The Annals of Regional Science (2026) 75:153
https://doi.org/10.1007/s00168-026-01586-4

ORIGINAL PAPER

Asymmetric decentralization and inequality

Pablo Beramendi[1] · **Melissa Rogers**[2]

Received: 24 March 2026 / Accepted: 5 October 2026
© The Author(s) 2026

Abstract
Recent political trends in Europe and the United States have highlighted the importance of rising spatial inequality for a range of political outcomes. Existing research has emphasized that distributional conflict between more and less productive subnational regions may result in limited taxation and spending. We ask how the spatial distribution of productive endowments and the institutional allocation of territorial political power jointly shape a fiscal system's capacity to redistribute. We show, first, that spatial inequality is associated with higher concentration at the top of the income distribution. Second, we show that the two institutional forms through which territorial asymmetry is codified differ: legislative malapportionment is strongly predicted by underlying spatial inequality and is associated with higher inequality and lower progressive taxation, whereas asymmetric regional authority is unrelated to spatial inequality and is associated with higher progressive taxation. Third, with implications for how regional authority is measured, we show that the two domains of the Regional Authority Index differ: asymmetry in shared rule (regions' influence over national revenue sharing) is associated with higher progressive tax revenue, while asymmetry in self-rule is associated with lower top-end inequality. Because our institutional measures vary almost entirely across rather than within countries, we interpret these findings as long-run equilibrium relationships rather than as causal effects, and we discuss what follows for research on decentralization and regional inequality.

1 Introduction

The organization of political power is central to the origins and persistence of multiple forms of economic inequality. Disparities in the distribution of political influence stem from and help perpetuate disparities in the allocation of economic resources. The origins and nature of this connection are hardly a new area of interest in comparative

✉ Melissa Rogers
melissa.rogers@cgu.edu

Pablo Beramendi
pablo.beramendi@duke.edu

[1] Duke University, Durham, USA

[2] Claremont Graduate University, Claremont, USA

Published online: 22 October 2026

politics and political economy. From classic and reductionist views of the state as the managing committee of the bourgeoisie (Marx and Engels. 1848), to modern efforts to understand how institutions shape coordination efforts to expand progressive taxation, social rights, and public good provision, the focus on the specifics of power as a mechanism behind inequality remains at center stage. In this paper, we focus on one specific aspect of this general problem: the connection between the organization of power in decentralized systems and the politics of economic inequality.

Reducing economic inequality requires capacity to enforce rules, to punish those who defect and to create incentives for people to comply willingly with the tax code. The ability of the modern fiscal state to curb inequality is a combination of all three factors. It requires a stock of capacity to act and the choice by governments to deploy such capacity in the pursuit of a more even allocation of resources. We focus on one core instrument for reducing inequality, progressive taxation, and on several types of inequality. Our efforts are guided by two well-established facts in the literature on inequality. First, rising inequality reflects disproportionately large increases at the top end of the distribution (Piketty and Saez. 2003; Piketty and Zucman 2018; Blanchet and Gethin 2022).[1] Second, in the upper echelons, the distributions of income and wealth are increasingly overlapping (Piketty 2014; Chancel and Piketty 2022). Hence, we pay particular attention to the distributions of income and wealth at the top of the distribution.

We argue that this characteristic (inequality) and the instruments for its reduction (progressivity and top taxation) are in large part shaped by spatial asymmetries of political power. Asymmetry within decentralized polities is a multidimensional concept. It imbues certain subnational regions with greater authority to control their own finances, decide local policies, and greater voting power to decide national fiscal policy (asymmetric regional authority). These asymmetries may include de jure legal protections for these special rules, such as foral regions in Spain or constitutional provisions in Belgium. They may also include legislative malapportionment, which imbues certain regions with greater voting power in the national legislature. It also embodies de facto differences in regional economic power (possibly other powers too) that mean certain regions hold greater sway in decision-making in their own regions and in the national arena.

In this paper, we link spatial inequality to the politics of collecting taxes from the wealthy under conditions of asymmetric decentralization. We argue that a central component of asymmetry in decentralized contexts concerns the uneven distribution of political power among constituent units, such as special powers given to certain regions (asymmetric regional authority) or legislative malapportionment. This uneven distribution is itself the outcome of pre-existing spatial patterns of economic and political power (Beramendi and Rogers, 2022). Asymmetric decentralization may help solidify and reproduce such patterns and in doing so it conditions both the capacity of states to tax and the ability of governments to use such capacity once achieved. Asymmetry in decentralized contexts may work as a mechanism that translates and

[1] The USA is perhaps the only case that sees both disproportionate increases at the top and reductions in the relative shares of income and wealth at the bottom occurring simultaneously.

consolidates spatial inequalities into higher levels of overall inequality through its constraining effect on the center's ability to tax, redistribute, and regulate.

This framing raises an obvious concern: are asymmetric regional authority and malapportionment simply markers of the inequalities we seek to explain, rather than independent sources of subsequent divergence? The concern follows from earlier work on these questions. Beramendi and Rogers. (2021) and Beramendi and Rogers, (2022) show that the geography of economic endowments shapes the early fiscal and administrative capacity of the state, and Beramendi and Rogers (2025) argue that malapportionment is adopted, rather than randomly assigned, where baseline spatial inequality is large enough that elites in advantaged regions are unwilling to accept unweighted representation. Over the long run, then, institutions of asymmetric power-sharing are themselves the residue of an earlier distributive conflict rooted in the same economic geography we use here to explain contemporary inequality, a point consistent with institutionalist accounts of the endogenous origins of political inequality more broadly (Boix 2015; Rodden 2019).

Institutions that are endogenous to inequality at their origin can still shape outcomes once adopted, and elites fight over the design of these institutions because they expect the design to have lasting effects. A constitutional bargain struck under economic heterogeneity has to give the parties a veto over later departures from it, and that veto has to survive later shifts in the political environment. We therefore study asymmetric regional authority and legislative malapportionment separately rather than treating asymmetric decentralization as a single concept. The two institutions are different ways of making a veto durable. Asymmetric regional authority protects pivotal regions constitutionally: it fixes their competencies, fiscal autonomy, and role in constitutional reform largely independently of the outcome of any single election. Malapportionment protects pivotal regions electorally: it fixes their legislative weight independently of population shifts, which insulates their bargaining power from demographic and economic change. Both lock in veto power, but they insure against different threats (constitutional revision in the first case and electoral erosion in the second), and this difference is one reason they have distinct and sometimes opposing associations with taxation and inequality.

This perspective also shapes how our results should be interpreted. Because both institutions are products of constitutional bargains, the associations we document between asymmetric regional authority, malapportionment, and contemporary inequality are best read as evidence of long-run equilibria sustained by that bargain, rather than as a demonstration that these institutions independently amplify inequality after the fact. Institutional variation in our sample is almost entirely cross-national (for malapportionment, entirely so), and no design available to us can separate the historical selection of these institutions from their later operation. Elites who fought to constitutionalize asymmetric authority or to malapportion representation did so because they expected these arrangements to protect their advantage over time. The finding that malapportionment is associated with persistently higher inequality and lower progressive taxation, while asymmetric regional authority is not (and in some specifications is associated with lower inequality and higher progressive taxation), is consistent with those expectations having been well founded.

By way of motivation, Fig. 1 plots two measures of interpersonal inequality against spatial inequality, measured as the Gini coefficient of subnational GDP per capita. Across the countries in the figure the two are strongly correlated ($r = 0.58$ for the top 1% income share and $r = 0.53$ for the Gini coefficient of disposable income, computed over country means). The figure distinguishes high-income countries from other countries because the two groups occupy different ranges: high-income countries have both lower regional inequality and lower interpersonal inequality. Among the other countries the association remains positive ($r = 0.47$ for the top 1% share and $r = 0.34$ for the Gini). Among high-income countries it is weaker and depends on a single case. The correlation with the top 1% share is 0.48 for this group, but it falls to 0.22 when the United Arab Emirates is excluded, and it is 0.19 if the group is defined instead as long-standing OECD members other than Turkey. For the disposable-income Gini the correlation within this group is 0.09. Much of the association in Fig. 1 therefore reflects the difference between richer and poorer countries and variation among the poorer ones.

