regime is non-focal, so it bounds focal-group shares from below.

Table A.II.3: *Education sensitivity: alternative binary cut treating only primary schooling as less educated.*

Term	Estimate	t stat.	p-value	Obs.
Intercept	0.061	153.157	0.000	8810.000
mmd	-0.001	-0.720	0.494	8810.000

Note: The alternative cut counts legislators with at most primary schooling as the focal less-educated group (secondary schooling and above count as educated), built from the same harmonized education categories as the main coding. Country fixed effects are included but omitted from the printed table. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.4: *Education sensitivity: binned education-category robustness model.*

Term	Estimate	t stat.	p-value	Obs.
Intercept	2.805	532.877	0.000	8810.000
mmd	0.025	2.412	0.045	8810.000

Note: Country fixed effects are included but omitted from the printed table. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.5: *SGM sensitivity comparing observed-only and closed-world coding.*

Term	Estimate	t stat.	p-value	Obs.
mmd	0.043	0.564	0.649	82.000
mmd	0.003	2.449	0.040	13235.000

Note: The observed-only specification preserves public-disclosure missingness; the closed-world specification maps missing SGM status to zero. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.6: *Legacy-versus-harmonized class coding robustness comparison.*

Term	Estimate	t stat.	p-value	Obs.
mmd	-0.019	-1.539	0.165	9603.000
mmd	-0.020	-1.602	0.150	9756.000

Note: Rows compare the working-class coefficient using the legacy processed class coding versus the new harmonized coding. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.7: *Rurality threshold robustness comparing the default and alternative deterministic codings.*

Estimate	t stat.	p-value	Obs.
-0.010	-1.297	0.230	13235.000
-0.055	-3.255	0.012	13235.000

Note: The default deterministic rurality variable uses the 300 people per km2 rule. The alternative preserves the prior deterministic threshold rule. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.8: *Deterministic-versus-LLM rurality coding robustness comparison.*

Term	Estimate	t stat.	p-value	Obs.
mmd	-0.010	-1.297	0.230	13235.000
mmd	-0.055	-3.255	0.012	13235.000
mmd	-0.028	-2.531	0.040	8991.000

Note: The main pipeline keeps the default deterministic rurality coding as the primary analysis variable; the alternative deterministic and LLM rurality codings are shown as parallel robustness comparisons. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.9: Birthplace local-GDP robustness across alternative relative-deprivation codings.

Term	Estimate	t stat.	p-value	Obs.
mmd	-0.018	-1.942	0.088	13235.000
mmd	-0.021	-2.124	0.070	8203.000
mmd	-0.000	-0.053	0.959	8203.000
mmd	0.026	2.135	0.069	8203.000
mmd	0.064	2.169	0.066	8203.000
mmd	-0.025	-1.727	0.127	8203.000

Note: The benchmark indicator is bottom-quartile local GDP per capita. Continuous models use the population-weighted within-country percentile or the log ratio to the national median local GDP per capita. The t-statistic column reports t statistics. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.10: Drop-small-group robustness summary using a 1 percent national-share cutoff

Feature	Identity	Mean share diff.	Mean rep. diff.	Mean Rep I
Women	Women	0.101	0.089	0.0
SGM	SGM	0.004	-0.000	-0.0
Youth	Youth	0.016	0.016	0.0
Immigrant ethnic groups	Immigrant ethnic groups	0.018	0.010	0.0
Disabled	Disabled	0.001	0.001	0.0
Less educated	Less educated	0.002	0.002	0.0
Working class	Working class	-0.022	-0.013	-0.0
Native ethnic groups	Native ethnic groups	0.017	0.014	0.0
Generic ethnic minorities	Generic ethnic minorities	0.007	0.026	0.0
Ruralites	Ruralites	-0.016	-0.004	0.0
Low-GDP birthplace areas	Low-GDP birthplace areas	-0.015	-0.015	-0.0

Note: Groups below the 1 percent national-share cutoff are removed and the representation index is recomputed over the only, renormalizing population and body shares as in the main index construction. The baseline column repeats the unfiltered difference for comparison. This mirrors the appendix-style exclusion exercise used in the base scripts. Under the missForest estimates are fit once (on single-draw or MI-averaged inputs, not Rubin-pooled across the 20 imputations); see the main results for pooled estimates.

Table A.II.11: Zero-type summary for focal-group representation across

Feature	Identity	Country Election Rows	Zero Zero Cases	MM
Women	Women	44.000	0.000	
SGM	SGM	44.000	26.000	
Youth	Youth	44.000	0.000	
Immigrant ethnic groups	Immigrant ethnic groups	44.000	24.000	
Disabled	Disabled	44.000	25.000	
Less educated	Less educated	44.000	4.000	
Working class	Working class	44.000	0.000	
Native ethnic groups	Native ethnic groups	44.000	8.000	
Generic ethnic minorities	Generic ethnic minorities	450.000	174.000	
Ruralites	Ruralites	44.000	0.000	
Low-GDP birthplace areas	Low-GDP birthplace areas	44.000	0.000	

Note: Zero-zero cases have no focal-group representation in either tier; one-tier-zero cases have representation in exactly one tier (either single-draw or MI-averaged inputs, not Rubin-pooled across the 20 imputations); see the main results for pooled estimates.

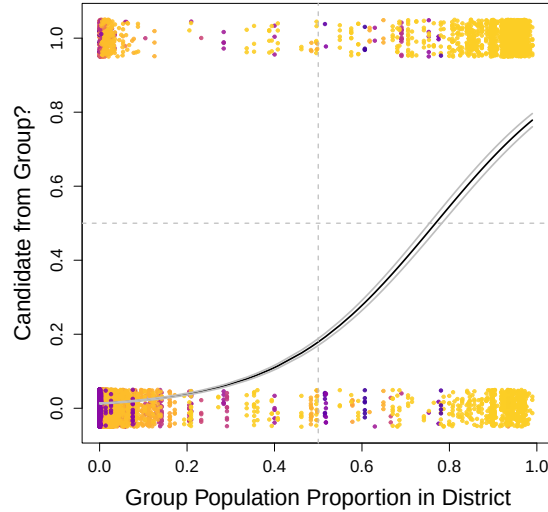


Figure A.II.3: A plot representing the group proportion in each district (X-axis) and an indicator of whether a given candidate is from that group. (AUC goodness of fit: 0.94; logistic regression coefficient: 5.68 [0.07]) $N=48,921$.

Table A.II.12: Two-part robustness model for different types of zero focal-group representation.

Term	Estimate	t stat.	p-value	Obs.
MMD tier				88.000
MMD tier	0.101	3.554	0.006	88.000
MMD tier	0.414	0.208	0.846	88.000
MMD tier	0.018	2.582	0.140	27.000
MMD tier				88.000
MMD tier	0.015	2.694	0.026	81.000
MMD tier				88.000
MMD tier	0.020	0.919	0.462	38.000
MMD tier	-0.348	-0.375	0.720	88.000
MMD tier	0.000	0.381	0.739	22.000
MMD tier	-1.067	-1.941	0.097	88.000
MMD tier	0.006	1.817	0.114	72.000
MMD tier				88.000
MMD tier	-0.019	-1.216	0.254	86.000
MMD tier	0.601	0.337	0.758	88.000
MMD tier	0.015	0.348	0.741	67.000
MMD tier	0.020	0.062	0.957	900.000
MMD tier	0.004	0.584	0.620	396.000
MMD tier				88.000
MMD tier	-0.015	-2.141	0.060	87.000
MMD tier	-1.931	-0.488	0.728	88.000
MMD tier	-0.017	-1.550	0.156	84.000

Note: The extensive model estimates any focal-group representation; the intensive model estimates focal-group share conditional on positive representation. Extensive-margin logits showing quasi-separation (fitted probabilities of 0 or 1, or implausibly large tier coefficients or standard errors) are reported as not estimated. The t-statistic column reports t statistics. Under the missForest regime these estimates are fit once (on single-draw or MI-averaged inputs, not Rubin-pooled across the 20 imputations); see the main results for pooled estimates.

Table A.II.13: *Leave-one-country-out stability of the individual*

Feature	Identity	Full estimate	Min leave-one-out estimate	Max leave-one-out estimate
Youth	Youth	0.018	0.014	0.022
Working class	Working class	-0.012	-0.016	-0.008
Disabled	Disabled	-0.000	-0.001	0.001
Less educated	Less educated	0.002	0.000	0.004
Women	Women	0.073	0.058	0.088
Immigrant ethnic groups	Immigrant ethnic groups	0.004	0.000	0.008
SGM	SGM	0.003	0.003	0.003
Native ethnic groups	Native ethnic groups	0.006	-0.006	0.018
Ruralites	Ruralites	-0.010	-0.013	-0.007

Note: The influential country is the omitted country producing the largest absolute deviation from the full-sample coefficient estimates. The maximum deviation is shown in parentheses.

Table A.II.14: *Controlled country-election share specifications.*

Term	Estimate	t stat.	p-value	Obs.
MMD tier	0.626	3.669	0.006	80.000
MMD tier	0.098	0.881	0.402	80.000
MMD tier	0.376	2.357	0.044	80.000
MMD tier	0.163	1.297	0.229	80.000
MMD tier	0.042	0.321	0.756	80.000
MMD tier	-0.071	-0.771	0.462	80.000
MMD tier	-0.252	-2.348	0.045	80.000
MMD tier	0.278	0.755	0.470	80.000
MMD tier	0.061	0.578	0.628	884.000
MMD tier	-0.117	-1.335	0.216	80.000
MMD tier	-0.073	-0.509	0.624	80.000

Note: Models estimate logit focal-group shares with MMD tier, election year, country fixed effects, and available election controls. The controls_included column lists exactly the controls that entered each model. Under the missForest regime these estimates are fit once (on single-draw or MI-averaged inputs, not Rubin-pooled across the 20 imputations); see the main results for pooled estimates.

Table A.II.15: Moderator interactions for the feature-level logit-share models.

Term	Estimate	t stat.	p-value	Obs.
				88.000
MMD tier x Reserved seats	0.299	1.006	0.393	88.000
MMD tier x Electoral threshold	0.094	1.456	0.187	88.000
				88.000
MMD tier x Reserved seats	-0.376	-2.683	0.081	88.000
MMD tier x Electoral threshold	-0.054	-1.358	0.215	88.000
				88.000
MMD tier x Reserved seats	-0.396	-0.704	0.536	88.000
MMD tier x Electoral threshold	-0.001	-0.007	0.995	88.000
				88.000
MMD tier x Reserved seats	0.305	1.271	0.299	88.000
MMD tier x Electoral threshold	0.028	0.913	0.391	88.000
				88.000
MMD tier x Reserved seats	0.271	1.374	0.270	88.000
MMD tier x Electoral threshold	0.039	0.946	0.375	88.000
				88.000
MMD tier x Reserved seats	0.224	1.210	0.319	88.000
MMD tier x Electoral threshold	-0.102	-1.707	0.130	88.000
				88.000
MMD tier x Reserved seats	-0.039	-0.123	0.910	88.000
MMD tier x Electoral threshold	0.015	0.264	0.799	88.000
				88.000
MMD tier x Reserved seats	0.778	0.732	0.521	88.000
MMD tier x Electoral threshold	0.074	0.782	0.459	88.000
				900.000
MMD tier x Reserved seats	0.706	1.175	0.404	900.000
MMD tier x Electoral threshold	0.019	0.306	0.798	900.000
				88.000
MMD tier x Reserved seats	-0.040	-0.277	0.801	88.000
MMD tier x Electoral threshold	-0.060	-1.371	0.211	88.000
				88.000
MMD tier x Reserved seats	0.002	0.004	0.997	88.000
MMD tier x Electoral threshold	0.023	0.428	0.681	88.000

Note: Rows report the MMD interaction term for the listed moderator. Moderators without a unique estimable MMD interaction are reported as not estimated. The t-statistic column reports t statistics. Under the missForest regime these estimates are fit once (on single-draw or MI-averaged inputs, not Rubin-pooled across the 20 imputations); see the main results for pooled estimates.

Table A.II.16: *Individual-level identity-outcome and district-magnitude predictor variants.*

Term	Estimate	t stat.	p-value	Obs.
mmd	0.073	2.356	0.046	13231.000
Log district magnitude	0.014	1.642	0.161	13231.000
mmd	0.003	2.449	0.040	13235.000
Log district magnitude	0.001	1.750	0.140	13234.000
mmd	0.018	2.963	0.018	13235.000
Log district magnitude	0.004	2.941	0.032	13234.000
mmd	0.004	0.783	0.456	13219.000
Log district magnitude	0.001	0.510	0.632	13219.000
mmd	-0.000	-0.413	0.691	13235.000
Log district magnitude	-0.000	-0.270	0.798	13234.000
mmd	0.002	0.708	0.499	13235.000
Log district magnitude	0.000	0.332	0.753	13234.000
mmd	-0.012	-1.228	0.254	13235.000
Log district magnitude	-0.003	-1.881	0.118	13234.000
mmd	0.006	0.446	0.667	13219.000
Log district magnitude	0.002	0.746	0.489	13219.000
mmd	-0.010	-1.297	0.230	13235.000
Log district magnitude	-0.003	-1.160	0.298	13234.000

Note: Identity membership is the dependent variable. Models include country-election fixed effects. Standard errors use country-clustered CR2 corrections; tests and 95% confidence intervals use coefficient-specific Satterthwaite degrees of freedom. Estimates use a single missForest imputation (draw 1 of 20) and are not MI-pooled; see the main results for pooled estimates.

Table A.II.17: *Summary of institutional mechanism checks.*

Mechanism	Evidence	Takeaway
Party-channel dispersion	A conditional randomization test holds fixed each tier's party-seat vector and number of focal-group legislators (Table 6.2; Figure A.II.1).	Raw party-channel counts are often higher in MMDs, but no identity shows multiplicity-adjusted evidence of excess MMD dispersion beyond the conditional-null expectation.
Gender quotas	Models add statutory and party-quota indicators and interact each quota type with MMD status (Table 6.3).	Neither interaction is precise enough to identify a quota-specific MMD mechanism; the positive party-quota interaction remains suggestive only.
Malapportionment and local rural balance	Local tier balance is checked across population density, SMD district-size inequalities are modeled, and the main gaps are recomputed after equalizing SMD electorate weights (Figure A.II.6; Tables 6.4, 6.5, and A.II.18).	Local rural imbalance and unequal SMD district sizes do not account for the central identity patterns; equalization barely changes the headline gaps.

Table A.II.18: *SMD malapportionment models of identity indicators on log eligible voters using all matched district-size rows. Estimator: identity-specific OLS linear probability models with country fixed effects and an election-year covariate; t statistics use country-clustered standard errors. Observations by identity: Women 3,007; SGM 3,008; Youth 3,008; Immigrant ethnic groups 3,007; Disabled 3,008; Less educated 3,008; Working class 3,008; Native ethnic groups 3,007; Ruralites 3,008.*

Identity	Estimate	t stat.	p-value
Women	0.067	3.380	0.017
SGM	0.002	1.507	0.187
Youth	0.009	0.269	0.798
Immigrant ethnic groups	-0.016	-1.122	0.309
Disabled	-0.003	-1.073	0.329
Less educated	-0.057	-1.754	0.135
Working class	-0.009	-0.364	0.729
Native ethnic groups	-0.080	-2.099	0.085
Ruralites	-0.032	-0.949	0.383

Note: Sensitivity sample includes all one-to-one matched SMD district-size rows, including country-elections below the 95 percent primary coverage threshold.

Table A.II.19: *Strengths and weaknesses of the Russia (1999) and New Zealand (2014) country studies.*

–RUSSIA (1999)–		–NEW ZEALAND (2014)–	
CONTEXT		CONTEXT	
Strengths:	Weaknesses:	Strengths:	Weaknesses:
- Large, diverse federation with many ethnic groups.	- Partial democracy; potential confounds from post-Soviet transition.	- Democratic context, a well-established party system.	- Smaller set of minority groups (less variation).
- Competitive election with thousands of candidates.	- Reliance on name-based ethnic coding, which may introduce classification errors.	- Accessible official data.	- Complications due to separate Māori roll.
- Rich variation in group size and regional concentration.			
DATA SCOPE		DATA SCOPE	
Strengths:	Weaknesses:	Strengths:	Weaknesses:
- Detailed candidate data (over 2,000 per tier) across 225 SMDs.	- Some missing district-level demographic data.	- Comprehensive census data by electorate.	- Fewer ethnic categories limit cross-group analyses.
- Large <i>N</i> for quantitative tests.	- Noise due to smaller minority groups.	- Official sources for candidate ethnicity; minimal missingness.	- Certain subpopulations (e.g., Pacific Peoples) remain small in many electorates.
SUMMARY		SUMMARY	
Strengths:	Weaknesses:	Strengths:	Weaknesses:
- Many geographically concentrated groups provide test of how SMDs capture smaller majorities.	- Post-communist realignments create potential confounders for vote choice.	- Illustrates how a well-functioning MMP system can reveal clear differences in descriptive representation.	- Fewer natural experiments to test extremes of group size/concentration.
- Demonstrates how partial democracy can still show mechanical (not purely strategic) effects.	- High regional heterogeneity demands careful district-level controls.	- Easily distinguishes representation of Māori, European, and other groups.	- Context of stable democracy may yield less dramatic variation in outcomes.

Table A.II.20: *Overview of principal empirical tables.*

Table	Purpose
Table 4.1	Presents the global sample characteristics across 15 countries, showing key electoral system features including: electoral system type (MMM/MMP), MMD aggregation units, seat distributions, presence of reserved seats, gender quotas, and statutory thresholds. Serves as the foundation for the empirical analysis.
Table 5.2	Estimates whether MMD rather than SMD election changes the prevalence of each identity among legislators within the same country-election. Reports seat-weighted and equal-country/election identity-outcome models with country-clustered CR2/Satterthwaite inference.
Table A.XII.3	Analyzes whether MMD status predicts overall representation (using the representation index) at the country-election level. Shows that MMDs improve gender representation but have minimal impact on ethnic representation. Tests multiple specifications with different controls.
Table 5.3	Compares the same 9 identity outcomes in pure MMD and pure SMD systems using controlled unit-level cross-sectional models. This provides a broader but more confounded external comparison, with smaller effects for women and more mixed results across identities than the mixed-system benchmark.
Table A.VIII.1	Focuses on representation of minority ethnic groups in Russia and New Zealand, analyzing how population share and geographic dispersion interact with electoral rules. Shows that SMDs favor larger groups, MMDs favor dispersed groups, and the combination of large size and dispersal enhances MMD benefits.

	Model 1	Model 2	Model 3	Model 4
Outcome	Gender	Gender	Ethnicity	Ethnicity
MMD	0.10 (3.60)*	0.10 (3.25)*	0.00 (0.47)	0.00 (0.47)
<i>Control variables</i>				
Electoral threshold		0.00 (0.78)		0.00 (0.21)
Election year		0.00 (3.41)*		0.00 (0.67)
Country fixed effects		✓		✓
<i>Other statistics</i>				
Countries	15	15	13	13
Observations	90	90	902	902
Adjusted R-squared	0.09	0.74	0.00	0.42

Table A.II.21: Outcome: Group body share (for ethnicity: largest proportion dropped; for gender: male group dropped). Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. First two models use gender as outcome; next two use ethnicity. Unit of analysis: Country-group-election. Full model results are given in Table A.IV.3.

	Model 1	Model 2	Model 3	Model 4	Model 5
Outcome	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	log(District Mag)
<i>Gender operationalization</i>					
Female indicator	0.45 (3.07)*	0.45 (3.06)*	0.45 (3.08)*	0.40 (2.36)*	0.38 (2.99)*
<i>Ethnicity operationalizations</i>					
logit(Nat'l ethnicity share)	-0.01 (-0.50)				
logit(Region ethnicity share)		-0.02 (-0.87)			
Non-plurality indicator			0.09 (0.45)	-0.03 (-0.37)	0.12 (0.63)
<i>Control variables</i>					
Election year	0.00 (0.47)	0.00 (0.44)	0.00 (0.49)	0.00 (0.91)	0.00 (0.81)
Country fixed effects	✓	✓	✓	✓	✓
<i>Other statistics</i>					
Countries	15	15	15	12	15
Observations	13735	13720	13739	12255	13748
AIC	17707.79	17684.15	17711.62	15726.60	58989.25

Table A.II.22: Unit of analysis: individual legislators. Outcome: Legislator in MMD arm indicator in Models 1-4; log of legislator's district magnitude in Model 5. Model 4 uses data only from countries without any reserved seats. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Representative-level unit of analysis. Estimator: Logistic regression for models 1-4; OLS for model 5. Full model results are given in Table A.IV.5.

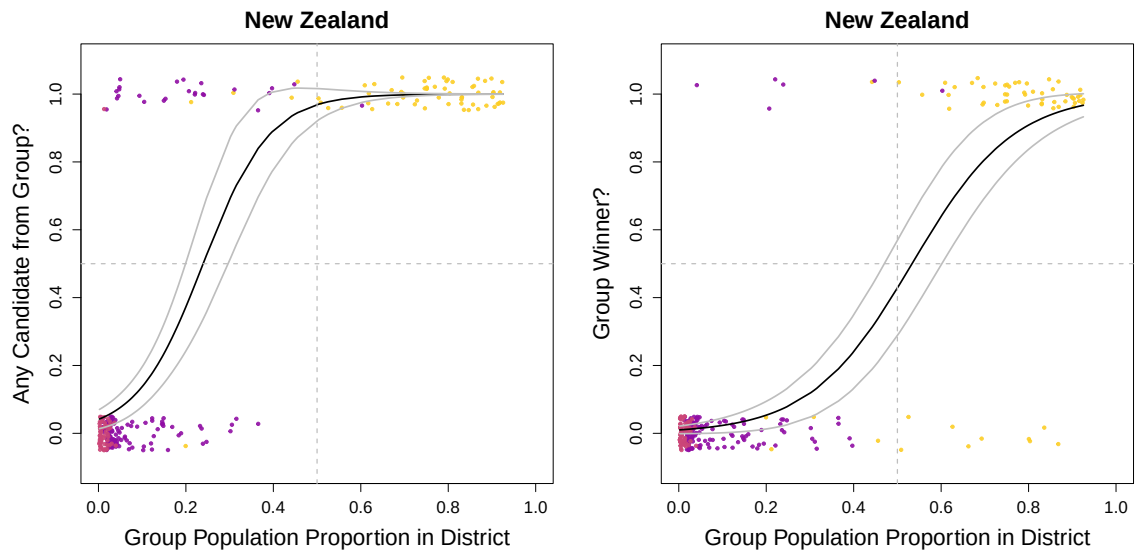


Figure A.II.4: *New Zealand analysis (all groups excluding Maori). LEFT. Any candidates. 0.96 ($N=256$). RIGHT. Winners. 0.97 ($N=256$).*

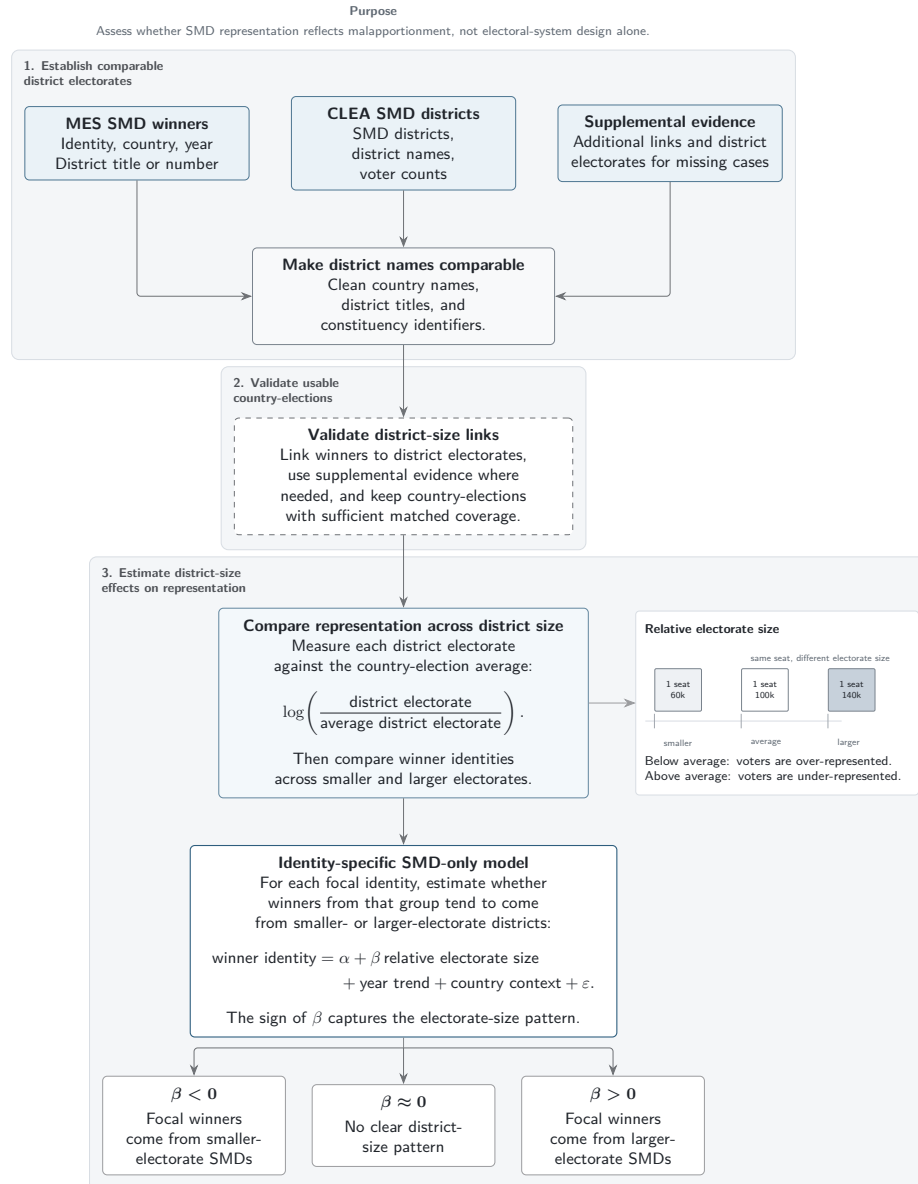


Figure A.II.5: Malapportionment analysis workflow.

