Economic Geography, Industrialization, and Redistribution: Malapportionment as Compensation*

Pablo Beramendi[†] Soomin Oh[‡] Melissa Rogers[§]

Abstract

Uneven economic geography leads some sub-national regions to pull ahead of the rest of the country in terms of economic productivity and development. Divergence in sub-national productivity then creates the potential for distributive conflict amongst regions in that nation's central government. These distributive conflicts guide choices about the formation of political institutions for central allocation. We argue that legislative malapportionment is one such institution that is designed to solidify political bargains around centralized redistribution to the satisfaction of both urban and rural elites. Using new data on legislative malapportionment and economic geography, we demonstrate a clear link between uneven economic geography, the over-representation of less productive regions, high levels of inter-regional distribution, and feeble centralized attempts to reduce economic inequality.

Preliminary Draft. Comments Welcome

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[†]Duke University; pb45@duke.edu

[‡]Duke University; soo.min.oh@duke.edu

[§]Claremont Graduate University; melissa.rogers@cgu.edu

1 Introduction

Legislative malapportionment is the over-representation of less populated geographic districts. These districts are in many cases less populated due to limited economic opportunity. Therefore, malapportionment tends to favor geographic areas with limited economic opportunity, providing a greater voice for those areas in the decision-making of the central government.

The choice to endow the less-populated regions with greater voting power is both a founding principle, and a dynamic characteristic of nations that are becoming increasingly agglomerated, such as the USA. In certain regards the decision to endow ostensibly weak geographic areas is surprising. If rules are made by the powerful, why would the well-endowed geographic areas and economic sectors weight their voting systems toward the economically weak?

Previous research has attributed this either to a foundational distributional agreement to ensure the support of the less populated regions for the union (as is often considered the case for upper house apportionment), or the decision of conservative elites to keep the votes out of cities where political opposition to the status quo is stronger (Samuels and Snyder, 2001, Calvo and Murillo, 2004, Boone and Wahman, 2015, Pepinsky, 2014, Ardanaz and Scartascini, 2013).

The aim of this paper is to explore the conditions that make malapportionment (and other institutions that favor the less populated regions) likely to emerge as an institutional solution to distributional conflict, and to see the long-run effect of those institutional arrangements. In particular, we argue that malapportionment is likely to have been chosen when countries have uneven economic endowments, both in quality of land for agriculture and access to trade, across the geography of the nation. We argue, consistent with related literature, that the apportionment decision is a credible commitment to the less populated regions to deliver them resources from the central government in exchange for their support for the economic policies preferred by elites in the most populated regions (Gibson and Calvo, 2000). Our analysis predicts levels of upper and lower house malapportionment with measures of sub-national variation in economic geography and then uses economic geography variables as instruments for malapportionment to predict levels of government redistribution and horizontal transfers. We also test whether economic geography has a direct or mediated (through malapportionment) effect on redistribution.

We take steps to elucidate the mechanisms through which the malapportionment coalitional bargain plays out. We demonstrate that malapportioned political institutions deliver low levels of redistributive effort to reduce inequality among individuals and high horizontal resources to less populated regions without clear regard for progressive regional development. These horizontal transfers to regions do not simply represent decentralized efforts to reduce inequality. On the contrary, we argue that these transfers represent national elite efforts to limit redistribution by shifting resources to elites in less developed regions in exchange for supporting policies that keep resources in the hands of elites throughout the country (Beramendi et al., 2017). It is non-urban transfers that further urban bias, whether in trade, monetary, or welfare policies. We test these propositions with region level data, showing the higher malapportionment is associated with more uneven redistributive effort across the territory, and that higher representation and higher transfers are not associated with greater redistributive effort within that region. In fact, more transfers appear to be linked to lower redistribution.