The regional Gini of GDP per capita is also partly an outcome of the processes we study: for a given distribution of population across regions, greater inequality among persons produces greater measured inequality among regions. Our analysis therefore measures spatial inequality with predetermined features of physical geography. With that measure the country-level association is positive but considerably weaker ($r = 0.17$ for the top 1% share, computed over 112 countries, and $r = 0.11$ for the disposable-income Gini, over 155). Among high-income countries these correlations are 0.20 and 0.47, and among the other countries 0.14 and 0.03 (Appendix Figure A1). In the empirical analysis we show that spatial inequality measured with physical geography is associated with top-end and disposable-income inequality, and we examine how two institutions of asymmetric decentralization, asymmetric regional authority and legislative malapportionment, relate to inequality and to progressive taxation.

Our argument draws on two literatures that are usually kept apart. Research in regional science has documented the extent and persistence of regional disparities in productivity and income (Azzoni 2001; Akita 2003; Mendoza-González and Guerrero-Jiménez 2024), and has asked how fiscal decentralization and fiscal policy affect those disparities (Bonet 2006; Nirola and Choudhury 2022; Mendoza-González and Guerrero-Jiménez 2024). Research in comparative political economy has asked how political institutions shape the fiscal capacity of states and the distribution of income across persons. We connect the two by treating the institutional allocation of territorial political power as the link: the spatial distribution of productive endowments conditions which institutional bargains are struck, and those bargains in turn condition how much a national fiscal system can redistribute across persons. Neither the spatial distribution of economic activity nor the architecture of territorial representation is separately sufficient to account for the patterns we document. Throughout the paper, spatial inequality refers to differences in productive endowments and output across a country's first-level administrative regions, and economic inequality refers to the distribution of income and wealth across persons. The two are related, since differences between regions are one component of inequality among persons, but they are distinct quantities; Novotný (2007) discusses how measures of regional inequality relate to income inequality more broadly.

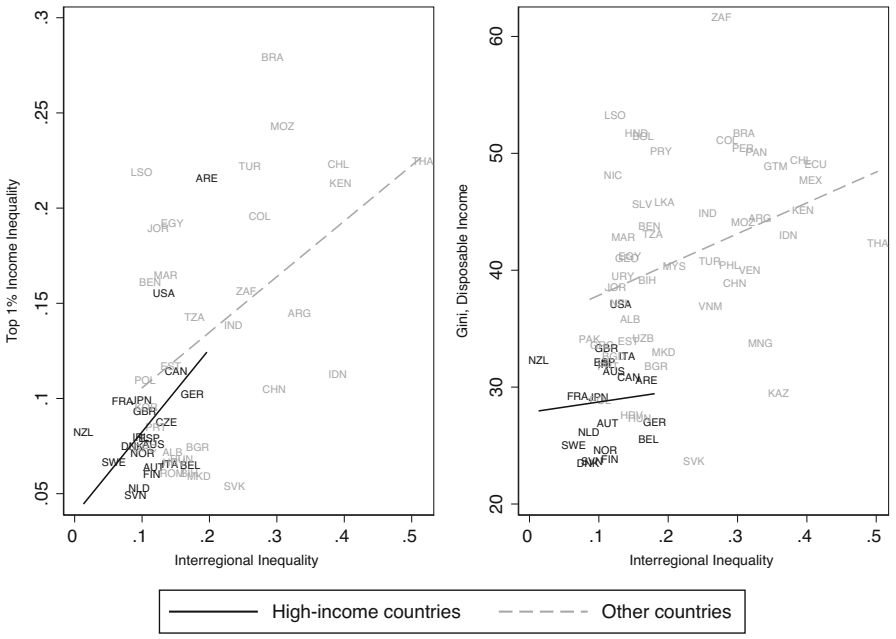


Fig. 1 Link between Spatial Inequality and Interpersonal Inequality

Section 2 develops our argument about how spatial inequality and institutions that codify regional asymmetries shape progressive taxation and inequality, and it states the hypotheses that guide the analysis. Section 3 describes the data, including the measures of natural economic geography we use to address endogeneity, the measurement of asymmetric regional authority and legislative malapportionment, the estimating equation, and the sample. Section 4 presents the results, beginning with whether each institution is selected on spatial inequality and ending with a decomposition of the Regional Authority Index into its components. Section 5 discusses the limits of the analysis and its implications for research on decentralization and regional inequality.

2 Asymmetry as a compromise and its implications

Asymmetric decentralization, that is, the uneven distribution of representation, policy autonomy, and resources across levels of government within a polity, is in itself a political choice. It reflects the outcome of an ongoing political struggle between elites at different levels of government. At times, winners manage to constitutionalize some of their relative gains, making them harder to change; otherwise, the degree of asymmetry under federalism is a recurrent object of political contention.

Choices about asymmetry reflect the combination of two vectors, heterogeneity in policy challenges and heterogeneity in resources. By *policy challenges* we refer to differences across localities in the nature of issues requiring policy interventions; by *resources* we refer to differences in productivity and economic development; the larger

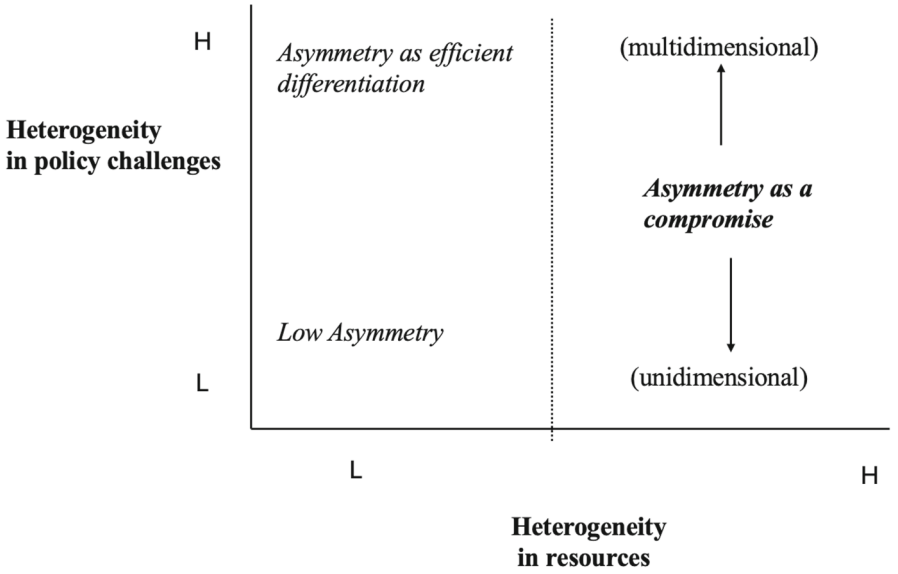


Fig. 2 Asymmetry in federations

these differences, the stronger the distributive conflict within the federation (Lee and Rogers 2019). Figure 2 displays the combination of these two dimensions. This simple exercise allows us to distinguish three scenarios. The first one is the least interesting one: polities with low levels of heterogeneity in both dimensions will feature lower levels of asymmetry. These are the cases in the lower-left quadrant of Fig. 2, which we label low asymmetry. Denmark and the Netherlands are examples, since their regions differ little in productive capacity and face similar policy problems. The contrast between the other two scenarios brings us closer to understanding the link between asymmetry and inequality.

Consider first a federation in which units are relatively balanced in terms of productivity and economic development but there are significant differences in other dimensions, such as demographic, cultural, linguistic, religious or identity-defined characteristics. In this case, decentralization is primarily about policy configurations that limit the mismatch between needs and interventions. These are the cases in the upper-left quadrant of Fig. 2, which we label asymmetry as efficient differentiation. This is the classic case of asymmetric regional authority, illustrated by Belgium, Canada and Switzerland, where regional differences in language and identity are central to the federal bargain. It may be about accommodating regionally concentrated minorities with specific cultural,[2] linguistic, or identity characteristics, or simply about managing informational asymmetries even when there are no minorities to accommodate. For instance, granting differentiated autonomy may let regions tailor anti-poverty and social policies to local needs and preferences, improving allocative efficiency and

[2] Asymmetry often accommodates territorially concentrated minorities; enhanced self-rule can expand access to education, health, and social protection for previously under-served populations, reducing vertical (interpersonal) and horizontal (group-based) inequalities (Zuber 2011; Watts 2008).

the incidence of transfers, which can lower interpersonal inequality (Oates 1972; Bardhan and Mookherjee, 2006; Faguet 2012).