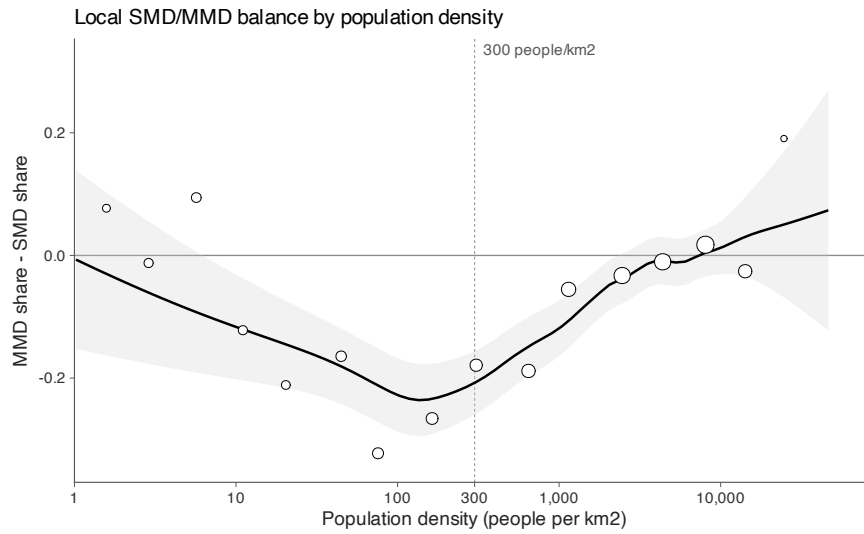


Figure A.II.6: Local SMD/MMD balance across population density. The solid line shows a LOESS-smoothed local balance measure, defined as MMD share minus SMD share, with shaded 95% confidence intervals. Points show equal-count binned means. Positive values indicate MMD-heavy density ranges; negative values indicate SMD-heavy density ranges. Population density is shown on a log scale, beginning at 1 person/km²; the dashed vertical line marks the 300 people/km² rurality threshold.

Appendix III. Ethnic Groups by Country

The coding of leader ethnicity builds on the Global Leadership Project (Gerring, Oncel, et al., 2019) along with a variety of country-specific sources. Ethnic groups are defined according to whatever set of features—linguistic, religious, racial, geographic, national origin, et al.—are most salient in a country at the time of data collection. In making coding decisions about ethnicity, coders draw on various sources, including parliamentary websites, Wikipedia, country-specific sources, and clues implicit in a political leader’s name, place of birth, and so forth.

Coding decisions thus rest on each leader’s self-presentation of their public persona. These identities are presumably crafted for political purposes. For example, a legislator with a mixed ethnic background may choose to emphasize one ethnicity over another by omitting a middle name, or perhaps even by changing their name. Since representation relies on public identities, it is appropriate to focus on how leaders present themselves and how they are perceived by others.

We recognize that ethnic categories can be aggregated at different levels. For example, in the United States, Japanese-Americans might be classified as Asian, East Asian, or Japanese. Here, we rely on coders’ judgments of which categories are most salient for political purposes in a particular country at a particular time. Likewise, where an individual has a mixed heritage, we report what is likely to have been their principal, or most widely known, ethnic identity. For example, Kamala Harris would be classified as Black rather than South Asian.

Groups with less than 1 percent of the population are excluded unless a member of that group gains representation in the national parliament — an occurrence that happens frequently in Russia and infrequently everywhere else.

To determine the size of each group in the general population, we consult censuses or surveys for each country—limiting our purview to legal citizens. Since nonvoting aliens are generally disqualified from holding office, they are excluded from our analysis.

Below, we provide a complete list of countries along with the coding decisions for their respective ethnic groups and their share of the national population. Numbers do not always add up to 100% due to our inclusion/exclusion criteria. We also exclude categories labeled “Other” or “Miscellaneous.”

Bolivia: Afroboliviana (1.00), Indigenous (24.00), Mestizo (75.00).

Georgia: Abkhaz (2.70), Armenian (5.70), Azeri (6.50), Georgian (83.70), Ossetian (1.40).

Germany: Austrian (0.20), Czech (0.20), Dutch (0.10), German (73.00), Greek (0.15), Italian (0.30), Kazakhstan (1.40), Other (3.00), Other European (1.80), Persian (0.20), Polish (1.70), Romanian (0.60), Russian Federation (1.20), Turkish (1.60).

Hungary: German (1.90), Hungarian (94.80), Roma (3.30).

Italy: Black (1.50), Germanophone (2.50), Italian (94.50), Moroccan (1.50).

Japan: Japanese (100.00).

Lithuania: Jewish (0.10), Lithuanian (84.20), Polish (6.60), Russian (5.80).

Mexico: Indigenous (9.36), White/Mestizo (90.64).

New Zealand: Asian (13.70), European (63.90), Maori (15.10), Pacific Islander (7.30). *NB:* The data are sourced from the census, where respondents can select multiple groups they identify with. Since the total of group percentages exceeds 100%, the percentages have been scaled down to sum to 100%.

Panama: Afro Panamanian (17.00), Indigenous (12.30), Mestizo (70.70).

Russian Federation: Abkhaz (0.01), Adigei (0.09), Altai (0.06), Armenian (0.79), Avar (0.57), Balkar (0.08), Bashkir (1.11), Belorussian (0.38), Bulgarian (0.02), Buryat (0.31), Chechen (4.70), Chuvash (1.15), Circassian (0.05), Darghin (0.35), Estonian (0.01), Evenk (0.03), Finnish (0.01), Georgian (0.11), German (0.42), Greek (0.06), Ingush (0.29), Jewish (0.11), Kabard-Balkar (0.00), Kabarda (0.38), Kalmyk (0.13), Karachay (0.15), Karelian (0.04), Kazakh (0.05), Khakass (0.05), Khanti (0.02), Komi (0.16), Korean (0.11), Koryak (0.01), Kumyk (0.29), Kurdish (0.01), Kurdish, Georgian (0.00), Kyrgyz (0.07), Lakets (0.11), Latvian (0.01), Lezgin (0.28), Mansi (0.01), Mari (0.43), Moldovan (0.11), Mordva (0.60), Nenets (0.03), Ossetian (0.35), Russian (75.20), Tajik (0.14), Tatar (3.80), Tuvan (3.80), Udmurt (0.44), Ukrainian (2.00), Uzbek (0.20), Yakut (0.31).

South Korea: Korean (100.00).

Taiwan: Aboriginal (2.50), Chinese (97.50).

Thailand: Malay (5.10), Other (2.00), Thai (92.90).

Ukraine: Adigei (<0.01), Armenian (0.20), Azerbaijani (0.10), Belorussian (0.51), Black (Rwandan) (<0.01), Bulgarian (0.41), Buryat (<0.01), Crimean Tatar (0.51), Dagestani (<0.01), Georgian (0.10), Greek (0.20), Hungarian (0.30), Jewish (0.20), Kazakh (0.01), Lakets (<0.01), Lithuanian (0.01), Moldovan (0.81), Polish (0.30), Romanian (0.10), Russian (17.44), Tatar (0.20), Ukrainian (78.58).

Appendix IV. Full Regression Tables

Table A.IV.1: Outcome: Representation index. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. First two models use gender as outcome; next two use ethnicity. Country-election unit of analysis.

	Model 1	Model 2	Model 3	Model 4
MMD	0.09 (3.59)*	0.09 (3.25)*	0.02 (1.20)	0.02 (1.08)
Electoral threshold		0.00 (0.43)		0.00 (0.17)
Election year		0.00 (3.89)*		0.00 (0.70)
Country - Georgia		-0.26 (-24.86)*		0.03 (1.74)
Country - Germany		-0.08 (-9.14)*		0.03 (2.52)*
Country - Hungary		-0.27 (-29.56)*		0.11 (7.93)*
Country - Italy		-0.05 (-4.30)*		0.09 (9.05)*
Country - Japan		-0.26 (-20.87)*		0.16 (14.24)*
Country - Lithuania		-0.16 (-20.89)*		0.06 (3.91)*
Country - Mexico		0.07 (16.84)*		0.08 (15.34)*
Country - New Zealand		-0.02 (-2.26)*		-0.03 (-11.11)*
Country - Panama		-0.22 (-16.62)*		0.04 (5.41)*
Country - Russian Federation		-0.23 (-23.08)*		0.02 (2.44)*
Country - South Korea		-0.10 (-5.45)*		0.15 (7.14)*
Country - Taiwan		-0.02 (-2.06)*		0.13 (6.69)*
Country - Thailand		-0.25 (-76.53)*		0.12 (18.70)*
Country - Ukraine		-0.22 (-30.68)*		0.02 (9.30)*
Adjusted R-squared	0.08	0.74	0.01	0.58
Observations	90	90	90	90
Countries	15	15	15	15

Table A.IV.2: Outcome: Representation index. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. First two models use gender as outcome; next two use ethnicity. Region-election unit of analysis.

	Model 1	Model 2	Model 3	Model 4
MMD	0.03 (0.85)	0.03 (0.84)	-0.02 (-0.60)	-0.02 (-0.60)
Electoral threshold		0.01 (1.53)		-0.05 (-42.00)*
Election year		0.00 (2.04)*		0.00 (0.57)
Country - Georgia		-0.20 (-13.12)*		
Country - Germany		-0.03 (-2.28)*		0.44 (101.57)*
Country - Hungary		-0.18 (-20.58)*		
Country - Italy		0.00 (-0.15)		
Country - Japan		-0.17 (-7.53)*		
Country - Lithuania		-0.09 (-10.60)*		
Country - Mexico		0.13 (31.19)*		
Country - New Zealand		0.02 (1.02)		
Country - Panama		-0.19 (-8.00)*		
Country - Russian Federation		-0.19 (-14.10)*		
Country - South Korea		-0.08 (-2.28)*		
Country - Taiwan		0.04 (2.49)*		
Country - Thailand		-0.19 (-45.44)*		

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	Model 1	Model 2	Model 3	Model 4
Country - Ukraine		-0.27 (-22.47)*		
Adjusted R-squared	0.00	0.50	0.00	0.29
Observations	530	530	162	162
Countries	15	15	3	3

Table A.IV.3: Outcome: Group body share (for ethnicity: largest proportion dropped; for gender: male group dropped). Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. First two models use gender as outcome; next two use ethnicity. Unit of analysis: Country-group-election.

	Model 1	Model 2	Model 3	Model 4
MMD	0.10 (3.60)*	0.10 (3.25)*	0.00 (0.47)	0.00 (0.47)
Country - Georgia		-0.29 (-22.16)*		-0.18 (-82.04)*
Country - Germany		-0.10 (-11.25)*		-0.19 (-164.80)*
Country - Hungary		-0.29 (-24.60)*		-0.18 (-114.87)*
Country - Italy		-0.07 (-5.30)*		-0.19 (-158.42)*
Country - Japan		-0.28 (-22.22)*		
Country - Lithuania		-0.19 (-17.84)*		-0.17 (-98.87)*
Country - Mexico		0.05 (9.62)*		-0.17 (-278.66)*
Country - New Zealand		-0.03 (-3.08)*		-0.11 (-408.53)*
Country - Panama		-0.23 (-18.32)*		-0.05 (-61.13)*
Country - Russian Federation		-0.24 (-21.66)*		-0.18 (-210.66)*
Country - South Korea		-0.12 (-6.10)*		
Country - Taiwan		0.01 (0.46)		-0.18 (-84.79)*
Country - Thailand		-0.26 (-61.98)*		-0.17 (-240.31)*
Country - Ukraine		-0.24 (-33.01)*		-0.18 (-863.18)*
Electoral threshold		0.00 (0.78)		0.00 (0.21)
Election year		0.00 (3.41)*		0.00 (0.67)
Adjusted R-squared	0.09	0.74	0.00	0.42
Observations	90	90	902	902
Countries	15	15	13	13

Table A.IV.4: Unit of analysis: individual legislators. Outcome: Legislator in MMD arm indicator in Models 1-4; log of legislator's district magnitude in Model 5. Model 4 uses data only from countries without any reserved seats. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Representative-level unit of analysis. Estimator: OLS (see Table A.II.22 for results from generalized linear models).

	Model 1	Model 2	Model 3	Model 4	Model 5
logit(Nat'l ethnicity share)	0.00 (-0.50)				
Female indicator	0.10 (3.11)*	0.10 (3.10)*	0.10 (3.13)*	0.09 (2.40)*	0.38 (2.99)*
Election year	0.00 (0.49)	0.00 (0.45)	0.00 (0.51)	0.00 (0.97)	0.00 (0.81)
Country - Georgia	0.22 (13.11)*	0.22 (13.89)*	0.22 (9.71)*		2.18 (23.05)*
Country - Germany	0.13 (14.68)*	0.14 (9.30)*	0.13 (7.29)*	-0.09 (-11.26)*	1.20 (15.90)*
Country - Hungary	0.01 (0.60)	0.02 (0.81)	0.02 (0.58)	-0.21 (-67.64)*	1.18 (10.83)*
Country - Italy	0.17 (8.34)*	0.18 (9.01)*	0.17 (7.71)*	-0.05 (-6.66)*	0.71 (7.39)*
Country - Japan	-0.05 (-1.55)	-0.04 (-1.22)	-0.05 (-2.20)*	-0.27 (-34.81)*	0.30 (3.21)*
Country - Lithuania	0.05 (3.21)*	0.05 (3.56)*	0.05 (2.39)*	-0.17 (-67.57)*	1.23 (13.82)*
Country - Mexico	-0.06 (-4.87)*	-0.06 (-4.70)*	-0.06 (-3.33)*	-0.28 (-25.32)*	0.56 (7.56)*
Country - New Zealand	-0.02 (-4.24)*	-0.02 (-4.15)*	-0.01 (-1.48)		0.89 (24.75)*
Country - Panama	0.19 (22.78)*	0.21 (18.94)*	0.19 (17.36)*	-0.02 (-2.71)*	0.76 (16.69)*

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	Model 1	Model 2	Model 3	Model 4	Model 5
Country - Russian Federation	0.07 (6.82)*	0.07 (6.99)*	0.07 (5.46)*	-0.14 (-9.10)*	1.92 (29.87)*
Country - South Korea	-0.30 (-11.97)*	-0.29 (-11.61)*	-0.30 (-13.22)*	-0.52 (-112.10)*	-0.27 (-2.88)*
Country - Taiwan	-0.14 (-6.52)*	-0.14 (-6.44)*	-0.15 (-7.04)*		0.20 (2.25)*
Country - Thailand	-0.19 (-11.29)*	-0.19 (-11.02)*	-0.19 (-9.69)*	-0.41 (-40.83)*	0.35 (4.20)*
Country - Ukraine	0.08 (8.59)*	0.08 (9.15)*	0.08 (6.29)*	-0.13 (-11.55)*	1.98 (34.42)*
logit(Region ethnicity share)		-0.01 (-0.88)			
Non-plurality indicator			0.02 (0.45)	-0.01 (-0.37)	0.12 (0.63)
Adjusted R-squared	0.08	0.08	0.08	0.09	0.10
Observations	13735	13720	13739	12255	13748
Countries	15	15	15	12	15

Table A.IV.5: Unit of analysis: individual legislators. Outcome: Legislator in MMD arm indicator in Models 1-4; log of legislator's district magnitude in Model 5. Model 4 uses data only from countries without any reserved seats. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Representative-level unit of analysis. Estimator: Logistic regression for models 1-4; OLS for model 5.

	Model 1	Model 2	Model 3	Model 4	Model 5
logit(Nat'l ethnicity share)	-0.01 (-0.50)				
Female indicator	0.45 (3.07)*	0.45 (3.06)*	0.45 (3.08)*	0.40 (2.36)*	0.38 (2.99)*
Election year	0.00 (0.47)	0.00 (0.44)	0.00 (0.49)	0.00 (0.91)	0.00 (0.81)
Country - Georgia	0.91 (12.44)*	0.92 (13.05)*	0.92 (9.45)*		2.18 (23.05)*
Country - Germany	0.52 (13.44)*	0.55 (8.69)*	0.54 (7.03)*	-0.37 (-11.00)*	1.20 (15.90)*
Country - Hungary	0.07 (0.66)	0.09 (0.86)	0.07 (0.63)	-0.86 (-74.90)*	1.18 (10.83)*
Country - Italy	0.72 (7.99)*	0.74 (8.56)*	0.72 (7.48)*	-0.21 (-6.63)*	0.71 (7.39)*
Country - Japan	-0.18 (-1.48)	-0.15 (-1.14)	-0.20 (-2.11)*	-1.11 (-33.29)*	0.30 (3.21)*
Country - Lithuania	0.20 (3.12)*	0.21 (3.44)*	0.21 (2.35)*	-0.71 (-50.79)*	1.23 (13.82)*
Country - Mexico	-0.25 (-4.92)*	-0.23 (-4.78)*	-0.24 (-3.34)*	-1.15 (-21.41)*	0.56 (7.56)*
Country - New Zealand	-0.06 (-3.88)*	-0.07 (-3.87)*	-0.04 (-1.41)		0.89 (24.75)*
Country - Panama	0.80 (19.98)*	0.86 (17.04)*	0.81 (15.56)*	-0.08 (-2.80)*	0.76 (16.69)*
Country - Russian Federation	0.28 (6.16)*	0.27 (6.31)*	0.30 (5.11)*	-0.58 (-8.42)*	1.92 (29.87)*
Country - South Korea	-1.58 (-15.90)*	-1.55 (-15.42)*	-1.59 (-17.52)*	-2.50 (-122.61)*	-0.27 (-2.88)*
Country - Taiwan	-0.61 (-6.89)*	-0.59 (-6.85)*	-0.63 (-7.39)*		0.20 (2.25)*
Country - Thailand	-0.88 (-12.56)*	-0.86 (-12.20)*	-0.87 (-10.80)*	-1.78 (-40.90)*	0.35 (4.20)*
Country - Ukraine	0.33 (7.79)*	0.33 (8.20)*	0.34 (5.95)*	-0.55 (-10.72)*	1.98 (34.42)*
logit(Region ethnicity share)		-0.02 (-0.87)			
Non-plurality indicator			0.09 (0.45)	-0.03 (-0.37)	0.12 (0.63)
AIC	17707.79	17684.15	17711.62	15726.60	58989.25
Observations	13735	13720	13739	12255	13748
Countries	15	15	15	12	15

Table A.IV.6: Unit of analysis: individual legislators. Outcome: Legislator in MMD arm indicator in Models 1-4; log of legislator's district magnitude in Model 5. Model 4 uses data only from countries without any reserved seats. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Robustness specification: groups below 1% of national population share (and their members) are excluded. Representative-level unit of analysis. Estimator: OLS.

	Model 1	Model 2	Model 3	Model 4	Model 5
logit(Nat'l ethnicity share)	0.00 (0.25)				
Female indicator	0.11 (3.35)*	0.11 (3.34)*	0.11 (3.37)*	0.10 (2.59)*	0.40 (3.31)*
Election year	0.00 (0.30)	0.00 (0.27)	0.00 (0.30)	0.00 (0.69)	0.00 (0.60)
Country - Georgia	0.21 (9.80)*	0.22 (11.23)*	0.22 (7.78)*		2.17 (18.43)*
Country - Germany	0.12 (8.28)*	0.13 (5.36)*	0.12 (5.03)*	-0.09 (-10.89)*	1.17 (11.09)*
Country - Hungary	0.00 (0.12)	0.01 (0.48)	0.01 (0.40)	-0.21 (-63.92)*	1.17 (8.79)*
Country - Italy	0.16 (4.92)*	0.17 (5.90)*	0.17 (5.92)*	-0.05 (-7.62)*	0.69 (5.72)*
Country - Japan	-0.07 (-1.37)	-0.05 (-1.05)	-0.05 (-1.88)	-0.27 (-30.18)*	0.28 (2.31)*
Country - Lithuania	0.04 (1.88)	0.04 (2.47)*	0.04 (1.64)	-0.17 (-71.03)*	1.21 (10.61)*
Country - Mexico	-0.07 (-3.30)*	-0.06 (-3.15)*	-0.06 (-2.69)*	-0.28 (-25.38)*	0.54 (5.38)*
Country - New Zealand	-0.02 (-3.95)*	-0.02 (-3.42)*	-0.02 (-1.42)		0.87 (17.08)*
Country - Panama	0.19 (22.52)*	0.21 (16.52)*	0.19 (15.45)*	-0.01 (-1.83)	0.76 (14.56)*
Country - Russian Federation	0.06 (4.30)*	0.06 (4.98)*	0.06 (3.00)*	-0.15 (-9.00)*	1.88 (18.78)*
Country - South Korea	-0.31 (-7.86)*	-0.30 (-8.06)*	-0.30 (-10.51)*	-0.52 (-91.24)*	-0.28 (-2.35)*
Country - Taiwan	-0.16 (-4.38)*	-0.14 (-4.38)*	-0.15 (-5.60)*		0.18 (1.58)
Country - Thailand	-0.20 (-7.66)*	-0.19 (-8.01)*	-0.19 (-7.67)*	-0.41 (-36.22)*	0.33 (3.00)*
Country - Ukraine	0.08 (6.09)*	0.08 (7.36)*	0.08 (4.49)*	-0.13 (-11.26)*	1.99 (24.08)*
logit(Region ethnicity share)		0.00 (-0.21)			
Non-plurality indicator			0.01 (0.10)	-0.04 (-1.60)	0.06 (0.21)
Adjusted R-squared	0.08	0.08	0.08	0.09	0.10
Observations	13382	13367	13384	11902	13393
Countries	15	15	15	12	15

Table A.IV.7: Outcome: Representation index. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Robustness specification: groups below 1% of national population share (and their members) are excluded. First two models use gender as outcome; next two use ethnicity. Country-election unit of analysis.

	Model 1	Model 2	Model 3	Model 4
MMD	0.09 (3.73)*	0.09 (3.38)*	0.02 (1.18)	0.02 (1.07)
Electoral threshold		0.00 (0.17)		0.00 (0.20)
Election year		0.00 (3.98)*		0.00 (0.64)
Country - Georgia		-0.26 (-24.53)*		0.03 (1.65)
Country - Germany		-0.07 (-9.13)*		0.04 (3.58)*
Country - Hungary		-0.27 (-32.11)*		0.11 (7.66)*
Country - Italy		-0.05 (-4.99)*		0.09 (8.86)*
Country - Japan		-0.27 (-22.98)*		0.16 (13.40)*
Country - Lithuania		-0.16 (-20.27)*		0.06 (3.77)*
Country - Mexico		0.07 (18.65)*		0.08 (14.83)*
Country - New Zealand		-0.02 (-2.55)*		-0.03 (-10.92)*
Country - Panama		-0.22 (-18.86)*		0.04 (5.13)*
Country - Russian Federation		-0.22 (-25.97)*		0.05 (6.46)*
Country - South Korea		-0.10 (-5.50)*		0.15 (6.70)*
Country - Taiwan		-0.02 (-1.78)		0.13 (6.35)*
Country - Thailand		-0.25 (-76.11)*		0.12 (17.79)*
Country - Ukraine		-0.22 (-34.58)*		0.05 (24.50)*
Adjusted R-squared	0.09	0.74	0.01	0.55
Observations	90	90	90	90
Countries	15	15	15	15

Appendix V. Analytical Derivations

Regression estimands and aggregation

We first state the two weighting propositions summarized in Section 4.9, then prove them.

PROPOSITION 1 (EQUAL WEIGHTING FOR COMPOSITION) Assign every legislator-seat in election ce the weight

$$w_i^C = \frac{N_{ce}}{K_c n_{1ce} n_{0ce}}. \quad (\text{A.V.1})$$

The weighted least squares (WLS) estimate of δ_g^C in Equation 4.11 is numerically identical to

$$\hat{\Delta}_g^{C,\text{eq}} = \frac{1}{C} \sum_{c=1}^C \frac{1}{K_c} \sum_{e=1}^{K_c} (\hat{\theta}_{1gce} - \hat{\theta}_{0gce}). \quad (\text{A.V.2})$$

The rule-as-exposure model is defined only where both identity cells are populated. Let $\mathcal{E}_{cg}^+$ collect the elections in country c in which both cells are non-empty ($n_{1ce}^g > 0$ and $n_{0ce}^g > 0$), let $K_{cg}^+ = |\mathcal{E}_{cg}^+|$, and let $\mathcal{C}_g^+$ (with $C_g^+ = |\mathcal{C}_g^+|$) collect the countries for which $\mathcal{E}_{cg}^+$ is non-empty.