Our paper speaks most directly to research identifying legislative malapportionment as a common phenomenon (Samuels and Snyder, 2001) with important distributive implications (Ardanaz and Scartascini, 2013, Gibson and Calvo, 2000, Albertus and Menaldo, 2014). We also see our research in the broader literature that views malapportionment as a tool to manipulate elections in favor of elites (Birch, 2011, Norris, 2014, Schedler, 2013, Pepinsky, 2014, Boone and Wahman, 2015), but with a specific focus on elite preferences in opposition to redistribution (Bruhn et al., 2010).

We distinguish our work from other contributions in several ways. First, we explicitly theorize about and measure the economic geography origins of malapportionment. We bring new economic geography data to these questions and offer an instrumental variables approach and mediation analysis to address concerns that malapporionment is endogenous to the distributive outcomes we examine. We focus specifically on a political geography story of coalition-building, which we see as fundamentally intertwined with the class-based story told in related research (Ardanaz and Scartascini, 2013). We test these phenomena with global data, sub-national data, and, unlike most of the literature, focus on both upper and lower house malapportionment to represent bargains across elites from different regions and economic sectors of their countries. Finally, we integrate research on the distortionary nature of inter-regional transfers as central to the malapportionment bargain (Rodden and Wibbels, 2002).

The paper is organized as follows. First we describe how uneven economic endowments across the geography of the nation might be theoretically linked to conflict over distribution by the central government. Second, we consider how elites from regions with very different endowments might overcome their disagreements to form a coalition. We suggest malapportionment and other region-enhancing institutions enable elite coalitions to be credible in the long-run. Third, we describe our empirical predictions and how we aim to test these hypotheses, given data limitations and concerns with endogeneity. Next, we describe our data and modeling approach, and offer preliminary results. We show a range of robustness tests in our Online Appendix. Finally, we consider alternative explanations to our theory and alternative interpretations of our results. We add some ideas we have to improve the paper moving forward.

2 Geography, Class, and Industrialization

Economic agglomeration and variation in economic activity across space is an important, enduring feature of nations (Henderson et al., 2017, Krugman, 1991). Uneven economic geography leads some sub-national regions to pull ahead of the rest of the country in terms of economic productivity and development. Disparate sub-national economic geography predicts long-term divergence in sub-national economic productivity (Beramendi and Rogers, 2018). Importantly, for our analysis, legislative malapportionment is built upon uneven economic geography by design.

In most research on legislative malapportionment, the conditions that make legislative malapportionment possible, economic geography and associated spatial population distributions, are not explicitly considered. Legislative malapportionment is examined as an independent variable for its distortionary effects on electoral or distributive outcomes. Yet, the origin of legislative malapportionment in uneven economic geography that drives population distributions and mobility toward productive regions is crucial to understand what elites in productive regions and elites in less productive regions expect to get in their coalitional bargains. Specifically, we view legislative malapportionment to be an institutional tool to trade votes for inter-regional transfers to less-populated sub-national regions.

We theorize malapportionment as one among several possible solutions to political struggles over redistribution. In any given policy arena, divergence in sub-national productivity creates the potential for distributive conflict, due to different needs and policy preferences, among regions in that nation's central government. Redistribution can be organized along class (interpersonal, from rich to poor citizens) or geographic lines (interregional, from rich to poor regions) (Bolton and Roland, 1997, Beramendi, 2012). We argue that the skew in economic geography, that is the distance between regions in terms of income and productivity, determines the relative balance between these two dimensions. As the skew increases, the relative importance of geography relative to class as a principle governing redistribution also increases. Indeed, uneven sub-national economic geography and productivity predict lower central tax collection, general tax collection, government consumption, government spending, and redistributive benefits targeted to individuals as sub-national regions fail to agree to delegate these resources and responsibilities to the central government (Beramendi and Rogers, 2018, Lee and Rogers, 2019). In the context of these conflicts, malapportionment emerges as a solution to overcome potential commitment problems between elites in high productivity and low productivity regions. As Gordin (2007) suggests, other institutions such as electoral colleges, bicameralism (Grazzini and Petretto, 2015), senates elected by state legislatures, region-based party selection and control, variation in district magnitude (Calvo and Murillo, 2004), sub-unit proliferation (Gottlieb et al., 2019) are other ways to give political voice to regional elites. We focus on malapportionment as a clear example of regional overrepresentation, and one that we find most commonly in developing nations.