This form of asymmetry may also bring two further benefits, well-established by classical theories of federalism. First, it can facilitate stronger accountability; bringing policy closer to voters (especially in regions with distinct preferences) can tighten electoral accountability and curb elite capture, reorienting outlays toward broad-based, pro-poor goods. Second, asymmetry may allow for "laboratories" in which progressive redistributive programs can be piloted and, once proven, emulated by other jurisdictions or the center, amplifying inequality-reducing policies (Volden 2006; Shipan and Volden 2008). This form of asymmetry as a source of efficient policy differentiation is, in principle, perfectly compatible with high levels of cost-sharing, coordination among units, and ultimately perfectly consistent, a priori, with high levels of economic equality. Thus, we might expect asymmetric regional authority to be linked to positive policy outcomes, including lower inequality and more progressive taxation because some of the most contested elements of policy are devolved, allowing for more cooperative national decision-making.

Asymmetry works rather differently in the presence of baseline economic differences across constituent units (the right half of Fig. 2, which we label asymmetry as a compromise). Brazil, Argentina and Mexico sit in the lower-right quadrant, where the conflict is unidimensional: they combine large economic disparities across regions with comparatively little identity-based differentiation. Spain, India and Italy sit in the upper-right quadrant, where it is multidimensional: they combine large economic disparities with strong linguistic or regional identities. In principle, where some regions have stronger egalitarian preferences or higher willingness to tax, asymmetric autonomy lets them adopt more progressive packages than a national median would permit, lowering aggregate interpersonal inequality even if cross-regional averages diverge (Beramendi 2012). It is also the case that well-designed intergovernmental transfers can offset disparities created by asymmetric authority in the presence of inequality (Boadway and Shah, 2007; Boadway and Flatters. 1982). When coupled with well-designed equalization grants, asymmetric arrangements can lift fiscal capacity in poorer jurisdictions and sustain progressive spending, compressing regional and interpersonal disparities (Boadway and Flatters. 1982; Boadway and Shah, 2007; Smart 2007). By contrast, poorly designed schemes can entrench them via adverse incentives and become a source of lagging taxation, inefficient redistribution, and persistent inequalities.

To the extent that asymmetry is itself the outcome of a distributive conflict, the latter tends to be a frequent scenario. Where spatial inequality is high at baseline, prospective taxpayers care about the design of the federation. As a result, the design of the specific contours of asymmetry becomes a crucial element of political contention geared toward the long-run preservation of their political and economic advantage. Seen from this angle, in the presence of spatial skew in economic capacity and productivity, asymmetry emerges endogenously as a compromise at the expense of taxation, redistribution, and equality (Beramendi 2012; Rogers 2015; Beramendi and Rogers 2025).

To begin with, asymmetry becomes a necessary condition to hold the polity together. Where affluent regions, especially identity-salient ones, leverage autonomy or exit threats, the response often takes the form of asymmetric political influence. The preser-

vation of the union requires channeling resources to pivotal regions, tilting inequality patterns (Alesina and Spolaore. 2003; Bolton and Roland. 1997; Zuber 2011). In turn, the continuity of this arrangement over time requires the adoption of a number of institutional characteristics that bear direct implications for the politics of inequality.

Asymmetry reflects, in the first place, representative institutions that solidify unequal patterns of political influence. These institutions, centered around various forms of special privileges for certain regions (Sahadžić 2018; Watts 2008) and/or the overrepresentation of specific interests and legislative malapportionment (Samuels and Snyder. 2001; Beramendi et al. 2025), help overcome potential commitment (and time-inconsistency) problems. Asymmetry also increases the number and strength of veto players and can empower privileged jurisdictions to block nationwide equalization or demand favorable side-payments, shifting redistributive outcomes and spatial inequality (Tsebelis 2002; Beramendi 2012).

As a result, a key necessary condition for redistribution to work, namely a strong, capable, and institutionally endowed center (often assumed in classical theories of fiscal federalism; Oates, 1972, 1999), may become hollowed out where regions have unequal political and economic power (Beramendi and Rogers, 2022). Confronting a relatively weak central state, privileged regions in asymmetric polities have an incentive to exploit their advantage further. They may pull ahead as agglomeration hubs and limit their contributions to the rest of the polity. Concerning the former, greater autonomy and influence for some regions intensify inter-jurisdictional competition over mobile tax bases, pressuring capital taxation and (often) social spending (Zodrow and Mieszkowski 1986; Wilson 1999; Keen and Marchand. 1997). This translates directly into lower levels of progressivity and higher levels of inequality. Similarly, privileged areas concentrating a large share of the tax base may be unwilling to provide insurance against asymmetric economic shocks. Given that central governments are in charge of insuring against asymmetric shocks, institutionalized differences in autonomy and influence can amplify moral hazard or impede risk-sharing compacts, altering transfers that shape the interpersonal distribution of income (Persson and Tabellini. 1996). Finally, uneven power allocations may create incentives for capture in the form of expectations of central bailouts for influential or special-status regions, diverting resources and weakening rules that underpin broad redistribution (Rodden 2006; Rodden et al. 2003).

2.1 Implications for taxation and inequality

The analysis above suggests that there are two forms of asymmetry in decentralized polities. The first one takes the form of differential institutional and policy responses to spatially differentiated political realities. It may deal with second-dimension issues (culture, identity, religion), with different policy specificities driven by the concentration of varying population subgroups even in a unidimensional policy space (say retirees in Florida or Mediterranean Spain) or both. As such, this first form of asymmetry need not undermine taxation or increase inequality, provided that the underlying disparities among constituent units within the federation are relatively low. In fact, these asymmetric arrangements may provide credible commitments to affluent or

minority regions that they will have sufficient authority to opt out of policies they do not prefer. This may lower the stakes of redistributive policies and thus enable greater redistribution.

The second form of asymmetry, captured by the notion of *asymmetry as a compromise*, is central to redistributive conflicts in complex unions. Asymmetry, whether of presence, of influence within the representation system, or in the ability to secure access to transfers, is an endogenous compromise reached precisely to moderate the reach of the tax state, progressive taxation, and, ultimately, efforts to reduce inequality. This is particularly the case in unions with high levels of spatial inequality at baseline. As the economy and the state grow, political pressure for new social contracts increases, as in the logic of the conscription of wealth. A spatial perspective identifies a conflict within this process between productive and unproductive regions, since taxation comes disproportionately from rich regions while redistributive spending may flow to poorer ones. The conflict is sharper for the taxation of wealth. Revenue from corporate income, personal income, and value-added taxes comes disproportionately from cities and productive areas (Beramendi 2012). Wealthy people tend to live in cities, in less industrialized as well as industrialized countries. And taxing the wealthy means extracting from property and capital, which places most of the burden on the productive areas.

In response, elites in rich regions may coordinate with elites in poor regions to secure an agreement that prevents overall taxation and redistribution from expanding and sustains very high levels of interpersonal income and wealth inequality as a result. This is the case in legislatively malapportioned systems (Beramendi and Rogers 2025). Political asymmetry in the federal contract and in the influence as the contract gets updated (through democratic means) guarantees the stability of the compromise over time. To the extent that asymmetry in decentralized contexts reflects this logic it will serve as a political factor limiting tax progressivity and preserving high levels of inequality.

Whether those institutions compound existing spatial inequalities may depend on the extent to which they are endogenous to existing spatial inequalities. In Fig. 3, we show a basic correlation plot between our two focal institutions (asymmetric regional authority and malapportionment) and underlying spatial inequalities in natural economic geography.[3] While malapportionment, in the right panel, is highly correlated with underlying spatial inequalities, asymmetric regional authority (measured with the standard deviation of the Regional Authority Index), in the left panel, is not clearly related to spatial inequalities. This may be the case because, for example, legislative malapportionment is highly intertwined with fiscal decision-making, and is designed to lock in spatially uneven economic development (Beramendi and Rogers 2025). On the other hand, asymmetric regional authority emerges for multiple reasons, relating to spatial economic inequalities and also to diversity in terms of language, culture, religion, and identity across regions, that may or may not be associated with spatial economic differences. As argued above, regional authority asymmetries may even lower the stakes of redistribution at the national level, making it more likely to occur.

[3] Appendix Table A4 shows the correlations between spatial inequalities and malapportionment and different facets of asymmetric decentralization.