PROPOSITION 2 (EQUAL WEIGHTING FOR LOCATION) Assign every legislator-seat in an election $e \in \mathcal{E}_{cg}^+$ of country c the weight

$$w_{ig}^L = \frac{N_{ce}^g}{K_{cg}^+ n_{1ce}^g n_{0ce}^g}. \quad (\text{A.V.3})$$

The WLS estimate of δ_g^L in Equation 4.12 is numerically identical to

$$\hat{\Delta}_g^{L,\text{eq}} = \frac{1}{C_g^+} \sum_{c \in \mathcal{C}_g^+} \frac{1}{K_{cg}^+} \sum_{e \in \mathcal{E}_{cg}^+} (\hat{\pi}_{1gce} - \hat{\pi}_{0gce}). \quad (\text{A.V.4})$$

The proofs below establish both equivalences. A practical payoff is that the estimates require no individual-level computation. The composition estimate can be rebuilt from a small summary table: for each election and tier, the total weight and the focal group's seat share. The location estimate needs only the analogous table by identity group: the total weight and the share of members entering through the MMD tier. Equivalently, one can compute each election's MMD–SMD contrast first and then average within countries, weighting elections by $1/K_c$ or $1/K_{cg}^+$. All three routes—legislator-level, cell-level, and contrast-then-average—yield exactly the same point estimates.

Two further variants of the composition regression can also be considered. A district-balanced specification counts each SMD constituency and each MMD aggregation unit once, rather than each seat, before applying the equal-country, equal-election weights; it asks how a typical district, rather than a typical seat, is composed. An MMD aggregation-unit fixed-effects specification makes the same composition comparison within regional aggregation units containing seats from both tiers.

Proof of Proposition 1. Consider a WLS regression of G_{ig} on the binary regressor T_i and a saturated set of country-election indicators. The Frisch–Waugh–Lovell theorem expresses the coefficient on T_i as a weighted average of the within-election contrasts:

$$\hat{\delta}_g^C = \frac{\sum_{ce} \omega_{ce} (\bar{G}_{1gce}^w - \bar{G}_{0gce}^w)}{\sum_{ce} \omega_{ce}}, \quad \omega_{ce} = \frac{W_{1ce} W_{0ce}}{W_{1ce} + W_{0ce}}, \quad (\text{A.V.5})$$

where

$$W_{tce} = \sum_{i \in ce} w_i^C \mathbb{1}\{T_i = t\} \quad (\text{A.V.6})$$

is the total weight assigned to tier t in election ce , and $\bar{G}_{tgce}^w$ is the corresponding weighted mean of G_{ig} . To see the form of ω_{ce} , let $W_{ce} = W_{1ce} + W_{0ce}$ and $p_{ce} = W_{1ce}/W_{ce}$. The total within-election variation in the residualized tier indicator is

$$W_{ce} p_{ce} (1 - p_{ce}) = \frac{W_{1ce} W_{0ce}}{W_{1ce} + W_{0ce}}. \quad (\text{A.V.7})$$

Under the weights in Equation A.V.1, w_i^C is constant within an election. Weighted and raw tier means therefore coincide:

$$\bar{G}_{tgce}^w = \hat{\theta}_{tgce}. \quad (\text{A.V.8})$$

The total tier weights are

$$W_{tce} = n_{tce} \frac{N_{ce}}{K_c n_{1ce} n_{0ce}} = \frac{N_{ce}}{K_c n_{(1-t)ce}}. \quad (\text{A.V.9})$$

Substitution into Equation A.V.5 gives

$$\begin{aligned} \omega_{ce} &= \frac{N_{ce}^2 / (K_c^2 n_{1ce} n_{0ce})}{N_{ce} (n_{1ce} + n_{0ce}) / (K_c n_{1ce} n_{0ce})} \\ &= \frac{1}{K_c}, \end{aligned} \quad (\text{A.V.10})$$

where the final equality uses $n_{1ce} + n_{0ce} = N_{ce}$. Because

$$\sum_{c,e} \frac{1}{K_c} = \sum_c \frac{K_c}{K_c} = C, \quad (\text{A.V.11})$$

Equation A.V.5 reduces to Equation A.V.2. This proves the legislator-level identity in Proposition 1.

The cell-level formulation restates the same weighted average. Because the regressor is constant within election-by-tier cells, the WLS normal equations depend on the legislator-level data only through each cell's total weight and weighted identity mean. A cell-level regression retaining those quantities reproduces the same normal equations and coefficient. $\square$

Proof of Proposition 2. On the support $e \in \mathcal{E}_{cg}^+$, regress T_i on G_{ig} and country-election indicators. Let

$$V_{qgce} = \sum_{i \in ce} w_{ig}^L \mathbb{1}\{G_{ig} = q\} \quad (\text{A.V.12})$$

be the total weight for identity status q . Applying the same Frisch–Waugh–Lovell calculation with G_{ig} as the binary regressor gives the election weight

$$\nu_{gce} = \frac{V_{1gce}V_{0gce}}{V_{1gce} + V_{0gce}}. \quad (\text{A.V.13})$$

The location weight in Equation A.V.3 is constant within an eligible election, so the weighted mean of T_i in identity cell q is $\hat{\pi}_{qgce}$. Moreover,

$$V_{qgce} = n_{qce}^g \frac{N_{ce}^g}{K_{cg}^+ n_{1ce}^g n_{0ce}^g} = \frac{N_{ce}^g}{K_{cg}^+ n_{(1-q)ce}^g}. \quad (\text{A.V.14})$$

Substituting Equation A.V.14 into Equation A.V.13 gives

$$\begin{aligned} \nu_{gce} &= \frac{(N_{ce}^g)^2 / [(K_{cg}^+)^2 n_{1ce}^g n_{0ce}^g]}{N_{ce}^g (n_{1ce}^g + n_{0ce}^g) / [K_{cg}^+ n_{1ce}^g n_{0ce}^g]} \\ &= \frac{1}{K_{cg}^+}, \end{aligned} \quad (\text{A.V.15})$$

using $n_{1ce}^g + n_{0ce}^g = N_{ce}^g$. Finally,

$$\sum_{c \in \mathcal{C}_g^+} \sum_{e \in \mathcal{E}_{cg}^+} \frac{1}{K_{cg}^+} = C_g^+. \quad (\text{A.V.16})$$

The WLS coefficient therefore reduces to Equation A.V.4.

The support restriction is necessary for the location estimand. If either n_{1ce}^g or n_{0ce}^g is zero, G_{ig} has no within-election variation, $\hat{\pi}_{qgce}$ is undefined for one identity cell, and the election cannot identify the reverse slope. By contrast, T_i varies in every mixed-system election, so an election in which group g holds either all seats or no seats contributes a well-defined zero composition contrast.

The same aggregation result holds for the location regression. Because G_{ig} is constant within an election-by-identity cell, the location normal equations depend only on the two cell weight totals and their weighted MMD-tier shares. Aggregating to those cells therefore leaves the point estimate unchanged, just as aggregating the composition regression to election-by-tier cells does. $\square$

Country-clustered variance after aggregation. For either binary regression, write the outcome as Y_i , the regressor as X_i , and the weight as w_i , with country-election fixed effects. Let x_i denote the residualized regressor and $\hat{\varepsilon}_i$ the fitted residual. For composition, $X_i = T_i$ and the relevant cells are election-by-tier cells. For location, $X_i = G_{ig}$ and the relevant cells are election-by-identity cells. In either case, x_i is constant within the relevant cell a . Before

any finite-sample adjustment, country c contributes the score

$$S_c = \sum_{i \in c} w_i x_i \hat{\varepsilon}_i. \quad (\text{A.V.17})$$

The contribution of cell a is

$$\begin{aligned} \sum_{i \in a} w_i x_i \hat{\varepsilon}_i &= x_a \sum_{i \in a} w_i \hat{\varepsilon}_i \\ &= x_a W_a \bar{\varepsilon}_a^w, \end{aligned} \quad (\text{A.V.18})$$

where $W_a = \sum_{i \in a} w_i$. Thus, aggregating the composition data to election-by-tier cells or the location data to election-by-identity cells leaves every S_c unchanged. Both the score cross-product $\sum_c S_c S'_c$ and the WLS weighted cross-product matrix are identical at the legislator and cell levels. The unadjusted country-clustered variance is therefore also identical.

This invariance does not extend automatically to CR2. CR2 adjusts cluster scores using the observation-level projection matrix, and both that adjustment and the coefficient-specific Satterthwaite degrees of freedom can change when observations are aggregated to cells. Legislator- and cell-level CR2 intervals may therefore differ even when their point estimates and unadjusted cluster scores agree exactly. The same aggregation argument applies to the pure-system regressions because their regressors are constant within country-election units. $\square$

Composition–location duality. For binary G and T within an election,

$$\text{Cov}(G, T) = \Pr(G = 1, T = 1) - \Pr(G = 1) \Pr(T = 1). \quad (\text{A.V.19})$$

The slope from regressing G on T is $\text{Cov}(G, T) / \text{Var}(T)$, and the slope from regressing T on G is $\text{Cov}(G, T) / \text{Var}(G)$. Multiplying each slope by its denominator yields the within-election duality

$$\delta^C \text{Var}(T) = \text{Cov}(G, T) = \delta^L \text{Var}(G), \quad (\text{A.V.20})$$

where δ^C and δ^L denote the two within-election slopes; both therefore share the sign of $\text{Cov}(G, T)$.

With fixed effects and common weights, apply the same argument to the weighted within-election variables. Both slopes then share the weighted within-election covariance in their numerators, although they divide by different variances. This establishes the sign identity of Equation A.V.20 in the weighted case as well. It does not imply equality of cluster-robust standard errors.

The pooled composition and location regressions do not satisfy the common-weight premise. The composition weights, w_i^C , balance tier cells. The location weights, w_{ig}^L , instead balance identity cells and exclude elections and countries without identity variation. The positive rescaling identity therefore holds election by election on common support, but it does not constrain the magnitude or sign of the two separately weighted averages. Nor does it apply after changing the outcome, controls, or functional form. $\square$

Equal-country, equal-election weighting in the logged district-magnitude regression. Let $\mathcal{I}_{ce}^{cc}$ be the complete-case observations in election ce , so $|\mathcal{I}_{ce}^{cc}| = n_{ce}^{cc}$, and let K_c^{cc} be the number of elections in country c that retain complete-case observations. The joint $\ln M_i$ regression assigns every complete-case legislator-seat the weight

$$w_i^M = \frac{1}{K_c^{cc} n_{ce}^{cc}}, \quad i \in \mathcal{I}_{ce}^{cc}, \quad (\text{A.V.21})$$

which applies the equal-country, equal-election principle of Equation A.V.1 to the complete-case sample. Under Equation A.V.21, the total observation weight in that election is

$$\sum_{i \in \mathcal{I}_{ce}^{cc}} w_i^M = n_{ce}^{cc} \frac{1}{K_c^{cc} n_{ce}^{cc}} = \frac{1}{K_c^{cc}}. \quad (\text{A.V.22})$$

Summing over the K_c^{cc} retained elections gives

$$\sum_{e=1}^{K_c^{cc}} \sum_{i \in \mathcal{I}_{ce}^{cc}} w_i^M = 1 \quad (\text{A.V.23})$$

for every retained country. Hence neither the number of complete-case legislators nor the number of complete-case elections gives a country extra weight. These weights do not make any individual coefficient in the joint $\ln M_i$ regression an exact average of election-level bivariate contrasts. Instead, each coefficient is a partial association for a continuous outcome, conditional on the other identity indicators, election year, and country fixed effects, in the sample determined by the missing-data pattern. $\square$

On the pure-system comparisons

The later pure-system analysis in Section 5.3 estimates a different contrast under stronger assumptions. Let u index country-election units, let g index focal groups, let $Z_u \in \{0, 1\}$ indicate a pure MMD rather than a pure SMD regime, and let $\theta_{ug}(z)$ denote the potential share of legislators in unit u belonging to group g under regime z . A causal interpretation of the average regime contrast requires conditional exchangeability and overlap.

ASSUMPTION 2 (*PURE-SYSTEM CONDITIONAL EXCHANGEABILITY AND OVERLAP*)

$$\begin{aligned} Z_u &\perp\!\!\!\perp (\theta_{ug}(0), \theta_{ug}(1)) \mid X_{ug}, \\ 0 &< \Pr(Z_u = 1 \mid X_{ug}) < 1, \end{aligned} \quad (\text{A.V.24})$$

where X_{ug} contains logged GDP per capita, logged population, polyarchy, logged chamber size, and continent indicators for every group. For the immigrant- and native-ethnicity outcomes, it also contains the combined population share of nonplurality ethnic groups, defined as one minus the plurality group's population share.

Together with consistency and a correctly specified adjustment strategy, Assumption 2 identifies $\mathbb{E}[\theta_{ug}(1) - \theta_{ug}(0)]$. The assumption is strong because countries choose electoral systems through historical political processes. Any unmeasured national feature associated

with both institutional choice and elite composition can confound the comparison. A causal reading also requires the covariates to precede the relevant regime intervention. This condition is especially restrictive when electoral institutions persist and may shape later national characteristics. Moreover, a linear covariate-adjusted coefficient equals a causal average only under the corresponding functional-form conditions; conditional exchangeability alone does not guarantee that interpretation. We therefore treat the pure-system results only as a robustness check.

Geographic Model Setup

We consider an electoral system with D districts. In each district d (where $d = 1, 2, \dots, D$), the group population fractions $\mathbf{P}_d = (P_{1d}, P_{2d}, \dots, P_{Kd})$ are drawn independently from a Dirichlet distribution with parameters, $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, \dots, \alpha_K)$:

$$\mathbf{P}_d \sim \text{Dirichlet}(\boldsymbol{\alpha}).$$

The quantity, $\alpha_0 = \sum_{k=1}^K \alpha_k$, is the Dirichlet concentration parameter. Holding the mean shares $\tilde{\alpha}_k = \alpha_k / \alpha_0$ fixed, smaller α_0 produces more extreme district compositions, while larger α_0 produces district shares closer to the mean vector. Throughout, P_{kd} denotes a random district share, $P_k = D^{-1} \sum_{d=1}^D P_{kd}$ denotes the realized aggregate share, and $\mathbb{E}[P_k] = p_k = \tilde{\alpha}_k$.

Representation Index Under SMD and Random Sampling

We first analyze the SMD case. For the sake of simplicity and following Gerring, Jerzak, and Öncel (2024), we assume that in each district, the probability that a candidate from group k wins is equal to the group's population fraction in that district:

$$\Pr(\text{Group } k \text{ wins in district } d \mid \mathbf{P}_d) = P_{kd}.$$

Then, under random sampling of elites to the body, the expected number of seats won by group k is given by the following (letting S_{kd} be an indicator variable that equals 1 if group k wins in district d):

$$\mathbb{E}[S_k] = \sum_{d=1}^D \mathbb{E}[S_{kd}] = D \cdot \mathbb{E}[S_{kd}] = D \cdot \mathbb{E}[\mathbb{E}[S_{kd} \mid P_{kd}]] = D \cdot \mathbb{E}[P_{kd}] = D \cdot \frac{\alpha_k}{\alpha_0} = D\tilde{\alpha}_k,$$

where $\tilde{\alpha}_k = \frac{\alpha_k}{\alpha_0}$.

Therefore, the expected share of seats for group k is:

$$\mathbb{E}[G_k^{\text{SMD}}] = \frac{\mathbb{E}[S_k]}{D} = \frac{\alpha_k}{\alpha_0} = \tilde{\alpha}_k.$$

Under uniform size of districts, the overall population share for group k across all districts is given by,

$$P_k = \frac{1}{D} \sum_{d=1}^D P_{kd}.$$

By linearity, the expected overall population share is:

$$\mathbb{E}[P_k] = \frac{1}{D} \sum_{d=1}^D \mathbb{E}[P_{kd}] = \frac{\alpha_k}{\alpha_0} = \tilde{\alpha}_k.$$

With these preliminaries in hand, we note the representation index R^{SMD} is:

$$R^{\text{SMD}} = 1 - \frac{1}{2} \sum_{k=1}^K |P_k - G_k^{\text{SMD}}|.$$

To make the problem analytically tractable given the complexity of even the baseline representation index expected value under random sampling (Gerring, Jerzak, and Öncel, 2024), we examine the related quantity,

$$\tilde{R}^{\text{SMD}} = 1 - \frac{1}{2} \sum_{k=1}^K (P_k - G_k^{\text{SMD}})^2.$$

Our goal is to find the expected value under stochasticity induced by P_k and by the random sampling of elites into the body via the seat indicators S_{kd} and their average $G_k^{\text{SMD}} = D^{-1} \sum_{d=1}^D S_{kd}$:

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] = \mathbb{E}\left[1 - \frac{1}{2} \sum_{k=1}^K (P_k - G_k^{\text{SMD}})^2\right]. \quad (\text{A.V.25})$$

We can begin by examining,

$$\begin{aligned} \mathbb{E}\left[(P_k - G_k^{\text{SMD}})^2\right] &= \mathbb{E}\left[P_k^2 - 2P_k G_k^{\text{SMD}} + (G_k^{\text{SMD}})^2\right]; \\ &= \mathbb{E}\left[P_k^2\right] - \mathbb{E}\left[2P_k G_k^{\text{SMD}}\right] + \mathbb{E}\left[(G_k^{\text{SMD}})^2\right]; \\ &= A - B + C. \end{aligned}$$

We first consider A :

$$\begin{aligned} A &= \mathbb{E}\left[P_k^2\right] \\ &= \mathbb{E}\left[\left(\frac{1}{D} \sum_{d=1}^D P_{kd}\right)^2\right] = \frac{1}{D^2} \mathbb{E}\left[\left(\sum_{d=1}^D P_{kd}\right)^2\right] = \frac{1}{D^2} \cdot \tilde{A} \end{aligned}$$

By expanding the square, we have:

$$\begin{aligned} \tilde{A} &= \mathbb{E}\left[\sum_{d=1}^D \sum_{d'=1}^D P_{kd} P_{kd'}\right] \\ &= \sum_{d=1}^D \mathbb{E}[P_{kd}^2] + 2 \sum_{1 \leq d < d' \leq D} \mathbb{E}[P_{kd} P_{kd'}]. \end{aligned}$$

By independence of districts, for $d \neq d'$, we have

$$\mathbb{E}[P_{kd}P_{kd'}] = \mathbb{E}[P_{kd}]\mathbb{E}[P_{kd'}] = (\tilde{\alpha}_k^2)$$

For other cases, we can compute $\mathbb{E}[P_{kd}^2]$ using the second moment of the Dirichlet:

$$\mathbb{E}[P_{kd}^2] = \frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)}.$$

Therefore, we have:

$$\begin{aligned} A &= \frac{1}{D^2} \left(\sum_{d=1}^D \mathbb{E}[P_{kd}^2] + 2 \sum_{1 \leq d < d' \leq D} \mathbb{E}[P_{kd}P_{kd'}] \right) \\ &= \frac{1}{D^2} \left(D \frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)} + 2 \cdot \left(\frac{D(D-1)}{2} \tilde{\alpha}_k^2 \right) \right) \\ &= \tilde{\alpha}_k^2 + \frac{\alpha_k(\alpha_0 - \alpha_k)}{\alpha_0^2(\alpha_0 + 1)D}. \end{aligned}$$

The final expression holds because

$$\begin{aligned} A &= \frac{1}{D^2} \left(D \cdot \frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)} + D^2 \left(\frac{\alpha_k}{\alpha_0} \right)^2 - D \left(\frac{\alpha_k}{\alpha_0} \right)^2 \right) \\ &= \frac{1}{D} \cdot \frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)} + \left(\frac{\alpha_k}{\alpha_0} \right)^2 - \frac{1}{D} \left(\frac{\alpha_k}{\alpha_0} \right)^2 \\ &= \left(\frac{\alpha_k}{\alpha_0} \right)^2 + \frac{1}{D} \left(\frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)} - \left(\frac{\alpha_k}{\alpha_0} \right)^2 \right). \end{aligned}$$

We next ponder B :

$$\begin{aligned} B &= \mathbb{E} \left[2P_k G_k^{\text{SMD}} \right] \\ &= \mathbb{E} \left[\mathbb{E} \left[2P_k G_k^{\text{SMD}} \mid P_k \right] \right] \\ &= \mathbb{E} \left[2P_k \mathbb{E} \left[G_k^{\text{SMD}} \mid P_k \right] \right] = \mathbb{E} \left[2P_k^2 \right]. \end{aligned}$$

We finally consider C :

$$\begin{aligned} C &= \mathbb{E} \left[\left(G_k^{\text{SMD}} \right)^2 \right] \\ &= \mathbb{E} \left[\left(\frac{S_k}{D} \right)^2 \right] \\ &= \frac{1}{D^2} \mathbb{E} \left[\left(\sum_{d=1}^D S_{kd} \right)^2 \right] \end{aligned}$$

$$= \frac{1}{D^2} \left(\sum_{d=1}^D \mathbb{E}[S_{kd}^2] + 2 \sum_{1 \leq d < d' \leq D} \mathbb{E}[S_{kd} S_{kd'}] \right)$$

By independence of districts,

$$\begin{aligned} C &= \frac{1}{D^2} \left(D\tilde{\alpha}_k + 2 \cdot \frac{D(D-1)}{2} \tilde{\alpha}_k^2 \right) \\ &= \tilde{\alpha}_k^2 + \frac{\alpha_k(\alpha_0 - \alpha_k)}{D\alpha_0^2} \end{aligned}$$

Hence,

$$\begin{aligned} \mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] &= A - B + C = A - 2A + C = C - A \\ &= \tilde{\alpha}_k^2 + \frac{\alpha_k(\alpha_0 - \alpha_k)}{D\alpha_0^2} - \left\{ \tilde{\alpha}_k^2 + \frac{1}{D} \left(\frac{\alpha_k(\alpha_k + 1)}{\alpha_0(\alpha_0 + 1)} - \left(\frac{\alpha_k}{\alpha_0} \right)^2 \right) \right\} \\ &= \frac{\alpha_k(\alpha_0 - \alpha_k)}{D\alpha_0(\alpha_0 + 1)}. \end{aligned}$$

From this, the analytical formula for Equation A.V.25 follows.

In the large D limit, we can simplify this expression:

$$\mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] \rightarrow 0.$$

Proposition 2 follows.

Representation Index Under SMD and Affinity Voting

We here change the earlier assumption that elites are drawn into the body uniformly at random given a population distribution for a district, P_{kd} . We now add a β factor that controls the degree to which the highest proportion group is upweighted.

$$\Pr(\text{Group } k \text{ wins in district } d \mid \mathbf{P}_d) = \frac{P_{kd}^\beta}{\sum_{k'=1}^K P_{k'd}^\beta}.$$

In its limit as $\beta \rightarrow \infty$, the formula reduces to:

$$\Pr(\text{Group } k \text{ wins in district } d \mid \mathbf{P}_d) = \begin{cases} 1 & \text{if } P_{kd} > \max_{j \neq k} P_{jd} \\ 0 & \text{otherwise} \end{cases}$$

As before, we have:

$$\begin{aligned} \mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] &= \mathbb{E} \left[P_k^2 - 2P_k G_k^{\text{SMD}} + \left(G_k^{\text{SMD}} \right)^2 \right]; \\ &= \mathbb{E} \left[P_k^2 \right] - \mathbb{E} \left[2P_k G_k^{\text{SMD}} \right] + \mathbb{E} \left[\left(G_k^{\text{SMD}} \right)^2 \right]; \end{aligned}$$

$$= A - B + C.$$

A will be unaltered (as the allocation of P_k 's is unaffected by the new assumption). B and C will take on some new dynamics, since they contain S_{kd} terms.

To formulate analytically tractable results, we focus on the case where $K = 2$ and $\beta \rightarrow \infty$. Let $F_{a,b}(x) \equiv \Pr(X \leq x)$ for $X \sim \text{Beta}(a, b)$, and let k' denote the other group. Define

$$\pi_k = \Pr(P_{kd} > 1/2) = 1 - F_{\alpha_k, \alpha_{k'}}(1/2),$$

We also need the upper-tail first moment

$$\mu_k = \mathbb{E}[P_{kd}S_{kd}] = \int_{1/2}^1 p \frac{p^{\alpha_k-1}(1-p)^{\alpha_{k'}-1}}{B(\alpha_k, \alpha_{k'})} dp = \tilde{\alpha}_k [1 - F_{\alpha_k+1, \alpha_{k'}}(1/2)].$$

This first moment is not the same object as the tail probability π_k .