The intensity of these conflicts is particularly high in countries where the patterns of industrialization reinforce the concentration of economic productivity in a few locations. Through increasing returns, the degree of concentration of economic activity shapes the level of heterogeneity among the elites, and the playing field in terms of political and economic preferences. At the extreme, a concentrated economic geography implies that most economic activity revolves around one sector of activity, say in our case agriculture (in the context of the transition from traditional to modern societies). In this situation, economic production within the country tends to be dominated by a few economic poles within the same sector of production, yielding high levels of elite homogeneity.[1] This concentration of activity isolates the gains of industrialization to a relatively small part of the nation, and leaves the rest behind. By contrast, a dispersed economic geography implies that economic activity is articulated around several poles both sectorally (agriculture versus manufacturing) and territorially.[2] Elites are as a result more heterogeneous and polarized more around class lines than they are along territorial lines.

The intensification of conflicts over redistribution presents important challenges to economic elites throughout the country. To the extent that redistribution requires empowering the state relative to local elites, the latter will try to limit it either by preventing its development in the first place or by pursuing a system of representation that privileges their voice over that of potential alternative majorities.

These distributive conflicts guide choices about the formation of political institutions for central allocation. The first option to overcome disagreement is to engage in ad hoc bargaining on an issue by issue basis for elites in rich and poor regions to get what they want. In the context of unforeseen future circumstances and incomplete contracts, elites across regions face significant commitment and coordination problems. The better long-term approach, therefore, is to create a durable, credible solution to the distributive conflict via political institutions (Gottlieb et al., 2019).

For the elites in less productive, less populated regions, failure to coordinate at the central level would result in low levels of transfers from the productive regions to their own regions. They also may be concerned that more powerful elites in other parts of the country renege from previous agreements in the future. For the elites in more productive regions, they may be concerned both that: 1) poor regions will demand too much from the rich regions or will

[1] Argentina provides a reasonable country case example of this process at work. Argentinas economy has historically (and currently) relied primarily on the export of primary products (wheat, beef, recently soy). Early market investments were primarily foreign (British) and were in railroads to deliver products to market. Argentinas early railroad system reflected its concentrated economic geography. The railroad system had only one hub (Buenos Aires) and all spokes radiate out from the port city and its surrounding agricultural land. As land grew scarcer in the late 19th century, rural elites diversified their portfolios to include manufacturing and financial sector activities (Sábato, 1988). This process of industrialization focused primarily on building industries and financial activities that supported the rural economy (Hora, 2002). The industrialization process in this country was shaped by rural elites.

[2] In terms of our measures at use later in the paper, more concentration leads to more inter-regional inequality (and vice versa). Henderson et al. (2017) document the relative deconcentration of economic activity in early industrializers due to their urbanization and development prior to dramatic fall of transportation costs in the last century.

block economic policies beneficial to the rich regions; and 2) if the voting power is placed in the hands of the rich regions populated with workers, leftist constituencies will hold sway, leading to excessive redistribution to poor individuals. Under these conditions, elites in populated, productive regions may look for a solution to advance their policy interests while limiting the overall distributive impact on themselves. Malapportionment provides such a solution.

We argue that legislative malapportionment is one institution that is designed to solidify political bargains over centralized redistribution. What is important about malapportionment is that it is credible to the weakest parties in the agreement, the least productive regions. These provinces, while typically more numerous than the highly productive regions nonetheless have a weaker bargaining position. The most productive regions control the economic production and related government revenue of the state. To provide the weaker regions with anything short of a credible bargaining position would leave less productive regions vulnerable to manipulation by the stronger regions, with their greater access to revenue, capital, and trading ports.