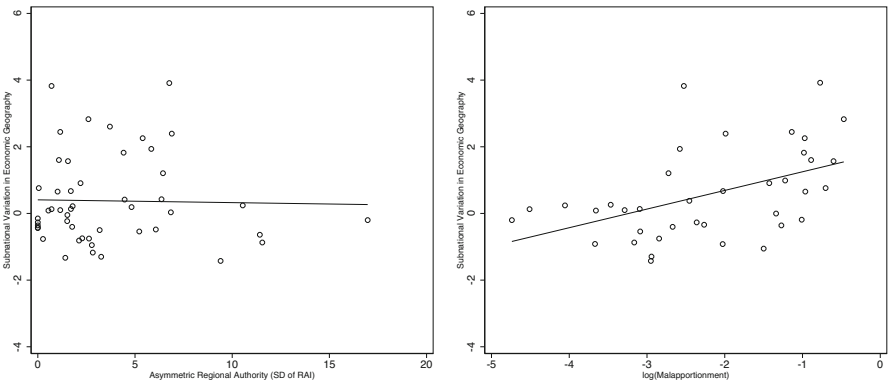


Fig. 3 Correlation between asymmetric institutions and spatial inequalities

Thus, we consider whether these institutional approaches to addressing diversity in decentralized polities, asymmetric regional authority or legislative malapportionment, may condition whether the negative impacts of spatial inequalities on progressive taxation and redistribution are compounded or lessened.

We argue that underlying spatial inequalities are associated with higher inequality and lower progressive taxation. Yet the institutions that codify unequal political power for regions, asymmetric regional authority and malapportionment, will have divergent associations with inequality and progressivity. While legislative malapportionment is designed to keep in place spatial economic inequalities, asymmetric regional authority may help keep the union together by accommodating a range of differences that coincide with geography, such as clusters of language communities. Asymmetric regional authority may be associated with lower inequalities and higher progressive taxation because by allowing the devolution of certain powers that protect certain regional interests, the majority of regions may be more favorable to centralized policies such as progressive taxation.

However, we expect the interaction of spatial inequalities and asymmetric institutions to be associated with lower taxation and higher inequality. This is because these institutions can compound underlying spatial inequalities. In the case of asymmetric regional authority, for example, richer regions can extract better fiscal deals for themselves to keep their resources in their region, which reduces the central pot for redistribution. This has been shown for the case of Spain (Zabalza and López-Laborda. 2017; De La n.d.). In the case of legislative malapportionment, the worse the spatial inequalities, the more severe the malapportionment tends to be, and the more regressive the fiscal state.

Our argument also implies which dimension of regional authority should matter. The mechanism we have described operates through privileged regions' influence over national fiscal decisions: their capacity to shape how revenue is raised and shared, to block equalization, and to secure favorable side-payments. In the vocabulary of the Regional Authority Index, this is shared rule, which covers a region's role in national law making, its participation in intergovernmental executive bodies, and its influence over national revenue sharing and allocation (which the index codes as fiscal control).

Self-rule measures something else, the authority a region exercises within its own borders. A region may have extensive autonomy over its own schools and hospitals without any special access to national fiscal bargaining, and our argument concerns the second kind of power. We therefore expect the association with taxation to come from asymmetry in shared rule, and from fiscal control in particular, and we test the components separately rather than relying on the composite index.

Both institutions are products of earlier distributive bargains, and our cross-national evidence cannot separate their historical selection from their later operation (Rodden 2006; Boix 2003). We can ask whether the two institutions are selected in the same way. Figure 3 and Appendix Table A4 show that they are not: spatial inequality in natural economic geography strongly predicts legislative malapportionment and explains almost none of the variation in asymmetric regional authority. The two institutions appear to arise from different conflicts, which is consistent with malapportionment being associated with lower progressive taxation and higher inequality, and asymmetric regional authority with the reverse, as we report below.

We consider empirical implications of our argument:

H1: Higher spatial inequality is associated with higher interpersonal inequality.
H2: Higher asymmetric regional authority is associated with lower inequality and higher progressive taxation. Because our argument locates the mechanism in bargaining over the central fiscal contract, we expect the association with taxation to come from shared rule, and specifically from fiscal control (regions' influence over national revenue sharing).
H3: Legislative malapportionment is associated with higher inequality and lower progressive taxation.
H4: The association between asymmetric regional authority and progressive taxation weakens as spatial inequality rises.

The rest of the paper evaluates them.

3 Data

To link spatial inequality to taxation outcomes, we draw on several cross-national datasets, described in this section.

3.1 Measuring spatial inequality in economic geography

Our main spatial inequality variables focus on exogenous variation in subnational physical geography. To capture variation in natural economic geography, we calculate multiple predictors of agricultural endowments and trade access at fine-grained levels of geography using Geographic Information Systems (GIS). Our methodology is described in greater detail in Appendix Section A1. We aggregate these economic geography measures into two administrative levels (the first and second) and "exogenous" grid cells. We then calculate subnational variation in these values (Beramendi and Rogers, 2022).

Physical geography is far removed from fiscal policy, so we state the links we have in mind. Natural endowments such as soil quality, growing season, and access to water shape where productive activity first locates. Agglomeration and infrastructure investment then make these early advantages persistent, so that regional differences in productivity outlast the conditions that created them. Persistent regional productivity gaps give regions different interests in the central fiscal contract, because productive regions supply most of the tax base while less productive regions depend more on transfers. These interests are bargained into institutional form, through asymmetric authority or malapportioned representation, and those institutions constrain how progressive national taxation can become. We use physical geography as a predetermined proxy for the spatial structure of productive potential. We do not claim that current regional wealth is determined by physical conditions, since much of today's regional variation in productivity reflects human capital, agglomeration, and policy. The advantage of the geographic measures is that they are not themselves outcomes of taxation or redistribution.

One of the most obvious physical features related to economic development is soil conditions conducive to agriculture (Sachs 2003). We employ *Grow Days*, the length, in days, of the growing period from FAO (2012) and a *Land Suitability* for agriculture indicator, measured as the predicted value of the likelihood that a given parcel of land would be under cultivation using four measures of climate and soil, from Ramankutty et al. (2002). In addition to these agriculture-specific measures, we capture *Precipitation* as the long-run (1960–1990) average of rainfall available from Willmott and Matsuura. (2012), *Elevation* in meters, from ISciences, LLC. (2008), and Temperature, the long-run (1960–1990) average available from Uea-Cru et al. (1901) based on Mitchell and Jones (2005).

We also measure access to trade routes, particularly water routes, which may account for economic differences. *Coastal Access*, *Lake Access*, *River Access*, and *Harbor Access* measure the average distance from the cells within the region to the nearest coast, large lake, navigable river, and natural harbor (Henderson et al. 2018).

For our main measure of economic endowments we follow Galor and Vollrath (2009) and use principal components analysis (PCA), because the geography variables are highly correlated and partly redundant.[4] Our index of spatial inequality is the first principal component of the within-country coefficients of variation of elevation, growing days, land suitability, precipitation, and temperature, together with the logarithm of land area. It explains 44 percent of the variance in these six variables. The trade-access variables are not part of the index.

3.2 Asymmetric regional authority

To measure asymmetric regional authority, we employ the most common measure, the standard deviation of the Regional Authority Index (Hooghe et al. 2016).

The Regional Authority Index (RAI) measures how much authority a regional government exercises over its own territory and how much influence it has in national decision-making. It is built from two domains:

[4] Appendix Table A1 reports the component loadings, and Appendix Table A2 reports summary statistics.

Self-rule captures authority a region wields within its borders, assessed on:

- *Institutional depth*: how autonomous and self-standing the regional tier is as a governing unit;
- *Policy scope*: the range of policy areas in which the region can legislate or regulate;
- *Fiscal autonomy*: the region's power to set and levy its own taxes;
- *Borrowing autonomy*: the region's discretion to borrow on its own account;
- *Representation*: whether the region has an elected assembly and a regional executive accountable to it.

Shared rule captures a region's influence over national decisions that affect it, assessed on:

- *Law making*: the region's formal role in national legislation;
- *Executive control*: participation of regional actors in national intergovernmental executive bodies;
- *Fiscal control*: regional influence over national revenue sharing and allocation;
- *Borrowing control*: regional say in setting national rules that constrain subnational borrowing;
- *Constitutional reform*: the region's role in altering the constitutional order.

The index rises as regions have deeper institutions, broader competencies, greater fiscal discretion, stronger representation, and more influence over national decision-making.

Let c denote a country and t a year. Let $\mathcal{R}_{ct}$ be the set of regions coded in the Regional Authority Index (RAI-MLG) for (c, t), and let $R_{rct} \in [0, 30]$ be the total RAI score (self-rule + shared rule) for region $r \in \mathcal{R}_{ct}$.[5] Our asymmetric regional authority measure is the within-country dispersion of regional authority,

$$\bar{R}_{\mathrm{ct}} = \frac{1}{R_{\mathrm{ct}}} \sum_{r \in \mathcal{R}_{\mathrm{ct}}} R_{\mathrm{rct}}, \qquad A_{\mathrm{ct}} = \sqrt{\frac{1}{R_{\mathrm{ct}} - 1} \sum_{r \in \mathcal{R}_{\mathrm{ct}}} \left(R_{rct} - \bar{R}_{ct}\right)^2},$$

where $R_{ct} \equiv |\mathcal{R}_{ct}|$. $A_{ct} = 0$ under perfect symmetry (all regions have identical authority) and increases with inter-regional differentiation in authority, that is, with greater asymmetry (Watts 2008; Zuber 2011).