First, considering B :

$$\begin{aligned} B &= \mathbb{E}[2P_k G_k^{\text{SMD}}] \\ &= \frac{2}{D^2} \mathbb{E}\left[\left(\sum_{d=1}^D P_{kd}\right) \left(\sum_{d=1}^D S_{kd}\right)\right] \\ &= \frac{2}{D^2} \left(\sum_{d=1}^D \mathbb{E}[P_{kd}S_{kd}] + \sum_{d \neq d'} \mathbb{E}[P_{kd}S_{kd'}]\right). \end{aligned}$$

For $d \neq d'$, independence across districts gives

$$\mathbb{E}[P_{kd}S_{kd'}] = \mathbb{E}[P_{kd}]\mathbb{E}[S_{kd'}] = \tilde{\alpha}_k \pi_k.$$

Therefore,

$$B = \frac{2}{D} \mu_k + \frac{2(D-1)}{D} \tilde{\alpha}_k \pi_k.$$

Finally, we consider C under affinity voting. Since S_{kd} is an indicator variable and $\mathbb{E}[S_{kd}] = \pi_k$,

$$\begin{aligned} C &= \mathbb{E}\left[\left(G_k^{\text{SMD}}\right)^2\right] \\ &= \frac{1}{D^2} \left(\sum_{d=1}^D \mathbb{E}[S_{kd}^2] + 2 \sum_{1 \leq d < d' \leq D} \mathbb{E}[S_{kd}S_{kd'}]\right) \\ &= \frac{1}{D^2} (D\pi_k + D(D-1)\pi_k^2) \\ &= \frac{\pi_k}{D} + \frac{D-1}{D} \pi_k^2. \end{aligned}$$

Putting everything together, we find that under affinity voting,

$$\begin{aligned}\mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] &= A - B + C \\ &= \left(\tilde{\alpha}_k^2 + \frac{\alpha_k(\alpha_0 - \alpha_k)}{\alpha_0^2(\alpha_0 + 1)D} \right) \\ &\quad - \left(\frac{2}{D}\mu_k + \frac{2(D-1)}{D}\tilde{\alpha}_k\pi_k \right) + \left(\frac{\pi_k}{D} + \frac{D-1}{D}\pi_k^2 \right).\end{aligned}$$

As D gets large, the diagonal terms vanish and we have:

$$\begin{aligned}\mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] &\rightarrow \tilde{\alpha}_k^2 - 2\tilde{\alpha}_k\pi_k + \pi_k^2 \\ &= (\tilde{\alpha}_k - \pi_k)^2.\end{aligned}$$

Propositions 3 and 4 follow from these results.

Analytical Derivations Summary in the $K = 2$ Case

In sum, we have found:

1. Without affinity voting (and random sampling of citizens into office), the expected value of $\tilde{R}^{\text{SMD}}$ is:

PROPOSITION 1: *Under random sampling of elites into districts,*

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2D} \sum_{k=1}^K \frac{\alpha_k(\alpha_0 - \alpha_k)}{\alpha_0(\alpha_0 + 1)},$$

where $\tilde{\alpha}_k = \alpha_k/\alpha_0$.

2. In the large- D limit—where the number of districts gets large—the expected value of the modified representation index approaches 1:

PROPOSITION 2: *Under random sampling of elites into districts,*

$$\text{As } D \rightarrow \infty, \quad \mathbb{E}[\tilde{R}^{\text{SMD}}] \rightarrow 1.$$

3. Assuming a model with two social groups and affinity voting (where the majority social group in each district captures the seat), let

$$\pi_k = 1 - F_{\alpha_k, \alpha_{k'}}(1/2), \quad \mu_k = \tilde{\alpha}_k \left[1 - F_{\alpha_k+1, \alpha_{k'}}(1/2) \right].$$

Then

PROPOSITION 3: *Under affinity voting,*

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2} \sum_{k=1}^2 \left\{ \left(\tilde{\alpha}_k^2 + \frac{\alpha_k(\alpha_0 - \alpha_k)}{\alpha_0^2(\alpha_0 + 1)D} \right) \right.$$

$$- \left(\frac{2}{D} \mu_k + \frac{2(D-1)}{D} \tilde{\alpha}_k \pi_k \right) + \left(\frac{\pi_k}{D} + \frac{D-1}{D} \pi_k^2 \right) \Big\}.$$

4. In the large D limit, the expected value of the modified representation index need not approach 1. Instead, we find:

PROPOSITION 4: *Under affinity voting,*

$$\text{As } D \rightarrow \infty, \quad \mathbb{E} [\tilde{R}^{\text{SMD}}] \rightarrow 1 - \frac{1}{2} \sum_{k=1}^2 (\tilde{\alpha}_k - \pi_k)^2.$$

Extension to $K > 2$: Large- D Asymptotics in Affinity Voting

Below is an extension of the “affinity voting” derivation—from the $K = 2$ case to the general case of $K > 2$ —focusing on the large- D asymptotics. In other words, we here assume affinity voting, that is, in each district d , the *largest* group (by population share) wins the single seat:

$$S_{kd} = \mathbb{1}\{P_{kd} > \max_{j \neq k} P_{jd}\}.$$

We wish to derive the large- D limit of

$$\mathbb{E} \left[\left(P_k - G_k^{\text{SMD}} \right)^2 \right] \quad \text{and hence the limit of} \quad \mathbb{E} [\tilde{R}^{\text{SMD}}] = \mathbb{E} \left[1 - \frac{1}{2} \sum_{k=1}^K \left(P_k - G_k^{\text{SMD}} \right)^2 \right].$$

Setup and Notation for $K > 2$ Case

1. **Group proportions in a single district.** Each district’s population share vector $\mathbf{P}_d = (P_{1d}, \dots, P_{Kd})$ is drawn i.i.d. as $\mathbf{P}_d \sim \text{Dirichlet}(\boldsymbol{\alpha})$. Define $\alpha_0 = \sum_{k=1}^K \alpha_k$ and $\tilde{\alpha}_k = \alpha_k / \alpha_0$.
2. **“Largest-group-wins” seat indicator.** In district d , group k wins the seat if $P_{kd} > P_{jd}$ for all $j \neq k$. (Ties occur with probability zero under the continuous Dirichlet, so we ignore them.) We write

$$S_{kd} = \mathbb{1}\{P_{kd} > \max_{j \neq k} P_{jd}\}.$$

Then

$$G_k^{\text{SMD}} = \frac{1}{D} \sum_{d=1}^D S_{kd} \quad \text{is the fraction of the } D \text{ seats captured by group } k.$$

3. **District-level probabilities and means.** For a single district (one Dirichlet draw), define

$$\pi_k = \Pr(P_{kd} > \max_{j \neq k} P_{jd}), \quad \mu_k = \mathbb{E} [P_{kd} \mathbb{1}\{P_{kd} > \max_{j \neq k} P_{jd}\}].$$

Thus π_k is the probability that group k is the largest in the district; μ_k is the *expected*

population fraction of group k , but only in those districts where k is largest (and 0 otherwise).

- $\pi_k = \mathbb{E}[S_{kd}]$.
- $\mu_k = \mathbb{E}[P_{kd}S_{kd}]$.
- For general $K > 2$, there is no simple closed form for π_k or μ_k . They are given by integrals of the Dirichlet PDF over the region $\{p_{kd} > p_{k'd}, \forall k' \neq k\}$.

4. **Overall population fraction and seat fraction.** As before, define

$$P_k = \frac{1}{D} \sum_{d=1}^D P_{kd}, \quad G_k^{\text{SMD}} = \frac{1}{D} \sum_{d=1}^D S_{kd}.$$

Large- D Asymptotics

As $D \rightarrow \infty$, law-of-large-numbers arguments apply to both P_k and G_k^{SMD} :

1. *Population fraction* P_k . Since each district's P_{kd} has mean $\tilde{\alpha}_k = \alpha_k/\alpha_0$, averaging over D i.i.d. draws yields

$$P_k = \frac{1}{D} \sum_{d=1}^D P_{kd} \xrightarrow{D \rightarrow \infty} \tilde{\alpha}_k \quad \text{with high probability.}$$

2. *Seat fraction* G_k^{SMD} . Because S_{kd} is an i.i.d. Bernoulli random variable with success probability $\pi_k = \Pr\{P_{kd} > \max_{j \neq k} P_{jd}\}$, we have

$$G_k^{\text{SMD}} = \frac{1}{D} \sum_{d=1}^D S_{kd} \xrightarrow{D \rightarrow \infty} \pi_k \quad \text{with high probability.}$$

Thus, in the limit of many districts, *group k 's overall seat share* converges to π_k , the probability that k is the largest group in a single draw.

Putting these together, we get

$$P_k \approx \tilde{\alpha}_k, \quad G_k^{\text{SMD}} \approx \pi_k, \quad \text{for large } D.$$

Hence

$$P_k - G_k^{\text{SMD}} \approx \tilde{\alpha}_k - \pi_k.$$

The Limit of $\mathbb{E}[(P_k - G_k^{\text{SMD}})^2]$

If we track the exact second moment $\mathbb{E}[(P_k - G_k^{\text{SMD}})^2]$ for finite D , we again get terms of the form

$$A = \mathbb{E}[P_k^2], \quad B = \mathbb{E}[2 P_k G_k^{\text{SMD}}], \quad C = \mathbb{E}[(G_k^{\text{SMD}})^2].$$

The derivation is conceptually the same as in the $K = 2$ case—only the probabilities $\mathbb{E}[S_{kd}]$ and $\mathbb{E}[P_{kd}S_{kd}]$ differ. One finds that for large D , P_k concentrates around $\tilde{\alpha}_k$. So $A = \mathbb{E}[P_k^2]$ approaches $\tilde{\alpha}_k^2$ by the law of large numbers.

Similarly, in a single draw, $(G_k^{\text{SMD}})^2$ involves the diagonal terms $\mathbb{E}[S_{kd}^2]$ and the off-diagonal terms $\mathbb{E}[S_{kd}S_{kd'}]$. Because S_{kd} are i.i.d. Bernoullis with mean π_k , it follows that

$$C = \mathbb{E}[(G_k^{\text{SMD}})^2] \xrightarrow{D \rightarrow \infty} \pi_k^2.$$

The cross term $B = \mathbb{E}[2 P_k G_k^{\text{SMD}}]$ turns out to concentrate around $2 \tilde{\alpha}_k \pi_k$. As with the $K = 2$ derivation, the leading term in $\frac{1}{D^2} \sum_{d=1}^D \sum_{d'=1}^D \mathbb{E}[P_{kd}S_{kd'}]$ is dominated by the *off-diagonal* part $\mathbb{E}[P_{kd}]\mathbb{E}[S_{kd'}]$ (since there are $D(D-1)$ such terms).

Putting these three pieces together and taking $D \rightarrow \infty$ yields

$$\mathbb{E}[(P_k - G_k^{\text{SMD}})^2] \xrightarrow{D \rightarrow \infty} \tilde{\alpha}_k^2 - 2 \tilde{\alpha}_k \pi_k + \pi_k^2 = (\tilde{\alpha}_k - \pi_k)^2.$$

Representation Index in the Limit for $K > 2$

Recalling

$$\tilde{R}^{\text{SMD}} = 1 - \frac{1}{2} \sum_{k=1}^K (P_k - G_k^{\text{SMD}})^2,$$

we have, in the large- D limit,

$$\mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2} \sum_{k=1}^K \mathbb{E}[(P_k - G_k^{\text{SMD}})^2] \xrightarrow{D \rightarrow \infty} 1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k)^2.$$

Hence for any $K \geq 2$, under “largest-group-wins” (i.e. $\beta \rightarrow \infty$ in the affinity-voting model), the asymptotic representation index simplifies to

$$\lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k)^2, \quad \text{where} \quad \pi_k = \Pr[P_{kd} > \max_{j \neq k} P_{jd}].$$

This generalizes exactly the two-group ($K = 2$) results in the paper to any $K > 2$. In the special case $\alpha_1 = \alpha_2 = \dots = \alpha_K$ (a symmetric Dirichlet), then $\pi_k = 1/K$ and $\tilde{\alpha}_k = 1/K$, so the sum of squares vanishes:

$$\tilde{\alpha}_k - \pi_k = 0 \implies \lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD}}] = 1.$$

Thus, when all groups are ex ante symmetric, even “largest-group-wins” does not distort seat shares on average (in the limit).

If the α_k ’s differ, $\{\pi_k\}$ generally *does not* match $\{\tilde{\alpha}_k\}$. In fact, for $K = 2$ one can compute π_k by a one-dimensional Beta integral, but for $K > 2$, π_k is given by a higher-dimensional region of the Dirichlet PDF. This leads to a limiting representation index < 1 . Thus, the $\mathbb{E}[S_{kd}] = \pi_k \neq \tilde{\alpha}_k$ in general, and similarly $\mathbb{E}[P_{kd}S_{kd}] = \mu_k$ must be computed over a $(K-1)$ -

dimensional region of the simplex.

In the large- D limit, the fraction P_k of the total population converges to $\tilde{\alpha}_k$, while the fraction G_k^{SMD} of seats converges to π_k , hence,

$$\lim_{D \rightarrow \infty} \mathbb{E}[(P_k - G_k^{\text{SMD}})^2] = (\tilde{\alpha}_k - \pi_k)^2, \quad \lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k)^2.$$

If the Dirichlet parameters α_k are unequal, then the limiting seat shares $\{\pi_k\}$ under “largest-group-wins” deviate from the population-fraction vector $\{\tilde{\alpha}_k\}$. The difference $\tilde{\alpha}_k - \pi_k$ can be positive or negative depending on the configuration of α_k values. If the α_k ’s are all equal, symmetry forces $\pi_k = \tilde{\alpha}_k = 1/K$, restoring perfect representation in the limit. These statements are extensions of Propositions 3–4 from the two-group regime to the general K -group regime.

How α_0 Can Affect the SMD Representation Index in the $K > 2$ Case

The large- D result above shows that, under largest-group-wins SMD voting,

$$\lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD}}] = 1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k)^2.$$

Thus changes in representation operate through changes in the mismatch between the mean population shares $\tilde{\alpha}_k$ and the local plurality probabilities π_k . Holding $\tilde{\alpha}_k$ fixed while scaling all α_k by a common factor changes α_0 and the dispersion of district-level draws, but it does not change the mean population-share vector.

If all α_k are equal, then $\tilde{\alpha}_k = 1/K$ for all k . By symmetry, $\pi_k = 1/K$ as well, so

$$\lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD}}] = 1$$

for any value of α_0 . In this symmetric case, changing the overall concentration parameter does not change the limiting mismatch.

When the α_k are unequal, the direction and size of the effect are governed by how the plurality probabilities π_k move as the Dirichlet distribution becomes more or less concentrated around its mean vector. As α_0 grows, district draws become less extreme and cluster more tightly around $(\tilde{\alpha}_1, \dots, \tilde{\alpha}_K)$. This can increase the advantage of groups with larger mean shares in becoming the local plurality, thereby increasing $\sum_k (\tilde{\alpha}_k - \pi_k)^2$ and lowering the representation index in many parameter configurations. The derivation here establishes the limiting formula, while general monotonic claims for all unequal $K > 2$ parameter vectors should be treated as numerical patterns unless separately proved. A graphical interface allowing readers to explore these $K > 2$ dynamics is available at this URL: HuggingFace.co/spaces/C8C9EA/LargestGroupWins.

Finite Electorates and the Continuous-Share Approximation

A note on interpretation is warranted. The Dirichlet model above can be interpreted as the large-district limit of a finite-electorate data-generating process. For this subsection, assume equal district electorates, $n_d = n$. First draw latent district propensities and then draw voter counts:

$$\mathbf{P}_d \sim \text{Dirichlet}(\boldsymbol{\alpha}), \quad \mathbf{N}_d \mid \mathbf{P}_d \sim \text{Multi}(n, \mathbf{P}_d),$$

where $\mathbf{N}_d = (N_{1d}, \dots, N_{Kd})$ and $\sum_k N_{kd} = n$. Marginally, $\mathbf{N}_d$ follows a Dirichlet–multinomial distribution. The observed district share and aggregate observed share are

$$\hat{P}_{kd} = \frac{N_{kd}}{n}, \quad \hat{P}_k = \frac{1}{D} \sum_{d=1}^D \hat{P}_{kd}.$$

The finite-count model preserves the same mean structure,

$$\mathbb{E}[\hat{P}_{kd}] = \tilde{\alpha}_k,$$

but adds finite-voter sampling noise. In particular,

$$\text{Var}(\hat{P}_{kd}) = \tilde{\alpha}_k(1 - \tilde{\alpha}_k) \frac{n + \alpha_0}{n(\alpha_0 + 1)},$$

which converges to the usual Dirichlet variance as $n \rightarrow \infty$.

Under the random-sampling seat rule, let

$$\Pr(S_{kd}^{(n)} = 1 \mid \hat{\mathbf{P}}_d) = \hat{P}_{kd}, \quad G_k^{\text{SMD},n} = D^{-1} \sum_{d=1}^D S_{kd}^{(n)}.$$

Then, conditional on the observed district shares,

$$\mathbb{E}[(\hat{P}_k - G_k^{\text{SMD},n})^2 \mid \hat{\mathbf{P}}_1, \dots, \hat{\mathbf{P}}_D] = \frac{1}{D^2} \sum_{d=1}^D \hat{P}_{kd}(1 - \hat{P}_{kd}).$$

Taking expectations gives

$$\mathbb{E}[(\hat{P}_k - G_k^{\text{SMD},n})^2] = \frac{1}{D} \mathbb{E}[\hat{P}_{kd}(1 - \hat{P}_{kd})] = \frac{1}{D} \tilde{\alpha}_k(1 - \tilde{\alpha}_k) \frac{\alpha_0(n - 1)}{n(\alpha_0 + 1)}.$$

As $n \rightarrow \infty$, this expression converges to the continuous-share expression derived earlier in this appendix:

$$\frac{\alpha_k(\alpha_0 - \alpha_k)}{D\alpha_0(\alpha_0 + 1)}.$$

When $n = 1$, by contrast, the expression equals zero. If each voter is their own district and each citizen is eligible to occupy the district seat, descriptive representation is mechanically perfect. This endpoint is therefore a degenerate institutional limit rather than the large-district approximation analyzed in the main derivation.

The same distinction applies under affinity voting. In the finite-count version, the largest-group-wins rule is based on observed counts rather than continuous shares. Let $T(\mathbf{N}_d) = \{j : N_{jd} = \max_{\ell} N_{\ell d}\}$ denote the set of groups tied for the largest observed count, and let $q_k(T)$ denote a fixed neutral tie-breaking rule, with $q_k(T) = 0$ if $k \notin T$ and $\sum_{k \in T} q_k(T) = 1$. Define

$$\pi_k^{(n)} = \mathbb{E}[q_k\{T(\mathbf{N}_d)\}].$$

Equivalently, $\pi_k^{(n)}$ is group k 's probability of winning a district under the finite-count largest-group-wins rule, including any probability assigned to k by the neutral tie-breaking rule.

Define the finite-count squared-deviation surrogate as

$$\tilde{R}^{\text{SMD},n} = 1 - \frac{1}{2} \sum_{k=1}^K (\hat{P}_k - G_k^{\text{SMD},n})^2.$$

For fixed n and large D ,

$$\hat{P}_k \xrightarrow{p} \tilde{\alpha}_k, \quad G_k^{\text{SMD},n} \xrightarrow{p} \pi_k^{(n)},$$

so that

$$\lim_{D \rightarrow \infty} \mathbb{E}[\tilde{R}^{\text{SMD},n}] = 1 - \frac{1}{2} \sum_{k=1}^K (\tilde{\alpha}_k - \pi_k^{(n)})^2.$$

For $n = 1$, $\pi_k^{(1)} = \tilde{\alpha}_k$, again yielding perfect representation. For large n , the multinomial shares concentrate around the latent Dirichlet shares, and

$$\pi_k^{(n)} \rightarrow \pi_k = \Pr(P_{kd} > \max_{j \neq k} P_{jd}),$$

which recovers the continuous-share affinity-voting expression derived earlier in this appendix. Thus, the propositions should be read as large-district analytical benchmarks, not as claims about a fixed-electorate path in which D increases by shrinking districts all the way to a single voter.

Lean Verification of the Analytical Claims

As a supplemental check on the formal derivations in this appendix, we provide a Lean 4 script, `setup-descriptive-rep-theorems.lean`. The script formalizes the algebraic content of the propositions above. Specifically, it verifies the displayed finite- D random-sampling expression for $\mathbb{E}[\tilde{R}^{\text{SMD}}]$; the corresponding large- D random-sampling convergence claim; the finite- D two-group affinity-voting expression under the largest-group-wins rule; the large- D two-group affinity-voting limit; the $K > 2$ largest-group-wins extension; and the finite-count benchmark used to interpret the continuous-share approximation.

The Lean file should be interpreted as a formal check of the algebraic and limiting consequences of the underlying model as specified; we do not provide complete formalization of the probability theory underlying the Dirichlet, Dirichlet–multinomial, beta-CDF, or law-of-large-numbers components. Those well-established probabilistic ingredients are supplied as assumptions or definitions in the script, matching the analytical setup in this appendix. Conditional on those ingredients, Lean checks that the stated expressions reduce to the claimed

formulas.

The script can be checked from a Lean project with:

```
lake env lean setup-descriptive-rep-theorems.lean
```

This script can be found on GitHub:

```
github.com/cjerzak/electoral-rules-and-representation-book/tree/main
```

Appendix VI. Robustness to Inclusion/Exclusion Criteria

Here, we assess robustness to three inclusion and exclusion decisions: dropping all groups and leaders from small groups ($< 1\%$ national population share), excluding elections in which statutory gender quotas apply asymmetrically across tiers, and excluding elections that use reserved-seat tiers.

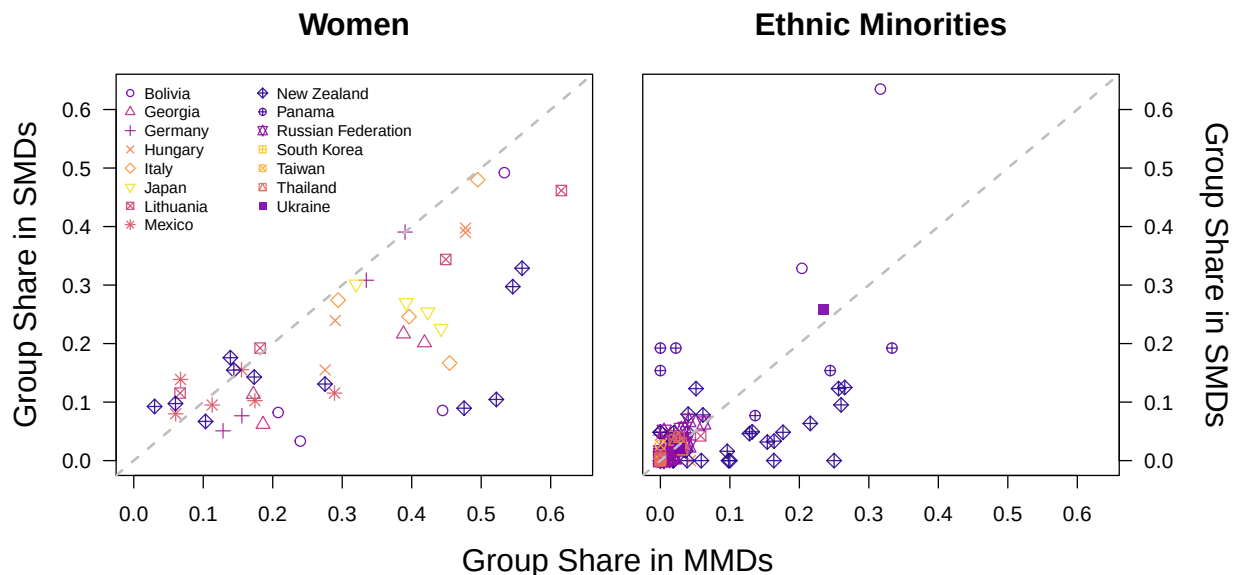


Figure A.VI.1: Robustness analysis to inclusion/exclusion criteria. Group-level representation across SMD and MMD tiers in 44 country-elections in 15 countries for women and ethnic minorities. For the same visualization, but with the addition of groups receiving no representation in either tier, see Figure A.II.2.

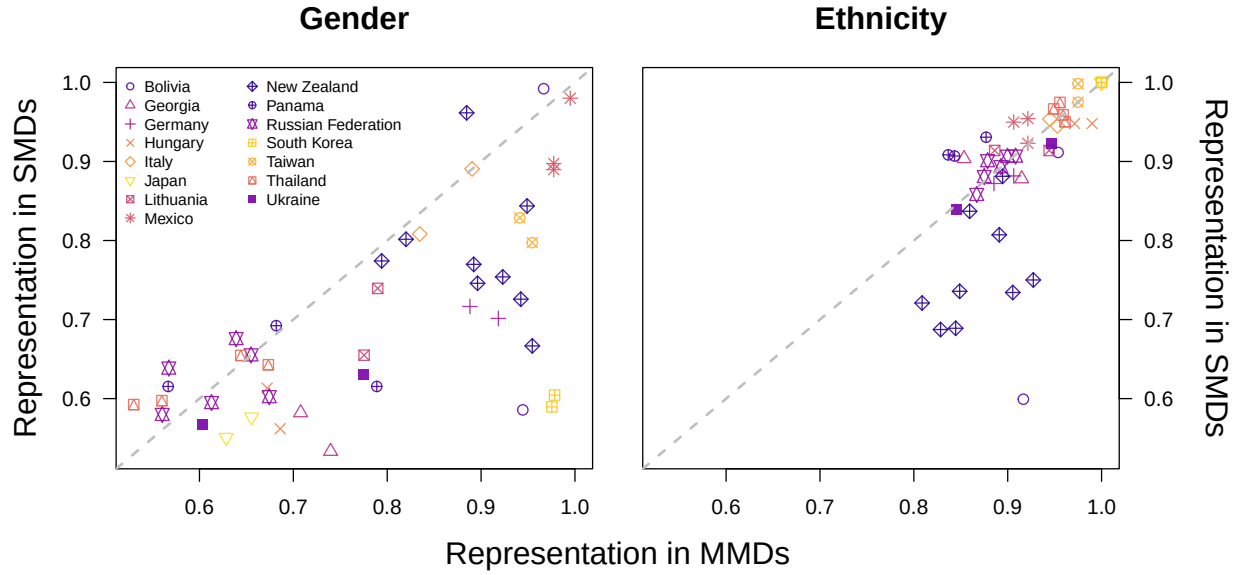


Figure A.VI.2: Robustness analysis to inclusion/exclusion criteria. Overall representation by gender and ethnicity across SMD and MMD tiers in 44 country-elections.