From the perspective of elites in rich regions that seek low redistribution and economic prosperity for their regions, malapportionment is a feasible, yet not ideal, solution. The first problem for rich regions (poor regions want too much and will block their policies) may be solved with proportional representation of individuals. However, proportional representation invokes the second problem (demands by the left or other opposition groups) by placing votes predominantly in the hands of middle and lower income individuals across all regions that may seek higher levels of government services and income protection than preferred by elites.

Essentially, we argue that a cross-regional coalition of elites throughout the country is seen as preferable to a cross-class coalition from the perspective of the elites in the most productive regions (Beramendi et al., 2017). The alignment of preferences of elites throughout the country comes in the malapportionment bargain whereby elites in underperforming regions gain disproportionate (conservative) voice that is used to constrain broadly redistributive policies. Their voice is also used to support (or at least not block) economic policies preferred by elites in the productive regions (such as open trade policies) that do not benefit the less productive regions directly. These exchanges are compensated with higher (than their population share would justify) inter-regional transfers (Gibson and Calvo, 2000). In this sense we think of malapportionment as a compensation from highly productive to lagging regions, one that privileges geography over class in the design of redistribution.

The long-term lock-in of the malapportionment bargain may be seen in several ways. First, legislative malapportionment remains in a large percentage of nations despite widespread recognition of its distortionary effects on policy. Indeed, with growing agglomeration associated with industrialization, malapportionment has only grown in most cases.[3] This is particularly true of late industrialization, where agglomeration is more pronounced (Henderson et al., 2017). Second, malapportioned nations spend higher amounts on inter-regional transfers than more evenly apportioned nations (Beramendi et al., 2017). Third, malapportioned countries have been shown to have weak redistributive policies (both tax and expenditure), controlling for other factors (Ardanaz and Scartascini, 2013).

2.1 The Distributive Implications

Following a long line of research, we anticipate that legislative malapportionment is associated with lower redistribution across the country. We expect this as the foundational condition of the bargain (i.e., rich regions would not have agreed to malapportionment if they were not gaining something tangible from it). The major benefit would come from limitation of taxes and redistribution that would be draw disproportionately from the rich, especially urban, economies.

The position of inter-regional transfers in this malapportionment bargain has not commonly been seen as a bargaining chip for the urban economy (or at least the elite urban economy) to gain in policy terms from a rural-biased policy-making process.[4] We make this argument explicitly, urban bias in policy requires non-urban transfers. This must be part of

[3]Bhavnani (2018, p.71) show this with cross-national data. “Frequently, differential growth occurs as people migrate from many rural areas to few urban areas. In other instances, it may occur as people migrate from old industrial cities to fewer, more dynamic ones. The concentration of people in relatively few areas tends to create more relatively underpopulated areas and fewer overpopulated areas. Cross-national data corroborate this claim. Using data on a broad cross-section of seventy-six countries between 1832 and 2013, Appendix Figure 1 shows that the proportion of overrepresented districts exceeded the proportion of under-represented districts in 64 per cent of country-years, and further that the proportion of over-represented districts was increasing in mean country-level malapportionment: 89 per cent of country-years with above-average malapportionment had more over-represented than under-represented districts.”

[4]The major exception is Gibson and Calvo (2000), who describe the transfer of resources from urban to rural elites to buy votes for privatization in Argentina. Both inter-regional transfers and maintained levels of public employment sustained rural votes for austerity to the detriment of workers, principally in urban agglomerates.

the character of malapportioned regimes that have nonetheless strong urban bias, to help to explain the disconnect between representation and outcomes.

In our argument, inter-regional transfers are central to the malapportionment bargain because they incentivize the less populated regions to accept policies inimical to their regions' interests. These policies include weak or regressive efforts to reduce economic inequality and policies that benefit the economic sectors of the productive regions, but not their own.