Because the composite index sums two conceptually distinct domains, we also construct dispersion measures for self-rule and shared rule separately, and for each of their ten constituent components, applying the identical procedure to the component scores. This allows us to test the prediction set out in Sect. 2 that the association with taxation should come from shared rule, and specifically from fiscal control. Appendix Table A5 also reports the range of regional authority as an alternative summary of dispersion. With the range, the composite measure is marginally significant for progressive tax revenue, as it is with the standard deviation, and it is not significant for the top 1% income share.

[5] RAI is built at the region level and sums self-rule (range 0–18) and shared rule (range 0–12) (Hooghe et al. 2016; Shair-Rosenfield et al. 2020; Hooghe et al. 2021).

The measure is highly persistent, with country dummies alone accounting for about 90 percent of its variance in our sample, and it is right-skewed: skewness is 1.36, the median is 2.12, and more than a tenth of country-years score zero, which indicates a perfectly symmetric allocation of regional authority. A high score can come from a single constitutionally distinctive region rather than from authority being unevenly distributed across all of a country's regions. The highest-scoring countries in the RAI data are Finland, Greece, Malaysia, Portugal and Denmark, whose scores derive largely from Åland, Mount Athos, Sabah and Sarawak, the Azores and Madeira, and the Faroe Islands and Greenland, respectively, while Germany, Austria, and Japan score zero. These scores are correct given the construction of the measure, since the arrangements in question are differentiated, but they mean that the standard deviation of regional authority and the theoretical concept of asymmetric federalism are related rather than identical. Appendix Figures A2 and A3 report the geographic and statistical distribution of the measure.

3.3 Legislative malapportionment

Our second institutional measure captures asymmetry in representation rather than in authority. Legislative malapportionment is the discrepancy between the share of legislative seats a region holds and its share of the national population. Where regions are systematically over- or under-represented relative to population, votes carry unequal weight in national decision-making, and the regions favored by that discrepancy hold disproportionate influence over national fiscal policy.

We use the index of Samuels and Snyder. (2001):

$$\mathrm{MAL} = \frac{1}{2}\sum_{i=1}^{n} |s_i - p_i|\,, \tag{1}$$

where s_i is the share of all legislative seats allocated to district or region i and p_i is that district's share of the national population, and n is the number of districts. The index equals zero under perfect apportionment and rises toward one as seats and population diverge; it can be read as the proportion of seats allocated to regions other than those a population-proportional apportionment would give them. For each country we sum the index for the lower chamber and, where the national legislature has one, the upper chamber, so that the measure captures the overrepresentation of regions across the legislature as a whole. Upper chambers matter for our argument because they are the institutions through which federations most often give territories representation that does not depend on population. The data are from Samuels and Snyder. (2001), who report one observation for each chamber in each country.

The combined measure is right-skewed across our sample (skewness 0.87), and we use its natural logarithm throughout, which is close to symmetric (skewness −0.35) and reduces the influence of the few countries with the largest discrepancies. Malapportionment is constructed entirely from legislative apportionment data. It is independent of the Regional Authority Index and does not draw on the shared-rule domain or any

other RAI component, although the two measures are conceptually related in that both concern regional influence over national decisions.

Because Samuels and Snyder. (2001) report one observation per country, the measure has no within-country variation. Section 3.6 discusses what this implies for our empirical strategy. As a check on this measure, Appendix Table A6 re-estimates our main models with the lower-chamber measure of Ong and Mori (2017), which covers many more countries. The associations of malapportionment with higher inequality and lower progressive taxation hold with this measure.

3.4 Unit of analysis

We utilize the first-level administrative region as our subnational unit of focus for our sample. This variable refers to states in cases such as the USA, Mexico, and Brazil, to provinces in places such as Canada and Argentina, to departments in Colombia, to regions in Russia, and the Nomenclature of Territorial Units for Statistics (NUTS2) level 2 designation in European Union countries. We use this level for important theoretical and empirical reasons. In the first place, the first-level administrative region is typically the most important administrative and political unit. In decentralized nations, such as federations, the first level is where the majority of public policy is legislated and administered. The first level is also typically the crucial political sub-unit in most nations, serving as the relevant geography for upper houses in bicameral legislatures, and most often as boundaries for lower house electoral districts. Moreover, these units are generally consistent over time, and are the only units upon which data are regularly collected for population and economic censuses. Other subnational levels, such as municipalities, are in many countries important units of policymaking and administration, but we primarily focus on the first-level region in this study.[6]

This unit of analysis matches the authority unit from the RAI dataset in our sample. It is the appropriate unit because it is the level at which regional self-rule is exercised and, in most of our cases, the level that defines legislative constituencies for the national chambers on which our malapportionment measure is based.

3.5 Inequality and tax revenue data

We draw on existing cross-national datasets to measure taxation and inequality. We report two measures of interpersonal inequality and two of progressive tax revenue rather than every available series.

- Top 1% Income Share (Alvaredo et al. 2018)
- Tax Collection (Prichard and Goodall 2014)
- Gini Disposable (Solt 2009)

[6] The subnational GDP per capita data used for the region-adjusted Gini coefficient in Fig. 1 were originally compiled for Rogers (2015). Appendix Table A3 lists the countries in each estimation sample and the years each covers.

3.6 Empirical structure

We estimate cross-national associations between subnational variation in economically valuable land, institutions of asymmetric decentralization, and outcomes related to interpersonal inequality and progressive taxation. We use static measures of variation in economic geography because taxation itself plausibly shapes current outcomes in subnational GDP per capita (Beramendi and Rogers. 2021), so a contemporaneous measure of spatial economic inequality would be endogenous to the outcomes we study.

This choice limits what our estimates can establish. Our geography-based measure of spatial inequality is time-invariant by construction: its within-country standard deviation is 0.001 against a between-country standard deviation of 1.63. Legislative malapportionment has no within-country variation in our sample. The dispersion measures built from the Regional Authority Index are not strictly constant, but they are close to it: country dummies alone explain 82 to 90 percent of their variance, dispersion in fiscal control changes in 11 of 49 countries and in under 2 percent of country-years, and dispersion in shared rule changes in 27 countries and in 8 percent of country-years. Country fixed effects therefore cannot identify the coefficients of interest, because they absorb all of the variation in these regressors.[7] Our estimates should therefore be read as cross-national equilibrium relationships among endowments, institutions, and fiscal outcomes, and not as evidence about what would happen if a given country's institutions were changed.[8]

Specifically, we use OLS to estimate:

$$F_{\mathrm{ct}} = \alpha + \beta_1 S_c + \beta_2 A_{\mathrm{ct}} + \beta_3 (S_c \times A_{\mathrm{ct}}) + \lambda_t + \boldsymbol{\gamma}' \mathbf{X}_{\mathrm{ct}} + \epsilon_{\mathrm{ct}}, \tag{2}$$

where c indexes countries and t years. F_{ct} is one of the inequality or taxation indicators. S_c is our measure of subnational variation in economic endowments, which is constant within country. A_{ct} is the asymmetric institution measure. λ_t are year fixed effects. $\mathbf{X}_{\mathrm{ct}}$ is a vector of controls. ϵ_{ct} is a random error term. Standard errors are clustered by country throughout.

For each outcome we report models with and without the logarithm of GDP per capita (Appendix Table A10). Our argument, following Beramendi and Rogers. (2021); Beramendi and Rogers, (2022), is that natural endowments shape the location and persistence of productive activity, which in turn shapes national fiscal capacity. On that account income per capita lies on the causal path between our explanatory variable and our outcomes, and conditioning on it removes part of the mechanism we are trying

[7] The dispersion measures built from the Regional Authority Index are the exception, since they vary over time as well as across countries. Appendix Table A7 reports country fixed-effects specifications for shared rule, fiscal control and the composite index. The associations with progressive taxation keep their sign but attenuate and are not statistically distinguishable from zero. These measures are close to time-invariant, so identification there rests on a small number of constitutional reforms. We discuss this in the appendix and in the conclusion.