	Model 1	Model 2	Model 3	Model 4	Model 5
Outcome	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	SMD (0) vs. MMD (1)	log(District Mag)
<i>Gender operationalization</i>					
Female indicator	0.11 (3.35)*	0.11 (3.34)*	0.11 (3.37)*	0.10 (2.59)*	0.40 (3.31)*
<i>Ethnicity operationalizations</i>					
logit(Nat'l ethnicity share)	0.00 (0.25)				
logit(Region ethnicity share)		0.00 (-0.21)			
Non-plurality indicator			0.01 (0.10)	-0.04 (-1.60)	0.06 (0.21)
<i>Control variables</i>					
Election year	0.00 (0.30)	0.00 (0.27)	0.00 (0.30)	0.00 (0.69)	0.00 (0.60)
Country fixed effects	✓	✓	✓	✓	✓
<i>Other statistics</i>					
Countries	15	15	15	12	15
Observations	13382	13367	13384	11902	13393
Adjusted R-squared	0.08	0.08	0.08	0.09	0.10

Table A.VI.1: Unit of analysis: individual legislators. Outcome: Legislator in MMD arm indicator in Models 1-4; log of legislator's district magnitude in Model 5. Model 4 uses data only from countries without any reserved seats. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Robustness specification: groups below 1% of national population share (and their members) are excluded. Representative-level unit of analysis. Estimator: OLS. Full model results are given in Table A.IV.6.

	Model 1	Model 2	Model 3	Model 4
Outcome	Gender	Gender	Ethnicity	Ethnicity
MMD	0.09 (3.73)*	0.09 (3.38)*	0.02 (1.18)	0.02 (1.07)
<i>Control variables</i>				
Electoral threshold		0.00 (0.17)		0.00 (0.20)
Election year		0.00 (3.98)*		0.00 (0.64)
Country fixed effects		✓		✓
<i>Other statistics</i>				
Countries	15	15	15	15
Observations	90	90	90	90
Adjusted R-squared	0.09	0.74	0.01	0.55

Table A.VI.2: Outcome: Representation index. Cluster robust standard errors at country level. *t*-statistics in parentheses; * denotes $p < 0.05$. Robustness specification: groups below 1% of national population share (and their members) are excluded. First two models use gender as outcome; next two use ethnicity. Country-election unit of analysis. Full model results are given in Table A.IV.7.

Table A.VI.3: Identity and electoral-tier sorting after excluding elections with asymmetric statutory gender-quota concerns.

	Tier outcome		Identity outcome	
	Pr(MMD identity) Eq. 4.12	$\mathbb{E}[\ln(M) \text{identity}]$	Pr(identity tier) Eq. 4.11	MMD aggregation-unit FE
Women	14.06 [4.56]***	0.51 [4.99]***	10.65 [3.74]***	10.93 [3.46]**
SGM	27.99 [2.62]	0.64 [1.50]	0.34 [2.60]**	0.39 [2.02]
Youth	11.35 [2.09]	0.21 [1.79]	1.82 [2.34]*	0.12 [0.16]
Immigrant	13.03 [1.54]	0.21 [0.90]	0.39 [1.09]	0.70 [1.58]
ethnic groups				
Disabled	5.62 [0.30]	0.35 [0.60]	0.05 [0.53]	-0.01 [-0.08]
Less educated	-2.43 [-0.40]	0.08 [1.16]	0.18 [0.58]	0.50 [0.93]
Working class	-4.77 [-1.61]	-0.12 [-1.12]	-0.93 [-0.96]	-1.76 [-1.71]
Native ethnic	-0.23 [-0.03]	0.03 [0.11]	-0.78 [-0.38]	-3.44 [-1.01]
groups				
Ruralites	-0.90 [-0.25]	-0.18 [-1.62]	-1.86 [-1.79]	-0.30 [-0.23]
<i>Other</i>				
<i>statistics</i>				
R^2	0.01–0.19	0.11	0.00–0.19	0.52–0.84
Countries	5–14	14	14	14
Observations	5,226–12,870	12,862	12,854–12,870	214

Note: Model cells report point estimates [t statistics], followed by significance stars. The Pr(MMD | identity) column reports the focal-minus-nonfocal difference in the probability of serving through the MMD tier in percentage points; positive estimates indicate that legislators with the focal identity are more likely to serve through MMD. The two identity-outcome columns report MMD-minus-SMD differences in focal-identity prevalence in percentage points; positive estimates indicate greater focal-identity prevalence in MMD seats. The two conditional-probability models weight countries equally and eligible elections equally within countries: the tier-outcome model uses paired-tier, identity-varying elections, while the identity-outcome model uses all elections containing both tiers. MMD aggregation-unit FE models use one focal-group seat share per tier within each paired MMD aggregation unit by election and include aggregation-unit-by-election fixed effects. The $\mathbb{E}[\ln(M) | \text{identity}]$ column reports log-point coefficients from an equal-country/equal-election legislator-level WLS of logged district magnitude on all listed identities jointly, election year, and country fixed effects; weights are constructed after restricting to rows complete on all listed identities and covariates. Bottom-row ranges summarize the identity-specific regressions; the logged-magnitude column is one joint model. Within-completion standard errors use country-clustered CR2 corrections; pooled two-sided tests use Barnard–Rubin degrees of freedom derived from the coefficient-specific Satterthwaite degrees of freedom. With finite coefficient-specific degrees of freedom, the two-sided 5% critical $|t|$ can exceed 1.96. Stars use unadjusted two-sided p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. MissForest estimates pool 20 completed datasets using Rubin/Barnard–Rubin rules. This specification excludes Georgia’s 2020 election and Taiwan’s 2016 and 2020 elections, the substantive-concern cases in which statutory gender quotas apply asymmetrically across tiers. South Korea and Panama remain in the sample. All other model definitions, weighting, missing-data pooling, and inference match the benchmark table.

Table A.VI.4: Identity and electoral-tier sorting after excluding elections using reserved-seat tiers.

	Tier outcome		Identity outcome	
	Pr(MMD identity) Eq. 4.12	$\mathbb{E}[\ln(M) \text{identity}]$	Pr(identity tier) Eq. 4.11	MMD aggregation-unit FE
Women	12.77 [3.74]**	0.51 [3.80]**	9.96 [3.03]**	9.65 [2.14]
SGM	34.05 [2.98]	1.24 [3.45]	0.32 [2.25]*	0.42 [1.77]
Youth	12.79 [2.08]	0.26 [2.06]	2.43 [3.39]**	0.75 [1.02]
Immigrant	12.83 [1.21]	0.06 [0.21]	0.07 [0.33]	0.41 [0.94]
ethnic groups				
Disabled	1.56 [0.09]	0.47 [0.83]	0.06 [0.51]	-0.05 [-0.67]
Less educated	-5.00 [-0.76]	0.05 [0.64]	0.05 [0.18]	0.07 [0.18]
Working class	-5.26 [-1.72]	-0.13 [-1.22]	-0.82 [-1.14]	-1.88 [-2.72]*
Native ethnic	-3.83 [-0.37]	-0.06 [-0.35]	-0.55 [-0.65]	-2.50 [-0.97]
groups				
Ruralites	-0.66 [-0.16]	-0.22 [-1.85]	-2.18 [-1.96]	-1.20 [-1.00]
<i>Other</i>				
<i>statistics</i>				
R^2	0.01–0.22	0.13	0.00–0.15	0.54–0.79
Countries	4–12	12	12	12
Observations	4,203–11,751	11,745	11,737–11,751	162

Note: Model cells report point estimates [t statistics], followed by significance stars. The Pr(MMD | identity) column reports the focal-minus-nonfocal difference in the probability of serving through the MMD tier in percentage points; positive estimates indicate that legislators with the focal identity are more likely to serve through MMD. The two identity-outcome columns report MMD-minus-SMD differences in focal-identity prevalence in percentage points; positive estimates indicate greater focal-identity prevalence in MMD seats. The two conditional-probability models weight countries equally and eligible elections equally within countries: the tier-outcome model uses paired-tier, identity-varying elections, while the identity-outcome model uses all elections containing both tiers. MMD aggregation-unit FE models use one focal-group seat share per tier within each paired MMD aggregation unit by election and include aggregation-unit-by-election fixed effects. The $\mathbb{E}[\ln(M) | \text{identity}]$ column reports log-point coefficients from an equal-country/equal-election legislator-level WLS of logged district magnitude on all listed identities jointly, election year, and country fixed effects; weights are constructed after restricting to rows complete on all listed identities and covariates. Bottom-row ranges summarize the identity-specific regressions; the logged-magnitude column is one joint model. Within-completion standard errors use country-clustered CR2 corrections; pooled two-sided tests use Barnard–Rubin degrees of freedom derived from the coefficient-specific Satterthwaite degrees of freedom. With finite coefficient-specific degrees of freedom, the two-sided 5% critical $|t|$ can exceed 1.96. Stars use unadjusted two-sided p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. MissForest estimates pool 20 completed datasets using Rubin/Barnard–Rubin rules. The benchmark sample already omits legislators elected through reserved seats. This stricter specification additionally excludes all remaining legislators from Bolivia’s 2009 and 2014 elections, New Zealand’s nine sampled elections from 1996–2020, and Taiwan’s 2016 and 2020 elections. All other model definitions, weighting, missing-data pooling, and inference match the benchmark table.

Appendix VII. Russia Re-analysis Combining Small Groups

In this appendix, we re-estimate the Russian ethnic-representation analyses of Chapter 6 after combining all groups comprising less than 0.5% of the national population into a single “Other” category, leaving 8 groups. Captions report statistics from this collapsed re-analysis.

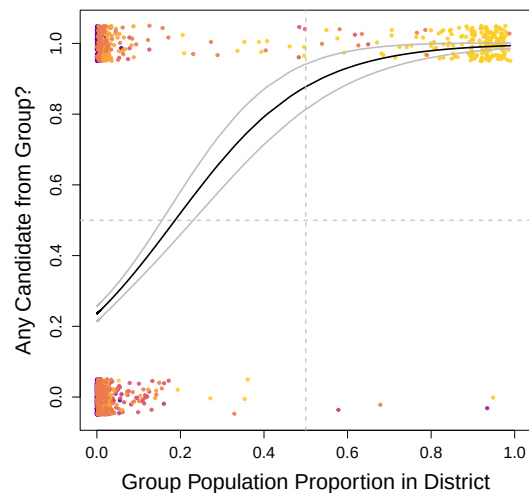


Figure A.VII.1: Robustness analysis. Probability of any ethnic group representation in the district candidate pool as a function of group population share (Russia only). AUC goodness of fit: 0.76; logistic regression coefficient: 6.29 (s.e. = 0.63); $N=1,726$.

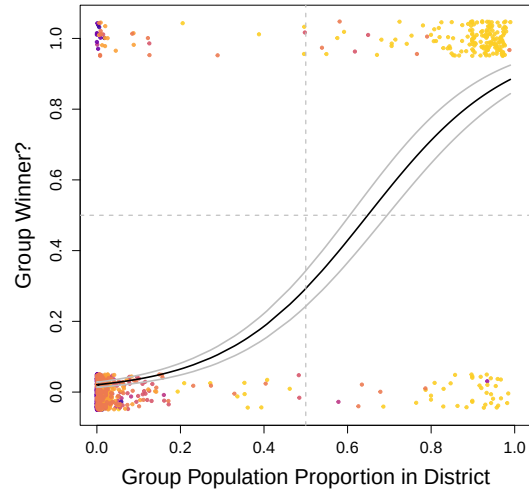


Figure A.VII.2: Robustness analysis. Probability that a given ethnic group wins the district seat (Russia only). AUC goodness of fit: 0.93; logistic regression coefficient: 5.95 ($s.e.=0.29$).

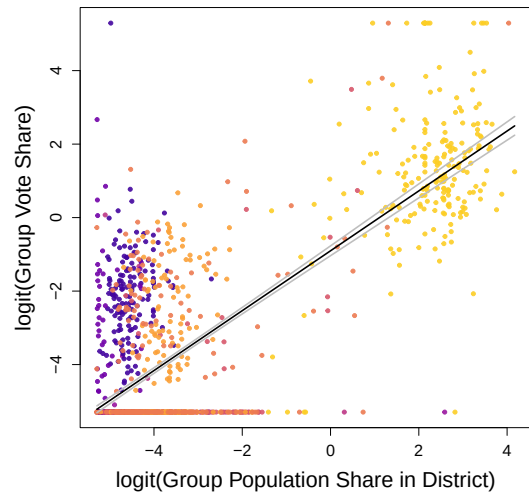


Figure A.VII.3: Robustness analysis. Ethnic population share vs. vote share for candidates from that ethnic group (Russia only). $N = 1,726$; $R^2 = 0.6$.

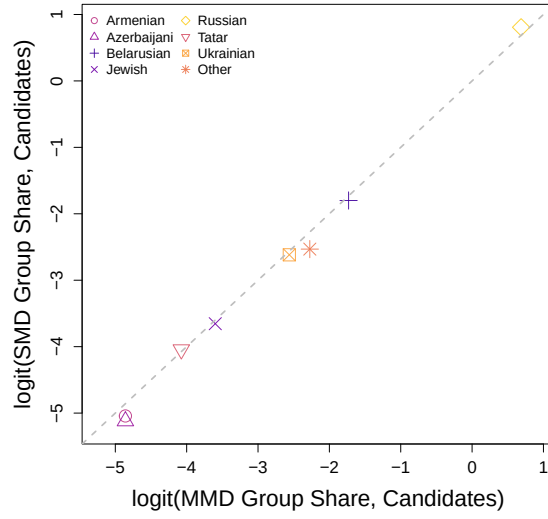


Figure A.VII.4: Robustness analysis. Ethnic group representation among candidates across SMD and MMD tiers (Russia only). ($N=8$ groups).

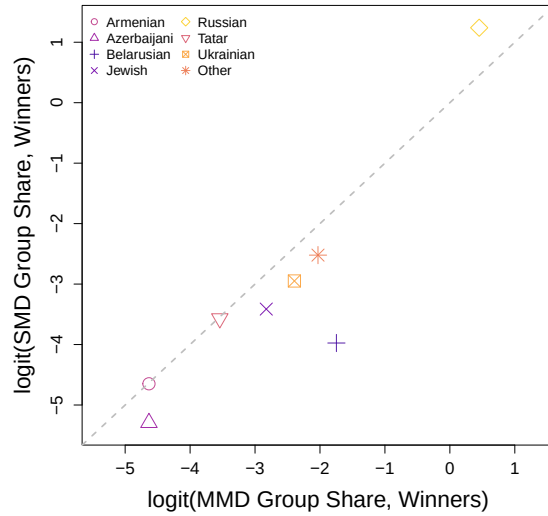


Figure A.VII.5: Robustness analysis. Ethnic group representation among winners across SMD and MMD tiers (Russia only). ($N=8$ groups).

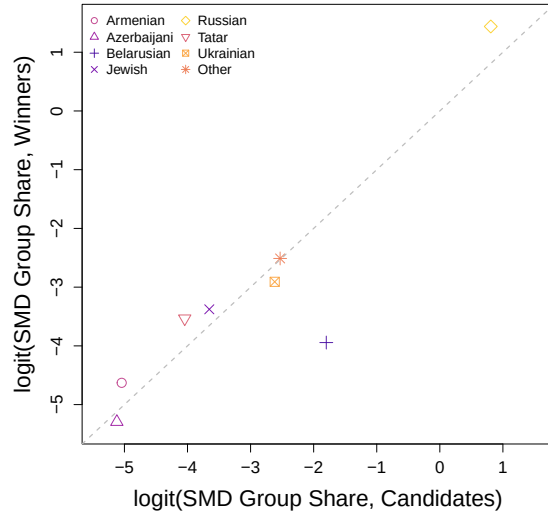


Figure A.VII.6: Robustness analysis. Ethnic group share among candidates vs. winners for the SMD tier (Russia only). ($N=8$ groups).

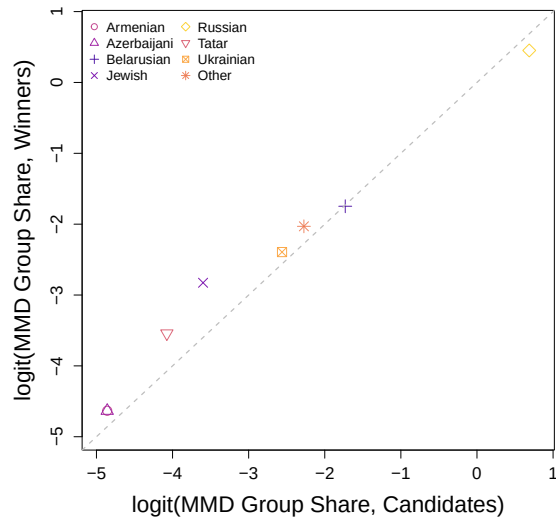


Figure A.VII.7: Robustness analysis. Ethnic group share among candidates vs. winners for the MMD tier (Russia only). ($N=8$ groups).

Appendix VIII. Electoral Geography in the Case Studies

Having confirmed that electoral rules have limited impact on descriptive representation for most ethnic groups in Russia and New Zealand, we turn to an important qualification. Our theory and simulations suggest that wherever ethnic groups are highly dispersed, MMDs offer greater opportunities for gaining representation than SMDs. While this hypothesis cannot be tested on a global scale with available data sources, we can enlist a more limited set of evidence from our chosen cases.

The regression analysis in Table A.VIII.1 focuses on the representation achieved by each minority ethnic group in Russia and New Zealand across the two electoral tiers. The dependent variable is calculated as the share of MMD seats won by a group minus the share of SMD seats won by that group. If positive, the group fared better in MMDs; if negative, it fared better in SMDs. To avoid non-monotonicities that would be difficult to model in a small-sample analysis, majority groups—ethnic Russians in Russia and Europeans in New Zealand—are excluded. (Interested readers will find their status recorded in Figure 3.1).

	Model 1
logit(Population share)	-0.36 (-4.93)*
Dispersion: Group entropy	0.41 (5.15)*
Interaction: Share times Entropy	0.08 (5.28)*
<i>Control variables</i>	
Russia indicator	0.13 (2.84)*
<i>Other statistics</i>	
Countries	2
Observations	26
Adjusted R-squared	0.58

Table A.VIII.1: Outcome: Difference between MMD and SMD group representation. Unit of analysis: Non-majority ethnic groups in Russia and New Zealand. Estimator: OLS. *t*-values in parentheses, heteroskedasticity-consistent standard errors used. * indicates $p < 0.05$.

Regressors of interest include the population share of the group (transformed by the logit), the group’s entropy score (higher = greater geographic dispersion), and the interaction of these two variables.⁵⁰ On the right side of the model, we include a country indicator to control for country-specific factors of no theoretical interest.

The analysis in Table A.VIII.1 suggests that SMD favors larger groups, MMD favors dispersed groups, and the conjunction of large size and dispersal enhances the benefit of MMD over SMD. Bear in mind that majority groups are excluded from this analysis, so increases in size are captured only among minority groups. Consistent with our simulations, the size advantages of SMD increase up to the point when a group reaches half of the population.

⁵⁰For group k , the entropy score is $H_k = -\sum_{d=1}^D q_{kd} \log q_{kd}$, where q_{kd} is the fraction of group k ’s national population located in district d .

Naturally, one cannot fully characterize the interplay of these factors through regression coefficients. In a concluding analysis, we generate a heatmap relating group proportions and entropy to predicted representation, understood as MMD minus SMD (the same outcome explored in Table A.VIII.1). In the right panel of Figure A.VIII.1, we show results for New Zealand, based on the data already presented (results for Russia are quite similar). As a basis of comparison, the left panel returns to our simulations (Figure 3.1), this time focused on the same range of data observed in New Zealand and included in Table A.VIII.1. We can see that as group proportion and entropy increase, the relative benefit of MMD also increases. Again, one must bear in mind that the data are restricted to non-majority groups, which is why the observed and predicted relationships are monotonic.

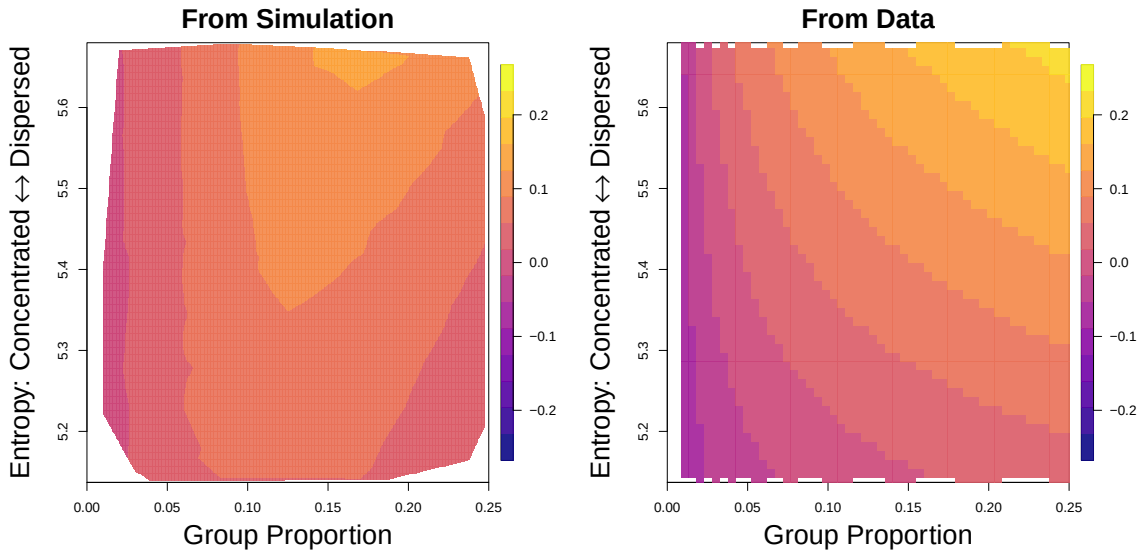


Figure A.VIII.1: LEFT. Theoretical heatmap relating group-level MMD minus SMD representation for minority groups using the simulation design from Figure 3.1, adapted for 6 ethnic groups (as in the New Zealand case). RIGHT. Empirical heatmap relating group-level MMD minus SMD representation using the regression analysis in Table A.VIII.1 (with country set to New Zealand) to generate predicted outcomes across a range of group proportions and entropies.

Overall, these results help clarify the complex interplay between ethnic geography and electoral institutions in shaping representational outcomes. In particular, MMD and SMD tiers show a high degree of similarity in the group distribution of candidates; there is also a high degree of correspondence between population characteristics and winners' ethnicities. Moreover, the national size and spatial distribution of groups also play a critical role in determining whether MMD and SMD institutions will better represent them, with larger, more spatially dispersed groups benefiting from MMD and more spatially concentrated groups from SMD—a pattern mirrored by both our simple simulations and our data analysis of these elections in Russia and New Zealand.

Appendix IX. Political Parties as Social Groups

The theory laid out in Chapter 3 should, in principle, be applicable to social groups of all sorts, including those brought together under the rubric of a political party. Like groups defined by ascriptive characteristics, parties have distinctive values, interests, and identities. They are also usually grounded in demographic features of their social base. So the difference between social categories such as “working class” or “Scottish” and political categories such as “Labour” or “Scottish National Party” is a matter of degree. One is the political expression of the other.

For our purposes, what is different is that with a political party there is minimal slippage between identity and voting behavior. Most members of a party vote for members of that party. Affinity voting, one might say, is extremely strong.

This means that our theory concerning the impact of electoral rules on groups of different sizes and geographic distributions should map almost perfectly onto the empirical facts. Here, we are dealing with relationships that are highly mechanical. Accordingly, results should closely match simulations for individual groups (Figure 3.1) and overall representation (Figure A.XII.1).

Ziegefeld (2013) offers a simulation in which actual votes in national legislative elections in Israel (a proportional system with a single nationwide district) and India (a plurality system with over 500 seats) are counterfactually reallocated under opposite electoral rules (majoritarian and proportional, respectively). In keeping with our theory and our own idealized simulations, the author shows that small, geographically concentrated parties are unaffected by the hypothetical change in electoral rules.

Of course, imaginary counterfactuals may not capture the behavior of voters and elites when acting strategically in response to electoral incentives. To get a more realistic sense of how party votes translate into seats according to different electoral rules we examine performance across tiers of a mixed system with unusual characteristics. In Italy, since the Rosatellum reform of 2017, electors can make only one choice; they may vote for the SMD candidate or the party/coalition list on the MMD tier. Since these are fused, there is effectively no difference between these choices and no possibility of vote-splitting. This, in turn, means that we can play out representational scenarios for parties with different sizes and geographic distributions.