[8] Appendix Tables A8 and A9 report specifications with world-region fixed effects. Physical conditions differ systematically across continents, so region indicators absorb about half of the cross-country variation in our geography index and roughly two thirds of the variation in top income shares, and the samples contain too few countries outside Europe to compare within regions.

to describe. Because reasonable readers may disagree, we report both and note where the two differ. Where we include additional controls, the table names them.

Interaction terms appear only where we report them explicitly. In our main tables, we estimate the constituent terms without the product term, because with 29 to 49 countries a saturated interaction specification is not well identified, and we prefer to report a smaller number of parameters estimated with reasonable precision.

3.7 Sample

Our sample consists of all countries for which data are available on the relevant outcome, our economic geography measures, and the institutional variable in question. We impose no minimum threshold of decentralization and no regime-type restriction; countries enter when data permit.

Coverage varies by outcome, from 29 to 49 countries (Tables 1 to 5). In the models of the top 1% income share, the models using asymmetric regional authority cover 29 countries.[9] Those using malapportionment cover 32 countries.[10] Coverage differs because the two institutional datasets cover different countries, and readers should bear in mind that our comparison of the two institutions rests on overlapping but not identical samples. Appendix Table A3 lists the countries in each sample and the years each covers.

Because our sample includes several countries that are not democracies for all or part of the period, and because our argument concerns bargaining within representative institutions, we report our main results restricted to country-years scoring above 0.5 on the V-Dem polyarchy index in Appendix Table A11. The substantive results are unchanged.

4 Results

We begin by reporting the associations of spatial inequality and the two institutions with interpersonal inequality and with progressive taxation. Finally, we disaggregate the Regional Authority Index into self-rule, shared rule, and their components, and we report tests of the interaction between spatial inequality and asymmetric authority.

All models are estimated by OLS on country-year data with year fixed effects and standard errors clustered by country. We report the number of countries alongside the number of country-year observations in every table, since our key regressors vary primarily or exclusively across countries and the number of countries is the relevant measure of independent information.

[9] Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, Brazil, Canada, China, Colombia, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Italy, Japan, Norway, Portugal, Russia, Serbia, Spain, Sweden, Thailand, the United Kingdom and the United States.

[10] Argentina, Australia, Austria, Brazil, Canada, Chile, Colombia, the Czech Republic, Denmark, Finland, France, Greece, India, Ireland, Italy, Japan, New Zealand, Norway, Poland, Portugal, Romania, Russia, the Slovak Republic, South Africa, Spain, Sweden, Switzerland, Tanzania, Thailand, Turkey, the United Kingdom and the United States.

Table 1 Spatial inequality, asymmetric institutions, and income inequality

	Top 1% Income		Gini disposable	
Spatial inequality (geography)	0.017***	0.015***	1.775**	2.611***
	(0.006)	(0.005)	(0.866)	(1.048)
Asymmetric RAI (SD)	−0.002		−0.332	
	(0.001)		(0.285)	
Malapportionment (log)		0.010**		2.739**
		(0.004)		(1.164)
Observations	565	882	1028	783
Countries	29	32	48	36
R-squared	0.287	0.416	0.099	0.318

Standard errors clustered by country in parentheses. Year fixed effects in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.1 Spatial inequality, institutions and income inequality

Table 1 reports the association between spatial inequality, each institution, and two measures of interpersonal inequality: the top one percent income share and the Gini coefficient of disposable income.

Spatial inequality is positively and significantly associated with inequality in every specification. A one-unit increase in our geography index is associated with a 1.7 percentage point higher top one percent income share and, in the malapportionment sample, with a 2.6 point higher Gini coefficient of disposable income.

Malapportionment is positively and significantly associated with both measures. Asymmetric regional authority, measured as the standard deviation of total RAI, is negative in every column (the direction our argument anticipates) but is not statistically distinguishable from zero. We take up this null in Sect. 4.3, where disaggregating the index shows why the composite measure performs poorly.

4.2 Spatial inequality, institutions, and progressive tax revenue

Table 2 reports the same models for progressive tax revenue, which we measure two ways, each as a percentage of GDP: revenue from direct taxes and revenue from taxes on income, profits and capital gains.

Malapportionment is negatively associated with both measures of progressive taxation, at the 5 percent level for taxes on income, profits and capital gains and at the 10 percent level for direct taxes. More malapportioned systems raise less revenue from progressive taxes relative to the size of their economies. Asymmetric regional authority is positive for both measures, marginally significant for taxes on income, profits and capital gains and not significant for direct taxes.

The same pattern holds for general income tax revenue, a narrower measure available for 26 countries, which we do not report; those estimates are in the replication package. Spatial inequality is negative but imprecisely estimated across the revenue

Table 2 Spatial inequality, asymmetric institutions, and progressive taxation

	Direct taxes		Income/Profits/CapGains	
Spatial inequality (geography)	−0.650	−0.820	−0.680	−0.665
	(0.927)	(0.937)	(0.789)	(0.838)
Asymmetric RAI (SD)	0.330		0.387*	
	(0.243)		(0.215)	
Malapportionment (log)		−1.620*		−1.491*
		(0.819)		(0.698)
Observations	920	1014	916	1011
Countries	46	36	47	36
R-squared	0.061	0.148	0.093	0.154

Both revenue measures are percentages of GDP. Standard errors clustered by country in parentheses. Year fixed effects in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

measures. Spatial inequality is therefore associated with inequality outcomes but not, on its own, with progressive tax revenue. This is consistent with our argument that institutions, rather than geography on its own, account for differences in revenue, although our design cannot establish that path.

4.3 Which dimensions of regional authority matter

The composite Regional Authority Index sums two conceptually distinct domains. Self-rule captures the authority a region exercises within its own borders; shared rule captures its influence over national decisions. Our theoretical argument in Sect. 2 concerns the second, because it holds that asymmetry matters through bargaining over the central fiscal contract, which is a matter of shared rule.

Table 3 reports progressive tax revenue against, in turn, the composite index, self-rule dispersion, shared-rule dispersion, and dispersion in fiscal control (the dimension our argument names), which the RAI codes as regional influence over national revenue sharing and allocation.

The composite index is marginally significant. Self-rule dispersion is not significant. Shared-rule dispersion is significant at the one percent level, and dispersion in fiscal control is both significant and substantively large. The composite measure performs poorly because it averages a strong shared-rule association with a null self-rule association.

For top income inequality the pattern is reversed. Table 4 shows that self-rule dispersion is significantly associated with lower top-end income inequality, with policy autonomy accounting for most of it, while shared-rule dispersion is not.

Table 5 and Fig. 4 report four of the five shared-rule components against progressive taxation. Fiscal control has the largest coefficient and the smallest p-value. Law making and executive control are also significant, and constitutional reform is marginally so. All three concern regional influence over national decisions, so this is consistent with our argument.

Table 3 Decomposing asymmetric authority: progressive taxation

	Dependent variable: taxes on income, profits and capital gains			
	(1)	(2)	(3)	(4)
Spatial inequality (geography)	−0.680	−0.750	−0.782	−0.306
	(0.789)	(0.836)	(0.743)	(0.622)
Asymmetric RAI (SD)	0.387*			
	(0.215)			
Asymmetric self-rule (SD)		0.214		
		(0.269)		
Asymmetric shared-rule (SD)			1.620 ***	
			(0.595)	
Asymmetric fiscal control (SD)				8.061 ***
				(2.387)
Observations	916	1180	1180	1180
Countries	47	49	49	49
R-squared	0.093	0.056	0.213	0.287

Each column adds one measure of asymmetric authority to the same specification. The dependent variable is measured as a percentage of GDP. Standard errors clustered by country in parentheses. Year fixed effects in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 Decomposing asymmetric authority: top income inequality

	Dependent variable: top 1% income share			
	(1)	(2)	(3)	(4)
Spatial inequality (geography)	0.017***	0.014***	0.013**	0.015***
	(0.006)	(0.005)	(0.005)	(0.005)
Asymmetric RAI (SD)	−0.002			
	(0.001)			
Asymmetric self-rule (SD)		−0.003**		
		(0.001)		
Asymmetric shared-rule (SD)			−0.001	
			(0.003)	
Asymmetric policy autonomy (SD)				−0.014***
				(0.005)
Observations	565	944	944	944
Countries	29	32	32	32
R-squared	0.287	0.339	0.306	0.356

Each column adds one measure of asymmetric authority to the same specification. Standard errors clustered by country in parentheses. Year fixed effects in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 Shared-rule components and progressive taxation