[Glancing over results from GPT, it appears that our theory is borne out: large (small) parties do better (worse) in SMDs, except for geographically concentrated parties, which do better in SMDs or about the same across both tiers. How can we measure geographic dispersion? TBA]

Italy is just one case, and a somewhat unusual one at that, given its fused ballot structure. To get an overall sense of which parties over- and under-perform on each tier, we calculate differences in performance across tiers for all countries, elections, and parties in our dataset. *[Possible? TBA]*

This statistic—one for each country/election/party—forms the dependent variable in a secondary analysis. The first predictor is party size, inferred from the party’s MMD seat share *[I assume it would be time-consuming to try to collect vote-shares. TBA]* The second predictor is geographic concentration *[how to measure? TBA]*

A second analysis focuses on factors viewed as prior to these mechanical forces. Of principal interest is party ideology, which we assume is linked to particular geographic patterns of support. Some parties are likely to draw on constituencies that are spatially concentrated. This would include ethno-regional parties and perhaps extreme parties on the left (concentrated in cities) and right (concentrated in rural areas). By contrast, we expect centrist parties to have a more distributed base of support. This speculative hypothesis can be tested directly if we can find a measure of geographic dispersion. In an additional specification, we might want to include party size as a covariate, or possibly an interaction.

Appendix X. Agent Details & Validation

Additional MP characteristics are coded with a structured, search-enabled LLM protocol developed for this project. Starting from the MES records, we construct one legislator-election record for each unique observation in the mixed-system sample and pass to the agent the identifying information most useful for disambiguation: name, country, election year, party, region, birth date when available, and the expert-coded sex and ethnicity fields already assembled for the core dataset. The agent is then asked to recover educational attainment, institution, and field; prior occupation and class background; birth year and birthplace; disability status; and publicly disclosed LGBTQ identity. These tasks are limited to information available in the public record. To facilitate ex post auditing, the script also draws a country-stratified validation sample, exporting up to 10 cases per country for human review.

The search procedure is intentionally conservative. The agent uses `gpt-5.4-mini` through Azure OpenAI, with OpenCode as the agent harness and a budget of 16 searches per record. The prompt directs the agent to use Wikipedia as an initial entry point and then verify information against official biographies, parliamentary or government profiles found via Internet search, and other credible news sources. It requires JSON output with field-specific source links, a global confidence score, and a brief justification. It also encodes substantive decision rules. The agent may not infer sensitive traits from names, appearance, or stereotypes; it codes disability and LGBTQ status only when they are publicly disclosed; it assigns class background based on the individual’s primary occupation before entering politics; and it excludes low-value people-search websites from the admissible source pool. The pipeline then validates every response before it enters the analytic dataset. Returned JSON is checked against the target output schema; malformed outputs trigger additional LLM parsing.

Below, in Table A.X.1, we present validation, judged on a country-stratified sample of 150 elites, hand-coded across 9 biographical features. Human coders reported each elite coding as taking approximately 40 minutes; if the analytic corpus were human coded, total costs at a \$20 per hour wage would be around \$175,000 USD.

- **Quality when the agent answers:** pooling the 733 judged attribute cells, the agent matches the human coding (including partial matches) 88.4% of the time; feature-level agreement ranges from 67.0% (class background) to 99.0% (education level).
- **Coverage:** the agent returns a substantive value for 67–82% of human-codable cells across attribute features.
- **Disclosure features:** the agent abstains rather than guesses (answering 1.3% and 1.4% of human-coded cells); its abstentions are consistent with the human coders’ negative codings in 98.7% and 99.3% of cells.
- **Judging:** 233 of 737 judged cells resolved by deterministic exact match; the remainder adjudicated by `gpt-5.4-mini` with the human coding as reference.

Table A.X.1: *Agreement between AI-agent and human biographical codings of political elites.*

Feature	Human coded (<i>n</i>)	Agent answered (%)	Judged (<i>n</i>)	Agreement incl. partial (%)
Birth year	147	80.3	118	98.3
Birth place	137	75.2	103	98.1
Education level	139	71.2	99	99.0
Education institution	129	72.9	94	86.2
Education field	139	66.9	93	94.6
Prior occupation	143	81.8	117	77.8
Class background	147	74.1	109	67.0
Disability status	149	1.3	2	—
LGBTQ status	146	1.4	2	—
All attribute features (pooled)	981	74.7	733	88.4

Note: Validation sample of 150 elites hand-coded by human coders. “Human coded” counts elites for whom the human coder found a substantive value; “Agent answered” is the share of those for whom the agent also returned a substantive value. Agreement is assessed among the cells where both answered (“Judged”), counting exact, semantically congruent, and partial matches; exact matches are scored deterministically (233 of 737 judged cells) and the remainder by an LLM judge (gpt-5.4-mini) with the human value as reference. Agreement rates based on fewer than 10 judged cells are suppressed (—). For the disclosure features the agent abstains rather than guesses (answering 1.3% and 1.4% of human-coded cells); its abstentions are consistent with the human coders’ negative codings in 98.7% and 99.3% of cells.

Appendix XI. Multi-Identity Missingness Robustness

This appendix collects robustness analyses for the multi-identity results. The main text uses `missForest` multiple imputation. Here, we present the same all-feature comparisons under that primary regime and two alternatives: no imputation (keep missing values as NA) and mode imputation.

Across regimes, the main focal-group signs remain similar: women show the clearest MMD advantage; SGM and younger legislators lean toward MMDs; immigrant-group results are weaker; disabled representation remains sparse; and less educated, working-class, native ethnic, and rural categories show little evidence of a consistent tier advantage. The representation-index analysis continues to show that focal-group gains do not always translate into higher overall representation of the full identity dimension.

Primary specification: `missForest` multiple imputation

Table A.XI.1: Full diagnostics. Identity and electoral-tier sorting among legislators. Probability and log-magnitude models use equal country/election weights.

Identity	Estimand	Estimate	SE	CI low	CI high	df	<i>p</i>	Holm <i>p</i>	Countries	Elections	Units
Women	Pr(MMD identity), equal country/election	14.40	2.90	7.63	21.17	7.5	0.001	0.012	15	44	13,231
Women	Pr(identity tier), equal country/election	11.80	2.80	5.27	18.34	7.5	0.003	0.031	15	44	13,231
Women	ln(M) outcome, country-election FE, equal country/election	0.54	0.11	0.28	0.80	7.5	0.002	0.015	15	44	13,231
Women	District-balanced	11.48	2.81	4.81	18.15	6.9	0.005	0.044	15	44	7,547
Women	MMD aggregation-unit FE	11.26	3.01	3.19	19.33	4.4	0.017	0.152	15	44	220
SGM	Pr(MMD identity), equal country/election	27.99	10.68	-15.07	71.04	2.1	0.112	0.892	6	18	5,226
SGM	Pr(identity tier), equal country/election	0.31	0.12	0.03	0.60	7.5	0.035	0.280	15	44	13,235
SGM	ln(M) outcome, country-election FE, equal country/election	1.24	0.54	-0.92	3.40	2.1	0.138	0.968	6	18	5,226
SGM	District-balanced	0.28	0.11	0.01	0.54	6.9	0.042	0.335	15	44	7,550
SGM	MMD aggregation-unit FE	0.38	0.19	-0.13	0.89	4.4	0.109	0.873	15	44	220
Youth	Pr(MMD identity), equal country/election	8.89	5.79	-8.48	26.27	3.3	0.213	1.000	15	44	13,235
Youth	Pr(identity tier), equal country/election	1.75	0.70	0.11	3.39	7.5	0.040	0.280	15	44	13,235
Youth	ln(M) outcome, country-election FE, equal country/election	0.37	0.22	-0.27	1.02	3.3	0.173	1.000	15	44	13,234
Youth	District-balanced	1.53	0.68	-0.08	3.15	6.9	0.059	0.416	15	44	7,550
Youth	MMD aggregation-unit FE	0.10	0.72	-1.83	2.03	4.4	0.895	1.000	15	44	220
Immigrant ethnic groups	Pr(MMD identity), equal country/election	13.03	8.47	-380.94	407.00	0.7	0.446	1.000	5	20	6,400
Immigrant ethnic groups	Pr(identity tier), equal country/election	0.36	0.33	-0.42	1.14	7.5	0.310	1.000	15	44	13,219
Immigrant ethnic groups	ln(M) outcome, country-election FE, equal country/election	0.46	0.36	-16.26	17.18	0.7	0.491	1.000	5	20	6,400
Immigrant ethnic groups	District-balanced	0.30	0.32	-0.46	1.07	6.9	0.382	1.000	15	44	7,542
Immigrant ethnic groups	MMD aggregation-unit FE	0.68	0.43	-0.47	1.84	4.4	0.183	1.000	15	44	220

Identity	Estimand	Estimate	SE	CI low	CI high	df	p	Holm p	Countries	Elections	Units
Disabled	Pr(MMD identity), equal country/election	7.00	16.62	-33.87	47.87	5.9	0.689	1.000	10	19	7,669
Disabled	Pr(identity tier), equal country/election	0.08	0.09	-0.14	0.30	7.5	0.443	1.000	15	44	13,235
Disabled	ln(M) outcome, country-election FE, equal country/election	0.51	0.65	-1.09	2.11	5.9	0.462	1.000	10	19	7,669
Disabled	District-balanced	0.08	0.09	-0.14	0.29	6.9	0.427	1.000	15	44	7,550
Disabled	MMD aggregation-unit FE	0.00	0.07	-0.19	0.20	4.4	0.981	1.000	15	44	220
Less educated	Pr(MMD identity), equal country/election	-1.61	5.71	-18.23	15.01	3.6	0.794	1.000	15	40	12,526
Less educated	Pr(identity tier), equal country/election	0.28	0.27	-0.36	0.92	7.5	0.341	1.000	15	44	13,235
Less educated	ln(M) outcome, country-election FE, equal country/election	-0.11	0.25	-0.84	0.62	3.6	0.689	1.000	15	40	12,525
Less educated	District-balanced	0.22	0.26	-0.39	0.84	6.9	0.413	1.000	15	44	7,550
Less educated	MMD aggregation-unit FE	0.51	0.52	-0.89	1.91	4.4	0.381	1.000	15	44	220
Working class	Pr(MMD identity), equal country/election	-4.15	2.73	-11.08	2.78	5.2	0.186	1.000	15	44	13,235
Working class	Pr(identity tier), equal country/election	-0.82	0.89	-2.89	1.25	7.5	0.385	1.000	15	44	13,235
Working class	ln(M) outcome, country-election FE, equal country/election	-0.18	0.09	-0.42	0.06	5.2	0.117	0.939	15	44	13,234
Working class	District-balanced	-0.78	0.77	-2.61	1.04	6.9	0.343	1.000	15	44	7,550
Working class	MMD aggregation-unit FE	-1.74	1.00	-4.41	0.94	4.4	0.151	1.000	15	44	220
Native ethnic groups	Pr(MMD identity), equal country/election	-4.80	8.39	-34.71	25.11	2.5	0.614	1.000	12	36	9,723
Native ethnic groups	Pr(identity tier), equal country/election	-1.12	1.90	-5.53	3.30	7.5	0.573	1.000	15	44	13,219
Native ethnic groups	ln(M) outcome, country-election FE, equal country/election	-0.04	0.31	-1.13	1.06	2.5	0.916	1.000	12	36	9,723
Native ethnic groups	District-balanced	-0.82	1.62	-4.66	3.02	6.9	0.630	1.000	15	44	7,542
Native ethnic groups	MMD aggregation-unit FE	-3.42	3.32	-12.30	5.46	4.4	0.356	1.000	15	44	220
Ruralites	Pr(MMD identity), equal country/election	-0.78	3.37	-9.69	8.12	4.6	0.826	1.000	15	44	13,235
Ruralites	Pr(identity tier), equal country/election	-1.60	1.01	-4.10	0.90	5.7	0.167	1.000	15	44	13,235
Ruralites	ln(M) outcome, country-election FE, equal country/election	-0.05	0.12	-0.36	0.26	4.4	0.683	1.000	15	44	13,234
Ruralites	District-balanced	-1.48	1.03	-4.08	1.13	5.3	0.208	1.000	15	44	7,550
Ruralites	MMD aggregation-unit FE	-0.26	1.27	-4.20	3.67	3.2	0.849	1.000	15	44	220
Women	ln(M) outcome, equal country/election	0.54	0.10	0.30	0.78	6.3	0.001	0.011	15	44	13,226
SGM	ln(M) outcome, equal country/election	0.64	0.43	-2.28	3.55	1.4	0.324	1.000	15	44	13,226
Youth	ln(M) outcome, equal country/election	0.20	0.11	-0.07	0.47	5.0	0.118	0.947	15	44	13,226
Immigrant ethnic groups	ln(M) outcome, equal country/election	0.20	0.23	-1.32	1.72	1.4	0.508	1.000	15	44	13,226
Disabled	ln(M) outcome, equal country/election	0.57	0.50	-1.63	2.77	2.0	0.378	1.000	15	44	13,226
Less educated	ln(M) outcome, equal country/election	0.10	0.06	-0.05	0.25	6.7	0.155	1.000	15	44	13,226
Working class	ln(M) outcome, equal country/election	-0.11	0.10	-0.36	0.14	6.9	0.337	1.000	15	44	13,226
Native ethnic groups	ln(M) outcome, equal country/election	-0.04	0.23	-1.04	0.97	2.0	0.879	1.000	15	44	13,226

Identity	Estimand	Estimate	SE	CI low	CI high	df	p	Holm p	Countries	Elections	Units
Ruralites	ln(M) outcome, equal country/election	-0.16	0.11	-0.51	0.19	3.0	0.244	1.000	15	44	13,226

Note: Conditional-probability estimates, standard errors, and confidence bounds are in percentage points; ln(M)-outcome quantities are in log points. The tier-outcome, per-identity ln(M), identity-outcome, and district-balanced estimands include country-election fixed effects. The tier-outcome model uses paired-tier, identity-varying elections and estimates the focal-minus-nonfocal probability of serving through MMD. The identity-outcome models estimate MMD-minus-SMD focal-identity prevalence. Both conditional models weight countries equally and eligible elections equally within countries. The MMD aggregation-unit FE estimand uses paired tier-level seat shares and aggregation-unit-by-election fixed effects. The joint ln(M) outcome model includes all listed identities jointly, election year, and country fixed effects, using equal-country/equal-election weights constructed after restricting to rows complete on all listed identities and covariates. The per-identity ln(M) country-election FE estimand instead regresses logged district magnitude on the focal identity alone, restricted to magnitude-complete paired-tier elections, with equal-country/equal-election weights recomputed on that sample. Standard errors use country-clustered CR2 corrections; two-sided tests use coefficient-specific Satterthwaite degrees of freedom. Units are legislators except for the district-balanced estimand, where they are district units, and the MMD aggregation-unit FE estimand, where they are tier-level seat shares. MissForest rows pool all completed datasets using Rubin/Barnard–Rubin rules and completion-specific Satterthwaite degrees of freedom.

Table A.XI.2: *Aggregation-unit fixed-effects identity-outcome models. Aggregation-unit estimates use paired tier-level seat shares.*

Identity outcome: aggregation-unit FE seat shares									
	Women	SGM	Youth	Immigrant ethnic	Disabled	Less educated	Working class	Native ethnic	Ruralites
MMD tier	11.26** [3.73]	0.38 [2.00]	0.10 [0.14]	0.68 [1.58]	0.00 [0.03]	0.51 [0.97]	-1.74 [-1.74]	-3.42 [-1.03]	-0.26 [-0.21]
R^2	0.74	0.70	0.61	0.84	0.52	0.66	0.60	0.84	0.74
Countries	15	15	15	15	15	15	15	15	15
Elections	44	44	44	44	44	44	44	44	44
Observations	220	220	220	220	220	220	220	220	220

Note: Model cells report point estimates [t statistics], followed by significance stars; each column is a separate identity-specific regression. Each MMD aggregation-unit FE model regresses the focal-group seat share on the MMD tier, using one seat share per tier within each paired MMD aggregation unit by election, with aggregation-unit-by-election fixed effects; estimates are MMD-minus-SMD differences in focal-identity prevalence (percentage points). Within-completion standard errors use country-clustered CR2 corrections; pooled two-sided tests use Barnard–Rubin degrees of freedom derived from the coefficient-specific Satterthwaite degrees of freedom. Stars use unadjusted two-sided p-values: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$; with finite degrees of freedom, the 5% critical $|t|$ can exceed 1.96. MissForest estimates pool 20 completed datasets using Rubin/Barnard–Rubin rules.

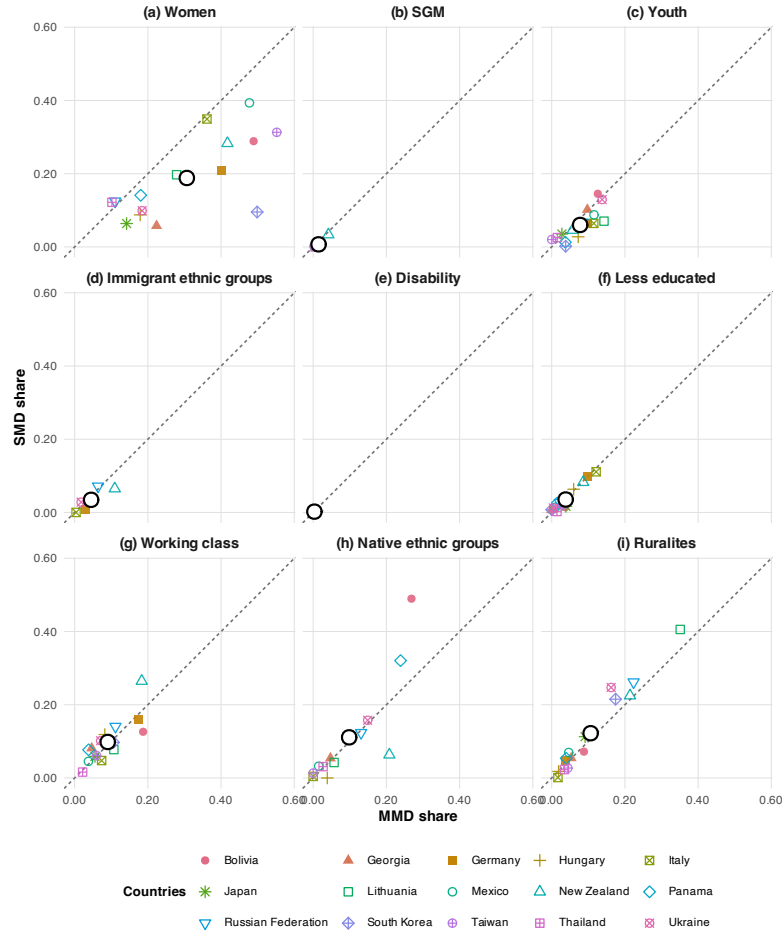


Figure A.XI.1: Common-axis all-feature focal-group representation across SMD and MMD tiers. Points below the diagonal indicate greater focal-group representation in MMDs; points above the diagonal indicate greater focal-group representation in SMDs. Missingness regime: *missForest* multiple imputation.

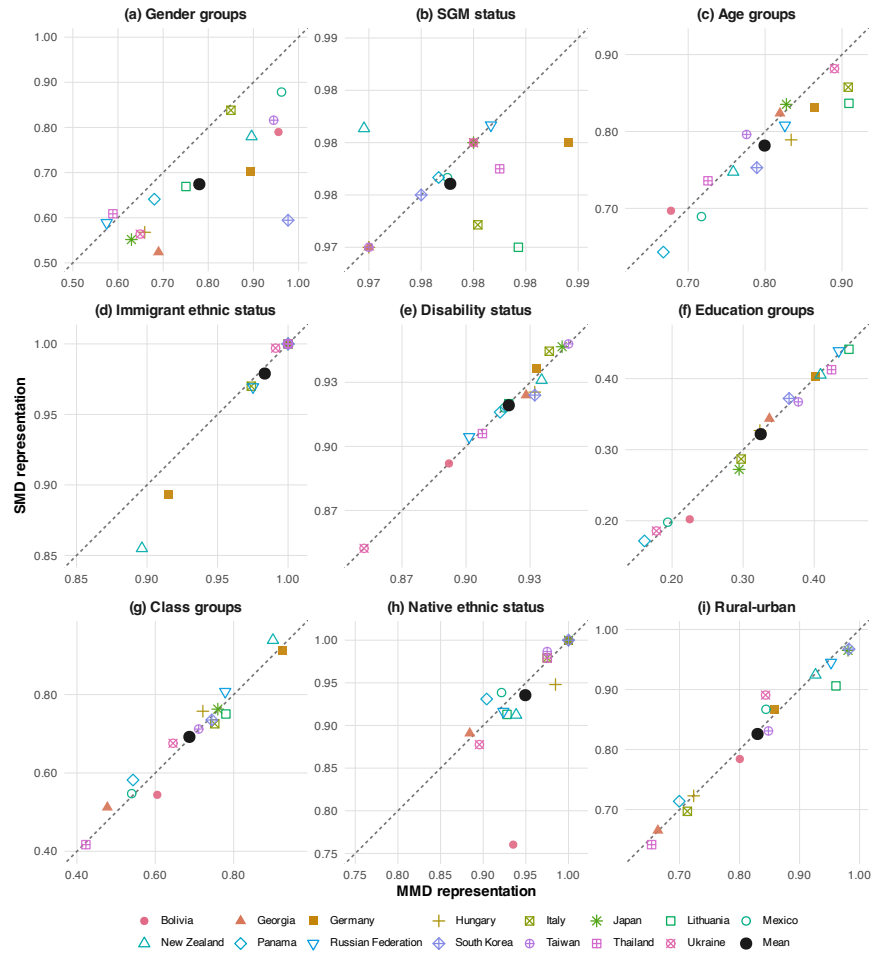


Figure A.XI.2: Country-election average representation-index values in MMDs (x -axis) and SMDs (y -axis) across 9 descriptive-representation dimensions. Points below the diagonal indicate higher overall representation in MMDs; points above the diagonal indicate higher overall representation in SMDs. Missingness regime: *missForest* multiple imputation.

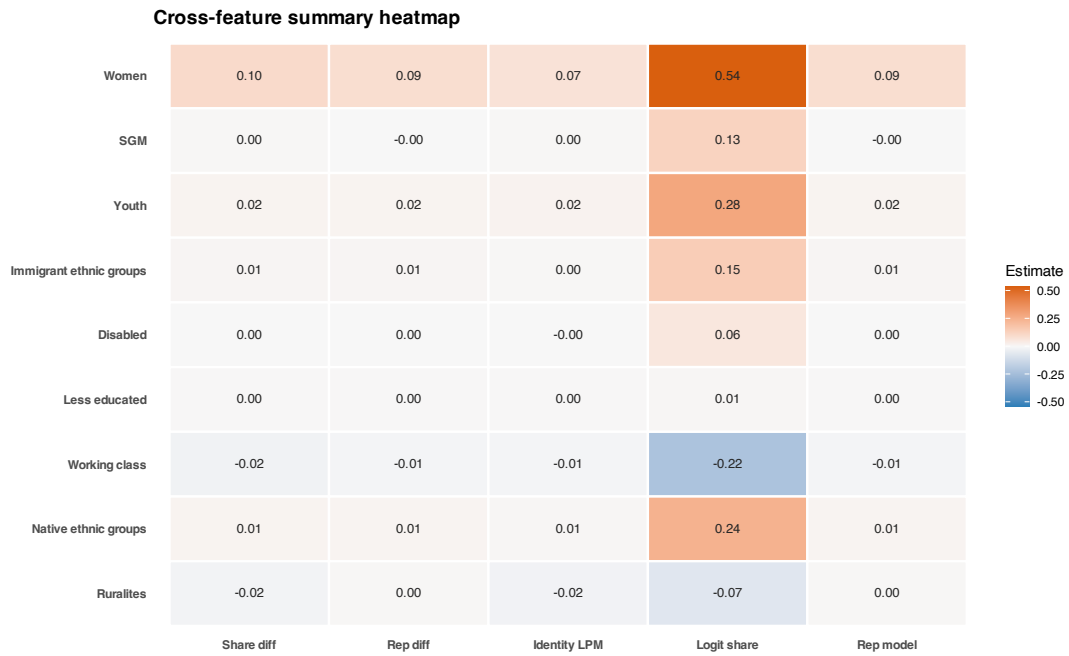


Figure A.XI.3: Cross-feature summary heatmap. Rows are descriptive-representation dimensions; columns report mean MMD–SMD differences and model-based coefficients from the multi-feature analysis. Warmer cells indicate stronger relative MMD advantages, while cooler cells indicate weaker or negative differences. Missingness regime: *missForest* multiple imputation.

No-imputation specification: no imputation (keep missing values as NA)

Table A.XI.3: Full diagnostics. Identity and electoral-tier sorting among legislators. Probability and log-magnitude models use equal country/election weights.

Identity	Estimand	Estimate	SE	CI low	CI high	df	p	Holm p	Countries	Elections	Units
Women	Pr(MMD identity), equal country/election	14.40	2.90	7.84	20.96	9.0	0.001	0.007	15	44	13,231
Women	Pr(identity tier), equal country/election	11.80	2.80	5.46	18.14	9.0	0.002	0.020	15	44	13,231
Women	ln(M) outcome, country-election FE, equal country/election	0.54	0.11	0.28	0.79	9.0	0.001	0.009	15	44	13,231
Women	District-balanced	11.48	2.81	5.04	17.92	8.4	0.003	0.029	15	44	7,547
Women	MMD aggregation-unit FE	11.26	3.01	3.80	18.72	5.7	0.011	0.095	15	44	220
SGM	Pr(MMD identity), equal country/election	27.99	10.68	-4.96	60.93	3.2	0.074	0.534	6	18	5,226
SGM	Pr(identity tier), equal country/election	0.31	0.12	0.04	0.59	9.0	0.030	0.242	15	44	13,235
SGM	ln(M) outcome, country-election FE, equal country/election	1.24	0.54	-0.41	2.89	3.2	0.099	0.693	6	18	5,226
SGM	District-balanced	0.28	0.11	0.02	0.53	8.4	0.036	0.288	15	44	7,550
SGM	MMD aggregation-unit FE	0.38	0.19	-0.09	0.85	5.7	0.094	0.754	15	44	220
Youth	Pr(MMD identity), equal country/election	7.66	6.24	-8.77	24.10	4.6	0.278	1.000	15	44	10,235
Youth	Pr(identity tier), equal country/election	2.04	1.20	-0.84	4.93	6.6	0.137	0.683	15	44	10,235
Youth	ln(M) outcome, country-election FE, equal country/election	0.29	0.24	-0.33	0.92	4.6	0.271	1.000	15	44	10,235
Youth	District-balanced	1.45	1.04	-0.92	3.82	8.7	0.200	1.000	15	44	5,532
Youth	MMD aggregation-unit FE	0.46	0.82	-1.60	2.52	5.4	0.597	1.000	15	43	190
Immigrant ethnic groups	Pr(MMD identity), equal country/election	13.03	8.47	-55.64	81.70	1.2	0.330	1.000	5	20	6,400
Immigrant ethnic groups	Pr(identity tier), equal country/election	0.36	0.33	-0.39	1.12	9.0	0.305	1.000	15	44	13,219
Immigrant ethnic groups	ln(M) outcome, country-election FE, equal country/election	0.46	0.36	-2.45	3.38	1.2	0.386	1.000	5	20	6,400
Immigrant ethnic groups	District-balanced	0.30	0.32	-0.44	1.04	8.4	0.376	1.000	15	44	7,542
Immigrant ethnic groups	MMD aggregation-unit FE	0.68	0.43	-0.39	1.75	5.7	0.168	1.000	15	44	220
Disabled	Pr(MMD identity), equal country/election	7.00	16.62	-31.98	45.98	7.3	0.686	1.000	10	19	7,669
Disabled	Pr(identity tier), equal country/election	0.08	0.09	-0.14	0.29	9.0	0.439	1.000	15	44	13,235
Disabled	ln(M) outcome, country-election FE, equal country/election	0.51	0.65	-1.01	2.04	7.3	0.457	1.000	10	19	7,669
Disabled	District-balanced	0.08	0.09	-0.13	0.29	8.4	0.422	1.000	15	44	7,550
Disabled	MMD aggregation-unit FE	0.00	0.07	-0.18	0.18	5.7	0.980	1.000	15	44	220
Less educated	Pr(MMD identity), equal country/election	-3.76	5.31	-17.48	9.97	4.9	0.511	1.000	15	40	8,324
Less educated	Pr(identity tier), equal country/election	0.41	0.55	-0.91	1.72	6.4	0.484	1.000	15	44	8,810
Less educated	ln(M) outcome, country-election FE, equal country/election	-0.20	0.23	-0.78	0.39	4.9	0.428	1.000	15	40	8,324
Less educated	District-balanced	0.50	0.70	-1.08	2.09	8.7	0.490	1.000	15	44	4,742
Less educated	MMD aggregation-unit FE	1.51	1.83	-3.09	6.11	5.4	0.444	1.000	15	44	186

Identity	Estimand	Estimate	SE	CI low	CI high	df	<i>p</i>	Holm <i>p</i>	Countries	Elections	Units
Working class	Pr(MMD identity), equal country/election	-6.74	3.07	-14.09	0.62	6.6	0.067	0.534	15	44	9,756
Working class	Pr(identity tier), equal country/election	-2.06	1.14	-4.70	0.57	8.1	0.109	0.652	15	44	9,756
Working class	ln(M) outcome, country-election FE, equal country/election	-0.28	0.10	-0.53	-0.03	6.6	0.035	0.279	15	44	9,756
Working class	District-balanced	-1.51	0.98	-3.76	0.74	8.5	0.161	0.965	15	44	5,255
Working class	MMD aggregation-unit FE	-2.46	1.91	-7.22	2.29	5.6	0.247	1.000	15	44	208
Native ethnic groups	Pr(MMD identity), equal country/election	-4.80	8.39	-29.16	19.55	3.6	0.601	1.000	12	36	9,723
Native ethnic groups	Pr(identity tier), equal country/election	-1.12	1.90	-5.40	3.17	9.0	0.571	1.000	15	44	13,219
Native ethnic groups	ln(M) outcome, country-election FE, equal country/election	-0.04	0.31	-0.93	0.86	3.6	0.913	1.000	12	36	9,723
Native ethnic groups	District-balanced	-0.82	1.62	-4.52	2.89	8.4	0.627	1.000	15	44	7,542
Native ethnic groups	MMD aggregation-unit FE	-3.42	3.32	-11.64	4.79	5.7	0.344	1.000	15	44	220
Ruralites	Pr(MMD identity), equal country/election	-2.17	3.19	-9.67	5.32	7.2	0.517	1.000	15	44	8,289
Ruralites	Pr(identity tier), equal country/election	-2.54	0.89	-4.76	-0.32	5.5	0.032	0.242	15	44	8,289
Ruralites	ln(M) outcome, country-election FE, equal country/election	-0.10	0.09	-0.31	0.12	7.2	0.330	1.000	15	44	8,289
Ruralites	District-balanced	-2.41	1.00	-4.67	-0.15	8.8	0.039	0.288	15	44	4,520
Ruralites	MMD aggregation-unit FE	1.91	2.15	-3.55	7.37	5.2	0.413	1.000	15	44	180
Women	ln(M) outcome, equal country/election	0.45	0.13	0.06	0.83	3.4	0.034	0.310	15	44	7,051
SGM	ln(M) outcome, equal country/election	0.60	0.54	-1.49	2.68	2.3	0.374	1.000	15	44	7,051
Youth	ln(M) outcome, equal country/election	0.24	0.19	-0.37	0.86	2.9	0.290	1.000	15	44	7,051
Immigrant ethnic groups	ln(M) outcome, equal country/election	-0.29	0.16	-0.94	0.36	2.2	0.205	1.000	15	44	7,051
Disabled	ln(M) outcome, equal country/election	-0.24	0.89	-3.57	3.09	2.4	0.811	1.000	15	44	7,051
Less educated	ln(M) outcome, equal country/election	0.28	0.09	0.00	0.57	3.3	0.050	0.399	15	44	7,051
Working class	ln(M) outcome, equal country/election	-0.26	0.10	-0.57	0.05	3.3	0.080	0.560	15	44	7,051
Native ethnic groups	ln(M) outcome, equal country/election	-0.01	0.26	-1.39	1.37	1.7	0.973	1.000	15	44	7,051
Ruralites	ln(M) outcome, equal country/election	-0.26	0.11	-0.60	0.08	3.3	0.093	0.560	15	44	7,051

Identity	Estimand	Estimate	SE	CI low	CI high	df	p	Holm p	Countries	Elections	Units
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Note: Conditional-probability estimates, standard errors, and confidence bounds are in percentage points; $\ln(M)$ -outcome quantities are in log points. The tier-outcome, per-identity $\ln(M)$, identity-outcome, and district-balanced estimands include country-election fixed effects. The tier-outcome model uses paired-tier, identity-varying elections and estimates the focal-minus-nonfocal probability of serving through MMD. The identity-outcome models estimate MMD-minus-SMD focal-identity prevalence. Both conditional models weight countries equally and eligible elections equally within countries. The MMD aggregation-unit FE estimand uses paired tier-level seat shares and aggregation-unit-by-election fixed effects. The joint $\ln(M)$ outcome model includes all listed identities jointly, election year, and country fixed effects, using equal-country/equal-election weights constructed after restricting to rows complete on all listed identities and covariates. The per-identity $\ln(M)$ country-election FE estimand instead regresses logged district magnitude on the focal identity alone, restricted to magnitude-complete paired-tier elections, with equal-country/equal-election weights recomputed on that sample. Standard errors use country-clustered CR2 corrections; two-sided tests use coefficient-specific Satterthwaite degrees of freedom. Units are legislators except for the district-balanced estimand, where they are district units, and the MMD aggregation-unit FE estimand, where they are tier-level seat shares. MissForest rows pool all completed datasets using Rubin/Barnard–Rubin rules and completion-specific Satterthwaite degrees of freedom.

Table A.XI.4: *Aggregation-unit fixed-effects identity-outcome models. Aggregation-unit estimates use paired tier-level seat shares.*

Identity outcome: aggregation-unit FE seat shares									
	Women	SGM	Youth	Immigrant ethnic	Disabled	Less educated	Working class	Native ethnic	Ruralites
MMD tier	11.26** [3.73]	0.38* [2.00]	0.46 [0.56]	0.68 [1.58]	0.00 [0.03]	1.51 [0.82]	-2.46 [-1.29]	-3.42 [-1.03]	1.91 [0.89]
R^2	0.74	0.70	0.57	0.84	0.52	0.57	0.57	0.84	0.70
Countries	15	15	15	15	15	15	15	15	15
Elections	44	44	43	44	44	44	44	44	44
Observations	220	220	190	220	220	186	208	220	180

Note: Model cells report point estimates [t statistics], followed by significance stars; each column is a separate identity-specific regression. Each MMD aggregation-unit FE model regresses the focal-group seat share on the MMD tier, using one seat share per tier within each paired MMD aggregation unit by election, with aggregation-unit-by-election fixed effects; estimates are MMD-minus-SMD differences in focal-identity prevalence (percentage points). Standard errors use country-clustered CR2 corrections; two-sided tests use coefficient-specific Satterthwaite degrees of freedom. Stars use unadjusted two-sided p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$; with finite degrees of freedom, the 5% critical $|t|$ can exceed 1.96.

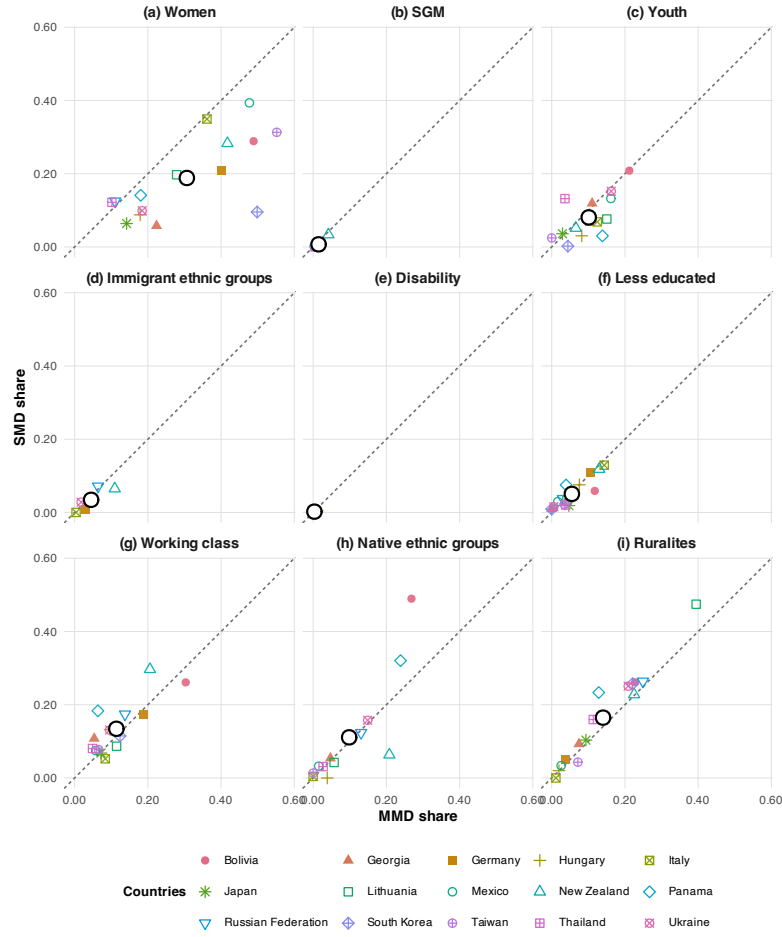


Figure A.XI.4: Common-axis all-feature focal-group representation across SMD and MMD tiers. Points below the diagonal indicate greater focal-group representation in MMDs; points above the diagonal indicate greater focal-group representation in SMDs. Missingness regime: no imputation (keep missing values as NA).

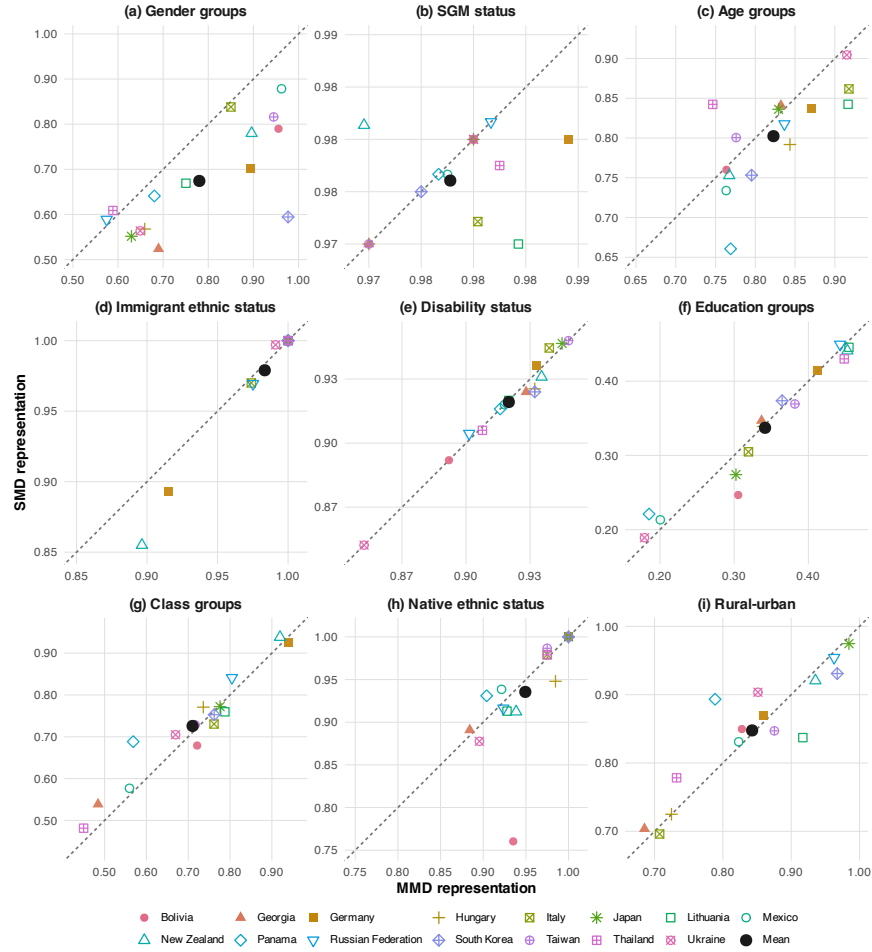


Figure A.XI.5: Country-election average representation-index values in MMDs (x -axis) and SMDs (y -axis) across 9 descriptive-representation dimensions. Points below the diagonal indicate higher overall representation in MMDs; points above the diagonal indicate higher overall representation in SMDs. Missingness regime: no imputation (keep missing values as NA).

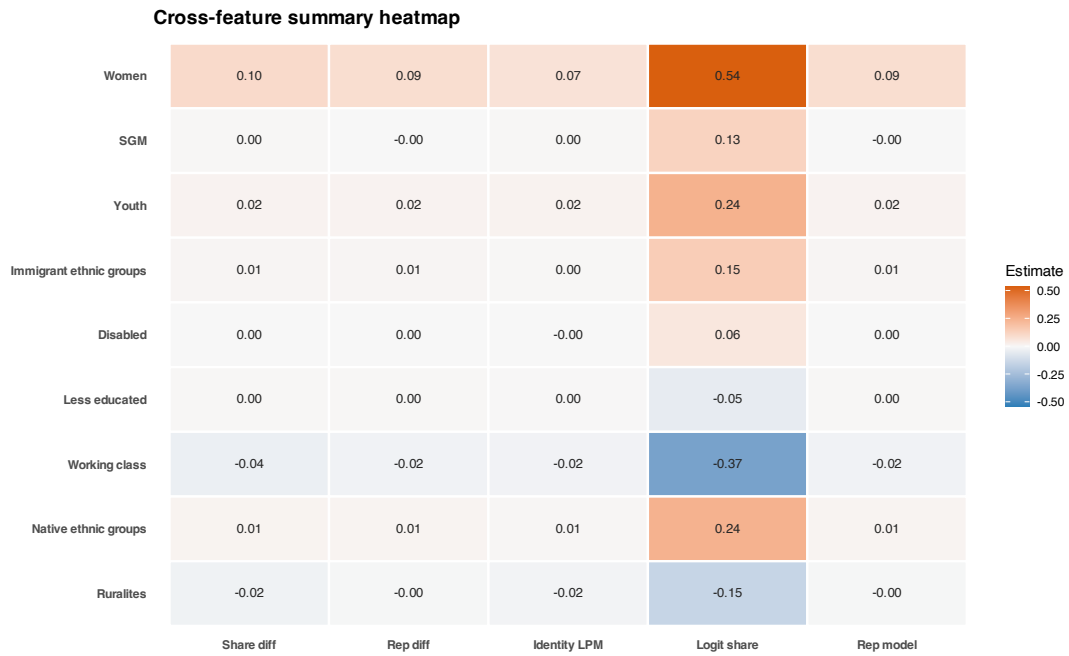


Figure A.XI.6: Cross-feature summary heatmap. Rows are descriptive-representation dimensions; columns report mean MMD–SMD differences and model-based coefficients from the multi-feature analysis. Warmer cells indicate stronger relative MMD advantages, while cooler cells indicate weaker or negative differences. Missingness regime: no imputation (keep missing values as NA).

Mode-imputation specification: mode imputation

Table A.XI.5: Full diagnostics. Identity and electoral-tier sorting among legislators. Probability and log-magnitude models use equal country/election weights.

Identity	Estimand	Estimate	SE	CI low	CI high	df	<i>p</i>	Holm <i>p</i>	Countries	Elections	Units
Women	Pr(MMD identity), equal country/election	14.40	2.90	7.84	20.96	9.0	0.001	0.007	15	44	13,231
Women	Pr(identity tier), equal country/election	11.80	2.80	5.46	18.14	9.0	0.002	0.020	15	44	13,231
Women	ln(M) outcome, country-election FE, equal country/election	0.54	0.11	0.28	0.79	9.0	0.001	0.009	15	44	13,231
Women	District-balanced	11.48	2.81	5.04	17.92	8.4	0.003	0.029	15	44	7,547
Women	MMD aggregation-unit FE	11.26	3.01	3.80	18.72	5.7	0.011	0.095	15	44	220
SGM	Pr(MMD identity), equal country/election	27.99	10.68	-4.96	60.93	3.2	0.074	0.595	6	18	5,226
SGM	Pr(identity tier), equal country/election	0.31	0.12	0.04	0.59	9.0	0.030	0.242	15	44	13,235
SGM	ln(M) outcome, country-election FE, equal country/election	1.24	0.54	-0.41	2.89	3.2	0.099	0.792	6	18	5,226
SGM	District-balanced	0.28	0.11	0.02	0.53	8.4	0.036	0.288	15	44	7,550
SGM	MMD aggregation-unit FE	0.38	0.19	-0.09	0.85	5.7	0.094	0.754	15	44	220
Youth	Pr(MMD identity), equal country/election	8.89	5.79	-6.43	24.22	4.6	0.191	1.000	15	44	13,235
Youth	Pr(identity tier), equal country/election	1.75	0.70	0.16	3.34	9.0	0.035	0.243	15	44	13,235
Youth	ln(M) outcome, country-election FE, equal country/election	0.37	0.22	-0.20	0.94	4.6	0.150	0.901	15	44	13,234
Youth	District-balanced	1.53	0.68	-0.02	3.09	8.4	0.053	0.370	15	44	7,550
Youth	MMD aggregation-unit FE	0.10	0.72	-1.68	1.88	5.7	0.893	1.000	15	44	220
Immigrant ethnic groups	Pr(MMD identity), equal country/election	13.03	8.47	-55.64	81.70	1.2	0.330	1.000	5	20	6,400
Immigrant ethnic groups	Pr(identity tier), equal country/election	0.36	0.33	-0.39	1.12	9.0	0.305	1.000	15	44	13,219
Immigrant ethnic groups	ln(M) outcome, country-election FE, equal country/election	0.46	0.36	-2.45	3.38	1.2	0.386	1.000	5	20	6,400
Immigrant ethnic groups	District-balanced	0.30	0.32	-0.44	1.04	8.4	0.376	1.000	15	44	7,542
Immigrant ethnic groups	MMD aggregation-unit FE	0.68	0.43	-0.39	1.75	5.7	0.168	1.000	15	44	220
Disabled	Pr(MMD identity), equal country/election	7.00	16.62	-31.98	45.98	7.3	0.686	1.000	10	19	7,669
Disabled	Pr(identity tier), equal country/election	0.08	0.09	-0.14	0.29	9.0	0.439	1.000	15	44	13,235
Disabled	ln(M) outcome, country-election FE, equal country/election	0.51	0.65	-1.01	2.04	7.3	0.457	1.000	10	19	7,669
Disabled	District-balanced	0.08	0.09	-0.13	0.29	8.4	0.422	1.000	15	44	7,550
Disabled	MMD aggregation-unit FE	0.00	0.07	-0.18	0.18	5.7	0.980	1.000	15	44	220
Less educated	Pr(MMD identity), equal country/election	-1.61	5.71	-16.46	13.24	4.8	0.790	1.000	15	40	12,526
Less educated	Pr(identity tier), equal country/election	0.28	0.27	-0.34	0.90	9.0	0.336	1.000	15	44	13,235
Less educated	ln(M) outcome, country-election FE, equal country/election	-0.11	0.25	-0.76	0.54	4.8	0.683	1.000	15	40	12,525
Less educated	District-balanced	0.22	0.26	-0.37	0.81	8.4	0.408	1.000	15	44	7,550
Less educated	MMD aggregation-unit FE	0.51	0.52	-0.79	1.81	5.7	0.370	1.000	15	44	220
Working class	Pr(MMD identity), equal country/election	-4.16	2.73	-10.69	2.38	6.6	0.174	1.000	15	44	13,235

Identity	Estimand	Estimate	SE	CI low	CI high	df	p	Holm p	Countries	Elections	Units
Working class	Pr(identity tier), equal country/election	-0.82	0.89	-2.83	1.19	9.0	0.381	1.000	15	44	13,235
Working class	ln(M) outcome, country-election FE, equal country/election	-0.18	0.09	-0.40	0.05	6.6	0.105	0.792	15	44	13,234
Working class	District-balanced	-0.78	0.77	-2.55	0.98	8.4	0.337	1.000	15	44	7,550
Working class	MMD aggregation-unit FE	-1.74	1.00	-4.21	0.74	5.7	0.135	0.948	15	44	220
Native ethnic groups	Pr(MMD identity), equal country/election	-4.80	8.39	-29.16	19.55	3.6	0.601	1.000	12	36	9,723
Native ethnic groups	Pr(identity tier), equal country/election	-1.12	1.90	-5.40	3.17	9.0	0.571	1.000	15	44	13,219
Native ethnic groups	ln(M) outcome, country-election FE, equal country/election	-0.04	0.31	-0.93	0.86	3.6	0.913	1.000	12	36	9,723
Native ethnic groups	District-balanced	-0.82	1.62	-4.52	2.89	8.4	0.627	1.000	15	44	7,542
Native ethnic groups	MMD aggregation-unit FE	-3.42	3.32	-11.64	4.79	5.7	0.344	1.000	15	44	220
Ruralites	Pr(MMD identity), equal country/election	0.24	2.98	-6.80	7.27	7.1	0.939	1.000	15	44	13,235
Ruralites	Pr(identity tier), equal country/election	-0.93	0.58	-2.25	0.39	9.0	0.146	0.878	15	44	13,235
Ruralites	ln(M) outcome, country-election FE, equal country/election	0.00	0.10	-0.23	0.23	7.1	0.977	1.000	15	44	13,234
Ruralites	District-balanced	-0.81	0.61	-2.20	0.58	8.4	0.217	1.000	15	44	7,550
Ruralites	MMD aggregation-unit FE	0.32	0.89	-1.88	2.53	5.7	0.729	1.000	15	44	220
Women	ln(M) outcome, equal country/election	0.54	0.10	0.32	0.77	7.7	0.001	0.005	15	44	13,226
SGM	ln(M) outcome, equal country/election	0.64	0.43	-1.02	2.31	2.2	0.257	1.000	15	44	13,226
Youth	ln(M) outcome, equal country/election	0.20	0.11	-0.05	0.46	6.3	0.100	0.803	15	44	13,226
Immigrant ethnic groups	ln(M) outcome, equal country/election	0.19	0.23	-0.72	1.09	2.2	0.499	1.000	15	44	13,226
Disabled	ln(M) outcome, equal country/election	0.57	0.50	-1.04	2.18	3.0	0.340	1.000	15	44	13,226
Less educated	ln(M) outcome, equal country/election	0.10	0.06	-0.04	0.25	8.1	0.148	0.890	15	44	13,226
Working class	ln(M) outcome, equal country/election	-0.11	0.10	-0.35	0.13	8.4	0.320	1.000	15	44	13,226
Native ethnic groups	ln(M) outcome, equal country/election	-0.04	0.23	-0.78	0.70	3.0	0.866	1.000	15	44	13,226
Ruralites	ln(M) outcome, equal country/election	-0.12	0.07	-0.29	0.05	5.1	0.127	0.888	15	44	13,226

Note: Conditional-probability estimates, standard errors, and confidence bounds are in percentage points; ln(M)-outcome quantities are in log points. The tier-outcome, per-identity ln(M), identity-outcome, and district-balanced estimands include country-election fixed effects. The tier-outcome model uses paired-tier, identity-varying elections and estimates the focal-minus-nonfocal probability of serving through MMD. The identity-outcome models estimate MMD-minus-SMD focal-identity prevalence. Both conditional models weight countries equally and eligible elections equally within countries. The MMD aggregation-unit FE estimand uses paired tier-level seat shares and aggregation-unit-by-election fixed effects. The joint ln(M) outcome model includes all listed identities jointly, election year, and country fixed effects, using equal-country/equal-election weights constructed after restricting to rows complete on all listed identities and covariates. The per-identity ln(M) country-election FE estimand instead regresses logged district magnitude on the focal identity alone, restricted to magnitude-complete paired-tier elections, with equal-country/equal-election weights recomputed on that sample. Standard errors use country-clustered CR2 corrections; two-sided tests use coefficient-specific Satterthwaite degrees of freedom. Units are legislators except for the district-balanced estimand, where they are district units, and the MMD aggregation-unit FE estimand, where they are tier-level seat shares. MissForest rows pool all completed datasets using Rubin/Barnard–Rubin rules and completion-specific Satterthwaite degrees of freedom.