	Dependent variable: taxes on income, profits and capital gains			
	(1)	(2)	(3)	(4)
Spatial inequality (geography)	−0.878	−1.012	−0.306	−0.799
	(0.824)	(0.821)	(0.622)	(0.808)
Asymmetric law making (SD)	6.557**			
	(2.455)			
Asymmetric executive control (SD)		6.149**		
		(3.045)		
Asymmetric fiscal control (SD)			8.061***	
			(2.387)	
Asymmetric constitutional reform (SD)				2.061*
				(1.070)
Observations	1180	1180	1180	1180
Countries	49	49	49	49
R-squared	0.151	0.134	0.287	0.148

Each column adds one shared-rule component to the same specification. The dependent variable is measured as a percentage of GDP. Standard errors clustered by country in parentheses. Year fixed effects in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

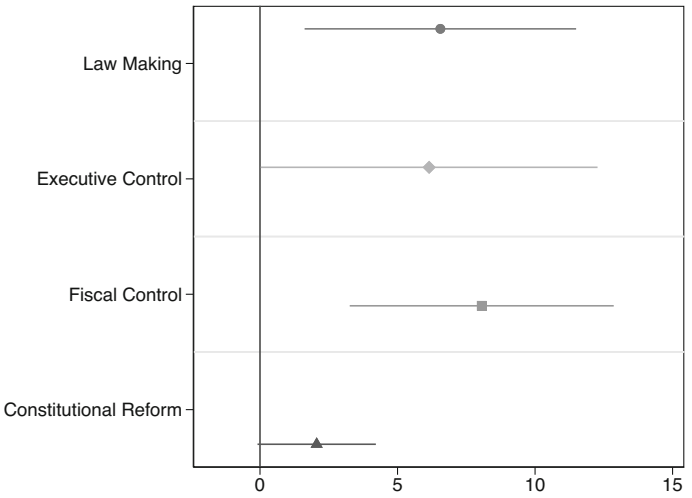


Fig. 4 Shared-rule components and progressive taxation

Borrowing control, the remaining shared-rule component, concerns regional say in the rules governing subnational borrowing rather than the division of national revenue, and it varies least across regions. Our argument expects no association between it and progressive taxation, and Appendix Table A12 reports none, while fiscal control shows a strong association.

Section 2 argues that asymmetry constrains taxation through privileged regions' influence over the central fiscal contract, and fiscal control is the RAI's measure of that influence, which is why we name it in advance as the dimension we expect the association with taxation to come from. We report every shared-rule component, including borrowing control, so that the pattern can be read as a whole rather than through a single coefficient.

Appendix Table A13 reports robustness for the fiscal control result. The association survives controlling for national income, for trade openness and population, and restricting the sample to democracies. It weakens when malapportionment is added, but the sample falls by roughly forty percent when it is, and malapportionment is itself insignificant in those models. We read this as a loss of power rather than as confounding, and we report the result in full.

4.4 Interactions

Our fourth hypothesis holds that the association between asymmetric authority and progressive taxation should weaken as spatial inequality rises, because richer regions in more spatially unequal settings can convert institutional access into fiscal advantage. Using the composite index, the interaction is negative for both revenue measures but reaches only marginal significance for one of them (taxes on income, profits and capital gains, $p = 0.073$). Using shared-rule dispersion, it is negative and significant for taxes on income, profits and capital gains ($p = 0.024$) and negative and marginal

for direct taxes ($p = 0.073$). Appendix Table A14 reports these models. We find no corresponding interaction for the inequality outcomes, and we therefore confine the claim to taxation. With 46 to 49 countries, the product term draws on the same between-country variation as the terms it multiplies, so these models have little power and a null result in them is weak evidence in either direction. We regard the pattern as suggestive rather than established.

5 Conclusion

This paper has asked how the spatial distribution of productive endowments and the institutional allocation of territorial political power jointly shape a national fiscal system's capacity to redistribute.

Spatial inequality is associated with higher concentration at the top of the income distribution and with higher disposable-income inequality. The association holds for both measures and under country-clustered inference. It is generally weaker when we condition on national income, which we argue lies on the causal path, but it remains positive in every specification we report other than those with country or world-region fixed effects. With world-region fixed effects it is not statistically distinguishable from zero.

The two institutional forms through which territorial asymmetry is codified differ. Legislative malapportionment is strongly predicted by underlying spatial inequality in natural economic geography, and asymmetric regional authority is not. The two appear to be selected on different underlying conflicts, and malapportionment is associated with lower progressive tax revenue while asymmetric regional authority is associated with higher. This contrast is the paper's central empirical claim. Our findings therefore cannot be reduced to a single account of institutional selection on economic geography.

The two domains of the Regional Authority Index also differ, and the composite index combines them. Asymmetry in shared rule, and specifically in fiscal control (regions' influence over national revenue sharing), is associated with higher progressive tax revenue. Asymmetry in self-rule, and specifically in policy autonomy, is associated with lower top-end income inequality. Aggregating the two into a single dispersion measure averages these associations toward zero. Studies that use the standard deviation of total RAI as a measure of asymmetric decentralization therefore combine two distinct relationships.

Our analysis has several limits. The most important is that we cannot separate the historical selection of political institutions from their later operation. Malapportionment has no within-country variation in our data, and our geography-based measure of spatial inequality is time-invariant by construction, so country fixed effects absorb the variation we would need to test our coefficients. What we estimate are cross-national equilibrium relationships among endowments, institutions, and fiscal outcomes, and not the effect of changing an institution while holding a country's history fixed. The dispersion measures built from the Regional Authority Index do move, but country dummies explain 82 to 90 percent of their variance, so a country fixed-effects specification discards most of the variation our argument concerns. With country fixed effects the associations with progressive taxation keep their sign but are not statistically dis-

tinguishable from zero (Appendix Table A7), and they are identified from 19 to 87 country-year changes. We read our estimates as long-run cross-national relationships rather than as the effect of institutional reform.

A second limit is sample size. Our institutional models rest on 29 to 49 countries depending on the outcome, and the two institutional comparisons are estimated on overlapping but distinct sets of countries. We report the number of countries alongside the number of country-years in every table so that the precision of our estimates is not overstated. The small samples also limit what can be learned from comparisons within world regions. Region indicators absorb about half of the cross-country variation in our geography index, and outside Europe the samples hold too few countries to compare within a region, so these specifications cannot test the inequality relationship (Appendix Tables A8 and A9). The association between shared-rule asymmetry and progressive taxation, which region indicators leave largely intact, holds in them.

A third limit concerns the measurement of asymmetry. A high score on the dispersion of regional authority can come from a single constitutionally distinctive region rather than from authority being unevenly distributed across all of a country's regions. Finland, Greece, Portugal and Denmark score highly on this measure largely because of Åland, Mount Athos, the Azores and the Faroe Islands, while Germany and Austria, the standard examples of symmetric federations, score zero. The scores are correct given the construction of the measure, but the measure and the concept are not identical, and measures that better separate the two would be valuable for research on asymmetric federalism.

Finally, our evidence on the taxation of wealth is thin. The cross-national wealth series cover very few countries. We also examined statutory top personal and corporate income tax rates, inheritance tax rates and the dates at which inheritance taxes were adopted, and found no relationship to either institution; those estimates are in the replication package. Our claims about progressive taxation rest on the revenue raised from progressive taxes, and we have confined them accordingly.

Subnational and quasi-experimental designs offer the most promising route to the causal question our cross-national design cannot settle. The useful cases would be episodes in which a region's access to national fiscal decision-making changed for reasons unrelated to its economic position. Spain's foral arrangements, the renegotiation of fiscal transfers in Canada and India, and the reallocation of shared rule in Belgium and Italy are candidate settings, although whether any of them meets that condition would have to be established case by case. Showing that fiscal control is the dimension that matters in a setting where it changes would considerably strengthen the mechanism we identify here.

For regional science, our results suggest that the spatial distribution of economic activity and the institutions of territorial representation should be studied together. In our data, spatial inequality in natural endowments is associated with interpersonal inequality and predicts legislative malapportionment, and the two institutions have distinct associations with progressive taxation.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00168-026-01586-4.

Author Contributions This article is part of the Asymmetric Federalism: The Perils and Advantages of Asymmetric Decentralization Arrangements special issue.