Table A.XI.6: Aggregation-unit fixed-effects identity-outcome models. Aggregation-unit estimates use paired tier-level seat shares.

	Identity outcome: aggregation-unit FE seat shares								
	Women	SGM	Youth	Immigrant ethnic	Disabled	Less educated	Working class	Native ethnic	Ruralites
MMD tier	11.26** [3.73]	0.38* [2.00]	0.10 [0.14]	0.68 [1.58]	0.00 [0.03]	0.51 [0.97]	-1.74 [-1.74]	-3.42 [-1.03]	0.32 [0.36]
R^2	0.74	0.70	0.61	0.84	0.52	0.66	0.60	0.84	0.69
Countries	15	15	15	15	15	15	15	15	15
Elections	44	44	44	44	44	44	44	44	44
Observations	220	220	220	220	220	220	220	220	220

Note: Model cells report point estimates [t statistics], followed by significance stars; each column is a separate identity-specific regression. Each MMD aggregation-unit FE model regresses the focal-group seat share on the MMD tier, using one seat share per tier within each paired MMD aggregation unit by election, with aggregation-unit-by-election fixed effects; estimates are MMD-minus-SMD differences in focal-identity prevalence (percentage points). Standard errors use country-clustered CR2 corrections; two-sided tests use coefficient-specific Satterthwaite degrees of freedom. Stars use unadjusted two-sided p-values: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$; with finite degrees of freedom, the 5% critical $|t|$ can exceed 1.96.

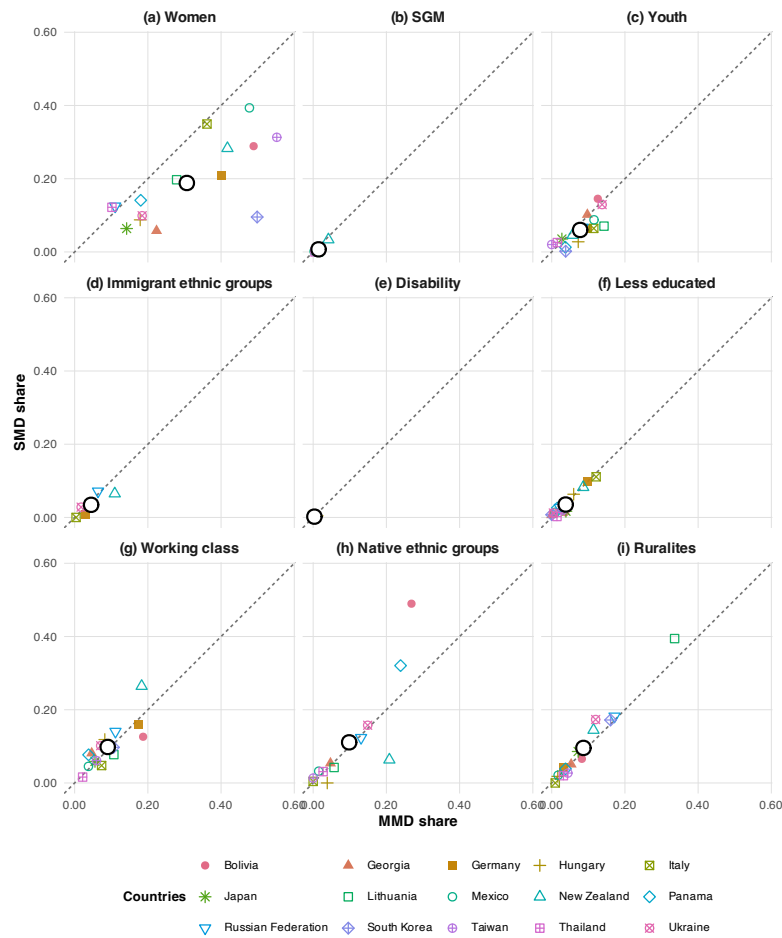


Figure A.XI.7: Common-axis all-feature focal-group representation across SMD and MMD tiers. Points below the diagonal indicate greater focal-group representation in MMDs; points above the diagonal indicate greater focal-group representation in SMDs. Missingness regime: mode imputation.

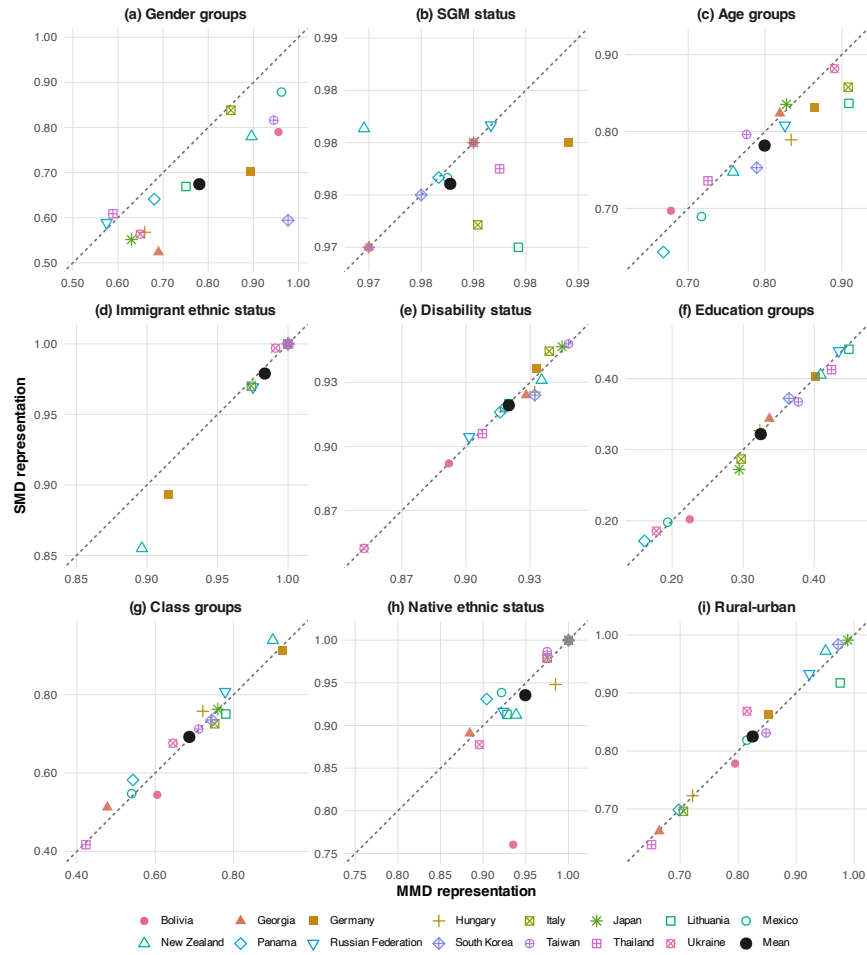


Figure A.XI.8: Country-election average representation-index values in MMDs (x -axis) and SMDs (y -axis) across 9 descriptive-representation dimensions. Points below the diagonal indicate higher overall representation in MMDs; points above the diagonal indicate higher overall representation in SMDs. Missingness regime: mode imputation.



Figure A.XI.9: *Cross-feature summary heatmap. Rows are descriptive-representation dimensions; columns report mean MMD–SMD differences and model-based coefficients from the multi-feature analysis. Warmer cells indicate stronger relative MMD advantages, while cooler cells indicate weaker or negative differences. Missingness regime: mode imputation.*

Appendix XII. The Representation of Demographic Cleavages

The preceding analyses focused on the representation of minority groups. These can be defined in different ways—gender, sexuality, ethnicity, and so forth. Whatever the definition, our focus was on the group, or groups, whose voting bloc constitutes less than fifty percent of the population. How, we asked, is the representation of each type of minority group affected by majoritarian and proportional electoral rules?

An equally important question concerns the impact of electoral rules on the representation of demographic cleavages. Do SMDs or MMDs do a better job of matching the characteristics of MPs with the characteristics of the populations they represent (variously defined)? And do results vary by cleavage?

For this purpose, we require a more differentiated picture of identity. Rather than classifying in a binary fashion (minority/majority), we recognize multiple groups wherever that is justifiable, e.g., for ethnic groups and age-based groups.

Additionally, we compare the representation of the group with its share of the general population. This latter step is complicated with some demographic categories such as SGM and disability, as there aren't accurate surveys of these identities in many of the countries in our sample. Accordingly, the analysis is limited to identity categories where a recent survey or census is available.

Table A.XII.1: *Hypotheses about overall representation.*

Identity	Geography	Expectation
<i>Gender (binary)</i>	Dispersed	SMD < MMD
<i>Sexuality and gender (non-binary)</i>	Dispersed	SMD < MMD
<i>Age</i>	Dispersed	SMD < MMD
<i>Immigrant/Native</i>	Dispersed	SMD < MMD
<i>Disability</i>	Dispersed	SMD < MMD
<i>Education</i>	Concentrated	SMD $\approx$ MMD
<i>Class</i>	Concentrated	SMD $\approx$ MMD
<i>Ethnicity (native)</i>	Concentrated	SMD $\approx$ MMD
<i>Urban/Rural</i>	Concentrated	SMD $\approx$ MMD

Note: Inequalities denote expected levels of overall descriptive representation across electoral systems along each dimension.

A representation index

Following Rose (1984) and Gerring, Jerzak, and Öncel (2024), we measure overall representation as the distance between the population distribution and the distribution of seats in a given tier. For each tier $I \in \{\text{MMD}, \text{SMD}\}$, let g_k denote group k 's share of the population and let G_k^I denote that group's share of seats, with $k = 1, \dots, K$ indexing the mutually exclusive and exhaustive categories within a dimension. We use the following representation

index:

$$R^I = 1 - \frac{1}{2} \sum_{k=1}^K |g_k - G_k^I|. \quad (\text{A.XII.1})$$

The index equals one when the tier exactly mirrors the population. It declines as seat shares diverge from population shares. The scaling by one-half gives the index a simple interpretation: $1 - R^I$ is the minimum share of seats that would have to be shifted from overrepresented groups to underrepresented groups for the tier to match the population. A higher value of R^I therefore indicates a more descriptively representative tier.

Since we are interested in the impact of electoral rules on representation, the outcome in Figure A.XII.1 is calculated as the MMD-minus-SMD difference in generating faithful descriptive representation (where representatives mirror the demographic traits of the population):

$$\Delta_R = R^{\text{MMD}} - R^{\text{SMD}} \quad (\text{A.XII.2})$$

Simulations

To explore the consequences of these discussions, we follow simulations presented in Chapter 3. For simplicity, as previously, the number of groups is limited to 2.

Figure A.XII.1 suggests that there are many scenarios where the two electoral systems render equally representative outcomes. This is the case when (a) one group dominates the population, (b) 2 groups are equal-sized, or (c) groups are spatially concentrated.

MMDs are superior to SMDs in providing overall descriptive representation in situations where a dispersed group comprises a large minority (30–45% of the population) or a small majority, echoing the seat-share pattern in Figure 3.1.

Finally, and perhaps most importantly, overall descriptive representation in MMDs is never materially worse than in SMDs at the 1-percentage-point material-parity tolerance across the range probed in these simulations; the strict minimum difference is -0.42 percentage points. In this respect, conventional wisdom is validated.

In further analyses, we alter various parameters in the simulation (Appendix I), including the formula for assigning votes to seats within MMDs and the level of affinity voting. These additional simulations confirm that the factors of greatest significance for descriptive representation are the size and spatial concentration of groups in the general population.

The index also changes the unit of comparison. The focal-group results above ask whether a particular group is more common in MMD or SMD seats. The representation index asks whether the tier as a whole better matches the population along a given dimension. We calculate R^I within each country-election and tier, and then compare the two tiers using $\Delta_R = R^{\text{MMD}} - R^{\text{SMD}}$. Positive values of Δ_R indicate that the MMD tier more closely mirrors the population; negative values indicate that the SMD tier does so.

Figure A.XII.2 repeats the comparison for the full set of identity dimensions using `missForest` multiple imputation. The gender result is the clearest case in which MMDs improve overall representation: the country averages cluster below the diagonal, indicating higher representation-index values in MMD tiers than in SMD tiers. For the other dimensions, the overall-representation results are more muted. Several focal groups are more common among MMD legislators, as shown above, but the full distribution of seats within their broader identity dimension does

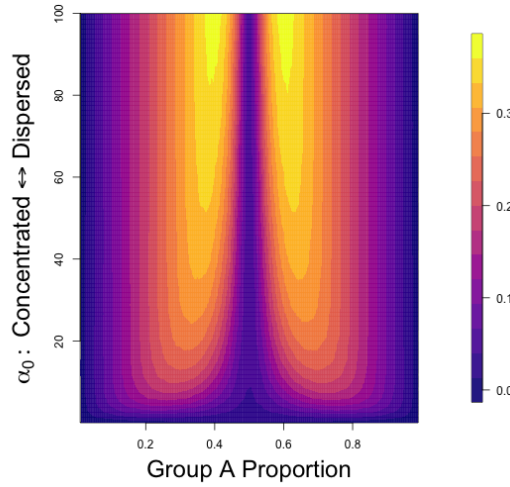


Figure A.XII.1: Outcome: MMD-minus-SMD representation-index difference (Δ_R). Blue: MMD=SMD. Yellow: MMD>SMD. Note: The outcome scale here, indicated by color, ranges from 0 to at most 1 (unlike Figure 3.1, where the scale ranges from -1 to 1).

not always move closer to the population distribution. This distinction is especially important for sparse traits such as SGM status and disability. Small absolute changes in representation for those traits can still leave the seat distribution dominated by the majority category and therefore produce little change in the overall representation index.

Table A.XII.2: Summary of key SMD-vs-MMD coefficients across all features.

Identity	Identity LPM	Share logit	Rep. index	Mean share	Mean rep.
Women	0.073	0.536	0.089	0.101	0.089
SGM	0.003	0.126	-0.000	0.004	-0.000
Youth	0.018	0.284	0.016	0.016	0.016
Immigrant ethnic groups	0.004	0.148	0.010	0.009	0.010
Disabled	-0.000	0.057	0.001	0.001	0.001
Less educated	0.002	0.007	0.002	0.002	0.002
Working class	-0.012	-0.224	-0.013	-0.022	-0.013
Native ethnic groups	0.006	0.244	0.014	0.015	0.014
Ruralites	-0.019	-0.071	0.004	-0.016	0.004

Coefficients compare MMD with SMD tiers. Mean share and representation-index differences are MMD minus SMD. The identity LPM predicts focal-identity membership from MMD tier within country-elections. The representation-index statistic uses the full within-feature group partition. Standard errors use country-clustered CR2 corrections; tests and 95% confidence intervals use coefficient-specific Satterthwaite degrees of freedom.

Table A.XII.2 summarizes the same contrast alongside the focal-group estimates from the preceding sections. The focal-group and representation-index columns answer related but distinct questions. Positive focal-group differences show that a minority group holds a larger seat share in MMDs than in SMDs. Positive representation-index differences show that the entire within-dimension distribution of seats is closer to the corresponding population distribution in MMDs. The clearest alignment between these two quantities is for women. For SGM leg-

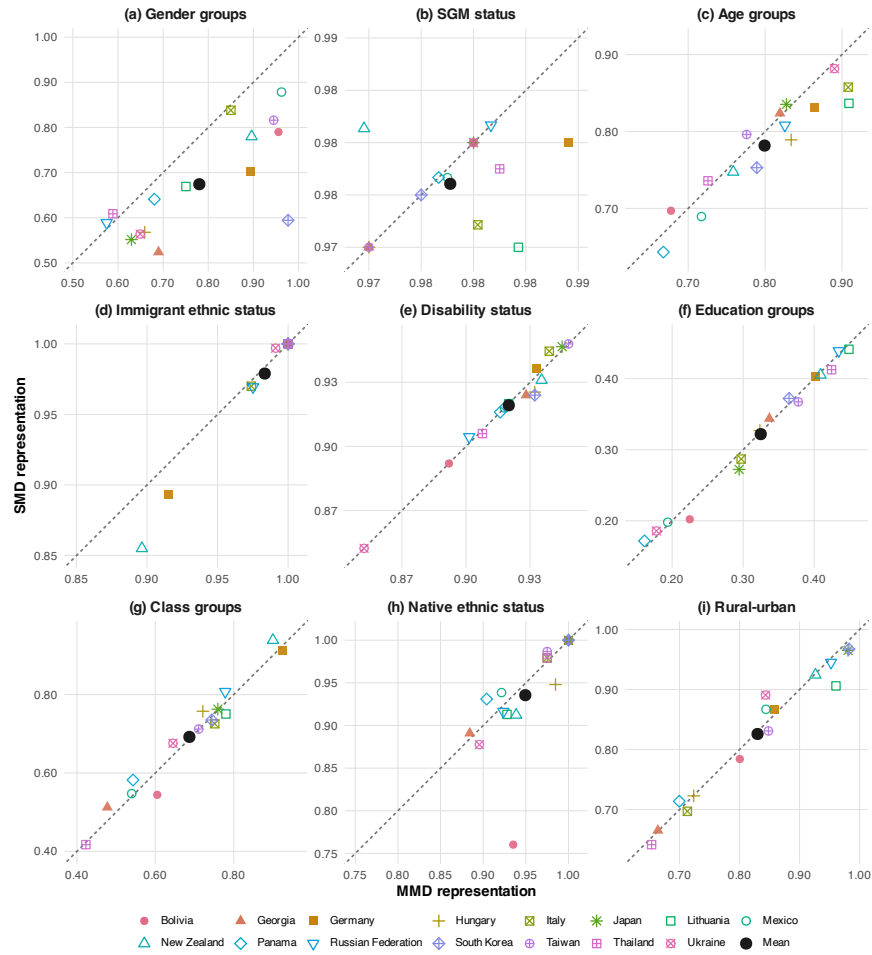


Figure A.XII.2: Country-election average representation-index values in MMDs (x -axis) and SMDs (y -axis) across 9 descriptive-representation dimensions. Points below the diagonal indicate higher overall representation in MMDs; points above the diagonal indicate higher overall representation in SMDs.

islators, youth, immigrants, and disabled legislators, focal-group representation is generally higher in MMDs, but the representation-index summaries are weaker or negative. Less educated, working-class, native ethnic, and rural categories continue to show little evidence of a systematic MMD advantage in overall representation.

Table A.XII.3: *Outcome: Representation index. Cluster robust standard errors at country level. t-statistics in parentheses; * denotes $p < 0.05$. First two models use gender as outcome; next two use ethnicity. Country-election unit of analysis. Full model results are given in Table A.IV.1.*

	Model 1	Model 2	Model 3	Model 4
Outcome	Gender	Gender	Ethnicity	Ethnicity
MMD	0.09 (3.59)*	0.09 (3.25)*	0.02 (1.20)	0.02 (1.08)
<i>Control variables</i>				
Electoral threshold		0.00 (0.43)		0.00 (0.17)
Election year		0.00 (3.89)*		0.00 (0.70)
Country fixed effects		✓		✓
<i>Other statistics</i>				
Countries	15	15	15	15
Observations	90	90	90	90
Adjusted R-squared	0.08	0.74	0.01	0.58

Table A.XII.3 preserves the original gender-and-ethnicity benchmark. It asks whether electoral system rules (SMD=0, MMD=1) predict overall representation as measured by the same representation index. Models 1-2 focus on representation by gender, where MMD is clearly superior to SMD. Models 3-4 focus on representation by ethnicity, where we find virtually no difference across tiers. These benchmark results are consistent with the broader multi-identity analysis: MMDs matter most where the relevant group is broadly dispersed across the population, while geographically concentrated identities generate weaker or more heterogeneous institutional effects. Further robustness tests in Appendix VI modify group inclusion and exclusion criteria, revealing similar results.

The party–dispersion test, step by step

Does proportional representation spread a group across *more party channels* than seat arithmetic alone predicts?

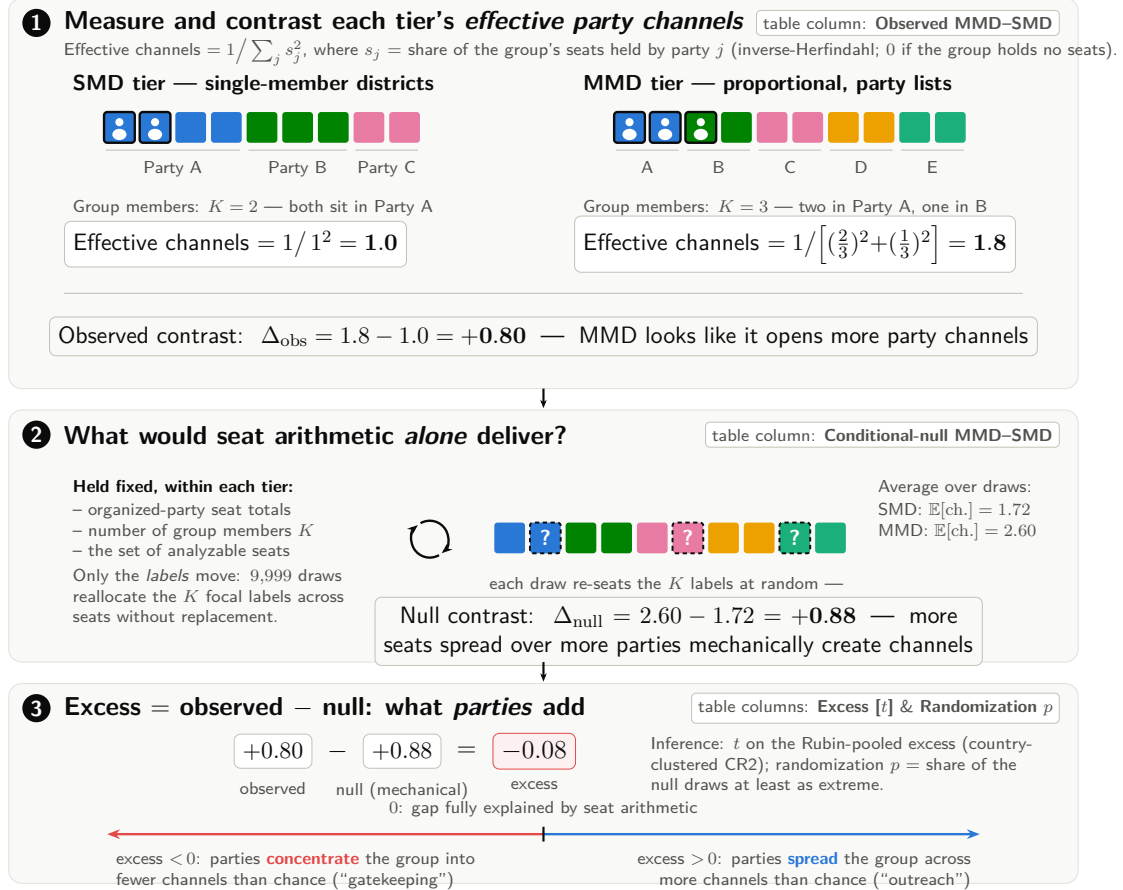


Figure A.XII.3: Schematic of the party–dispersion mechanism test. Card 1 measures each tier’s effective party channels (inverse-Herfindahl) and forms the observed MMD–SMD contrast; card 2 computes the conditional-null contrast by reshuffling group labels across seats while holding party seat totals and group size fixed; card 3 reports the excess (observed minus null), the quantity tested in Table 6.2. Seat counts are illustrative.