Funding Open access funding provided by SCELC, Statewide California Electronic Library Consortium

Data Availability All data for this analysis will be uploaded to the Harvard Dataverse upon publication.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Akita T (2003) Decomposing regional income inequality in China and Indonesia using two-stage nested Theil decomposition method. Ann Reg Sci 37(1):55–77

Alesina AE, Spolaore (2003) The size of nations. MIT Press, Cambridge, MA

Alvaredo F, Atkinson AB, Blanchet T, Chancel L, Bauluz LE, Fisher-Post M, Yang L (2018) "World inequality database.". Retrieved from https://wid.world

Azzoni CR (2001) Economic growth and regional income inequality in Brazil. Ann Reg Sci 35(1):133–152

Bardhan PD, Mookherjee, (eds) (2006) Decentralization and local governance in developing countries: a comparative perspective. MIT Press, Cambridge, MA

Beramendi P (2012) The political geography of inequality: regions and redistribution. Cambridge University Press

Beramendi P, Boix C, Guinjoan M, Rogers M (2025) Distorted democracies. Technical report Princeton University

Beramendi PM, Rogers (2021) Disparate geography and the origins of tax capacity. review of international organizations 16:213–237

Beramendi PM, Rogers (2022) Geography, Capacity, and Inequality. Cambridge University Press

Beramendi PM, Rogers (2025) The curse of malapportionment. Duke University,(Technical report)

Blanchet T, Gethin LCA (2022) Why Is Europe More Equal than the United States? Am Econ J Appl Econ 14(4):480–518

Boadway RA, Shah, (eds) (2007) Intergovernmental fiscal transfers: principles and practice. World Bank, Washington, DC

Boadway R, Flatters, F (1982) Efficiency and equalization payments in a federal system of government: a synthesis and extension of recent results. Can J Econ 15(4):613–633

Boix C (2003) Democracy and redistribution. Cambridge University Press

Boix C (2015) Political order and inequality. Cambridge University Press

Bolton P, Roland, G (1997) The breakup of nations: a political economy analysis. Quart J Econ 112(4):1057–1090

Bonet J (2006) Fiscal decentralization and regional income disparities: evidence from the Colombian experience. Ann Reg Sci 40(3):661–676

Chancel L, Piketty T (2022) Emmanuel saez gabriel zucman. technical report world inequality lab (World Inequality Report 2022)

de la Fuente Á (2022) "Sobre el Sistema de Financiación Foral vasco y navarro: notas para un debate necesario." *Hacienda Pública Española / Review of Public Economics* 242(3):53–90. https://hpe-rpe.org/ief/222/242-3-2022/5071/sobre-el-sistema-de-financiacion-foral-vasco-y-navarro-notas-para-un-debate-necesario-2.pdf

Faguet J-P (2012) Decentralization and Popular Democracy: Governance from Below in Bolivia. University of Michigan Press, Ann Arbor

FAO (2012) Global Agro-ecological Zones (GAEZ v3. 0). IIASA, Laxenburg, Austria and FAO, Rome, Italy
Galor O, Vollrath OMD (2009) Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. Rev Econ Stud 76(1):143–179
Henderson JV, Squires T, Weil ASD (2018) The global distribution of economic activity: nature, history, and the role of trade. Q J Econ 133(1):357–406
Hooghe L, Marks G, Schakel AH, Chapman-Osterkatz S, Shair-Rosenfield SNS (2016) Measuring Regional Authority: A Postfunctionalist Theory of Governance, vol I. Oxford University Press, Oxford
Shair-Rosenfield S, Schakel AH, Niedzwiecki S, Marks G, Hooghe L, Chapman-Osterkatz S (2021) "Codebook RAI-MLG: Regional Authority Index (RAI v.3)." https://garymarks.web.unc.edu/wp-content/uploads/sites/13018/2021/02/Codebook-RAI-MLG.pdf
ISciences, LLC (2008) Elevation and Depth v2 2000. Dataset, ISciences LLC
Keen MM, Marchand (1997) Fiscal competition and the pattern of public spending. J Public Econ 66(1):33–53
Lee DW, Rogers MZ (2019) Interregional Inequality and the Dynamics of Government Spending. The J Polit 81(2):487–504
Marx KF, Engels (1848) Manifesto of the Communist Party. Communist League, London
Mendoza-González MÁ, Guerrero-Jiménez LQ-RA (2024) Regional per capita income inequality and fiscal policy in Mexico, 1989–2021. Ann Reg Sci 73(4):1681–1699
Mitchell TD, Jones PD (2005) An improved method of constructing a database of monthly climate observations and associated high-resolution grids. Int J Climatol 25(6):693–712
Nirola N, Choudhury SSA (2022) Fiscal decentralization, regional disparity, and the role of corruption. Ann Reg Sci 68(3):757–787
Novotný J (2007) On the measurement of regional inequality: does spatial dimension of income inequality matter? Ann Reg Sci 41(3):563–580
Oates WE (1972) Fiscal Federalism. Harcourt Brace Jovanovich, New York
Oates WE (1999) An Essay on Fiscal Federalism. J Econ Literat 37(3):1120–1149
Ong K-M, Mori YKK (2017) Malapportionment and democracy: A curvilinear relationship. Elect Stud 49:118–127
Persson T, Tabellini, G (1996) Federal fiscal constitutions: risk sharing and moral hazard. Econometrica 64(3):623–646
Piketty T (2014) Capital in the twenty-first century. Belknap Press
Piketty T, Saez, E (2003) Income inequality in the United States, 1913–1998. Q J Econ 118(1):1–41
Piketty T, Zucman ESG (2018) Distributional national accounts: methods and estimates for the United States. Q J Econ 133(2):553–609
Prichard W, Cobham A, Goodall A (2014) "The ICTD government revenue dataset."
Ramankutty N, Foley JA, McSweeney JNK (2002) The global distribution of cultivable lands: current patterns and sensitivity to possible climate change. Glob Ecol Biogeogr 11(5):377–392
Rodden JA (2006) Hamilton's Paradox: The Promise and Peril of Fiscal Federalism. Cambridge University Press, Cambridge
Rodden JA (2019) Why Cities Lose: The Deep Roots of the Urban-Rural Political Divide. Basic Books, New York
Rodden J, Eskeland GS, Litvack J (eds) (2003) Fiscal Decentralization and the Challenge of Hard Budget Constraints. MIT Press, Cambridge, MA
Rogers MZ (2015) The politics of place and the limits of redistribution. Routledge
Sachs JD (2003) Institutions don't rule: direct effects of geography on per capita income. National Bureau of Economic Research,(Technical report)
Sahadžić M (2018) "Constitutional asymmetry as a tool to manage diversity." *50 shades of Federalism*
Samuels D, Snyder, R (2001) The value of a vote: malapportionment in comparative perspective. British J Polit Sci 31(04):651–671
Shair-Rosenfield S, Schakel AH, Niedzwiecki S, Marks G, Hooghe L, Chapman-Osterkatz S (2020) "Codebook RAI-Country: Regional Authority Index (RAI v.3)." https://garymarks.web.unc.edu/wp-content/uploads/sites/13018/2021/02/RAI_country-codebook-1.pdf. Version November 23, 2020
Shipan CR, Volden C (2008) The Mechanisms of Policy Diffusion. Am J Polit Sci 52(4):840–857
Smart M (2007) Raising Taxes through Equalization. Can J Econ 40(4):1188–1212
Solt F (2009) Standardizing the world income inequality database*. Soc Sci Q 90(2):231–242

Tsebelis G (2002) Veto Players: How Political Institutions Work. Princeton University Press and Russell Sage Foundation, Princeton, NJ

UEA-CRU, Jones P, I Harris et al (2013) "CRU TS3. 21: Climatic Research Unit (CRU) Time-Series (TS) version 3.21 of high resolution gridded data of month-by-month variation in climate (Jan. 1901–Dec. 2012)." *NCAS British Atmospheric Data Centre*. http://catalogue.ceda.ac.uk/uuid/2949a8a25b375c9e323c53f6b6cb2a3a

Volden C (2006) States as Policy Laboratories: Emulating Success in the Children's Health Insurance Program. Am J Polit Sci 50(2):294–312

Watts RL (2008) Comparing Federal Systems, 3rd edn. McGill-Queen's University Press, Montreal and Kingston

Willmott CJK, Matsuura (2012) Terrestrial Precipitation: 1900–2010 Gridded Monthly Time Series (V 3.02). Center for Climatic Research, Department of Geography, University of Delaware, Newark

Wilson JD (1999) Theories of Tax Competition. Natl Tax J 52(2):269–304

Zabalza A, López-Laborda, J (2017) The uneasy coexistence of the Spanish foral and common regional finance systems. Invest Reg- J Regional Res 37:119–152

Zodrow GR, Mieszkowski P (1986) Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods. J Urban Econ 19(3):356–370

Zuber CI (2011) Understanding the Multinational Game: Toward a Theory of Asymmetrical Federalism. Comp Pol Stud 44(5):546–571

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.