Interregional transfers may be considered neutral from a redistributive standpoint. In theory, money spent at the sub-national level could be spent just as well or better than resources allocated from the center. Research emerging on fiscal federalism and inter-regional transfers, however, suggests that resources transferred from the center tend to have pernicious effects on national and sub-national budgets (Rodden and Wibbels, 2002) and may preclude more serious effects to improve the economic circumstances of poor regions (Wibbels, 2005). These resources are commonly used to benefit local elites through clientelism or political spending to bolster incumbents (Gervasoni, 2010). Along the lines of this research, we expect that inter-regional transfers, which tend to be more abundant in malapportioned countries, may not have principally redistributive effects to increase the economic position of the least well off and to reduce poverty. If we see, for example, that higher levels of resources are associated with no redistributive or negative redistributive effect, we might interpret the effects of this spending in elite pay-off and clientelistic terms, rather than redistributive in nature.

Sawers (1996, 245) describes the outcome of this process in Argentina is money in the hands of elites in less productive regions through the inter-regional transfers scheme "Coparticipation":

> In 1900, when federal assistance was minimal, the most advanced provinces (Buenos Aires, Córdoba, Santa Fé, and Mendoza) spent five times per capita what the most backward provinces spent (La Rioja, Catamarca, Corrientes, Jujuy, Misiones, Chaco, Santiago, and Formosa). By 1960, they were spending roughly the same amount per capita. By the mid–1980s, the poorest provinces were spending almost twice what the most prosperous provinces spent on each citizen.

Research on the topic has shown that this spending in the least productive regions of Argentina has not had a meaningful impact to reduce provincial disparities in productivity and income, or meaningfully reduce income inequality across the nation and is associated with political control held by provincial incumbents (Gervasoni, 2010, Díaz-Cayeros, 2006, Beramendi et al., 2017).

3 Empirical Predictions

Our argument leads to three primary empirical predictions that we examine in our statistical analysis:

H1: Uneven economic geography predicts malapportioned political institutions.

H2: Malapportioned political institutions are associated with lower economic redistribution.

H3: Malapportioned political institutions deliver higher horizontal transfers to better represented sub-national regions. Higher representation and horizontal transfers are not associated with higher redistributive effort at the regional level.

4 Empirical Approach

Our empirical set up involves three distinct dependent variables: malapportionment, government redistribution to reduce income inequality, and inter-regional government transfers. We model each separately.

A primary concern in our empirical analysis is the endogeneity of malapportionment and redistribution (both efforts to reduce interpersonal inequality and inter-regional transfers) that is the central feature of our argument. To address endogeneity, we first predict malapportionment with exogenous measures of variation in economic geography across the country, then we use those exogenous measures as instruments for malapportionment in our models of government redistribution and inter-regional transfers. Yet we also recognize that instrumental variables analysis has limitations, especially regarding the extent to which we can claim that the distribution of economic geography does not have a direct effect on redistribution. We thus apply mediation analysis to our models in H2, to explicitly account for the multiple paths of causality. We also take additional steps to demonstrate robustness in each model.

Our models are structured as follows. Because our malapportionment and economic geography data is static, we take a cross-sectional approach to our first two hypotheses and part of H3. We employ panel data in the regional redistribution model in H3.

4.1 H1: Explaining Malapportionment

Our first hypothesis is that uneven economic geography, in terms of access to trade and land suitability for agriculture, is associated with malapportioned political institutions.

$$M_i = \alpha + \beta T_i + \beta L_i + \gamma' \mathbf{X_i} + \epsilon_i, \tag{1}$$

where i indexes each country. M_i is one of our measures of malapportionment (lower house, upper house). T_i is our measures of sub-national variation in access to trade (distance to the coast). L_i is our measures of sub-national variation in land suitability for agriculture. $\mathbf{X_i}$ is a vector of controls for observable characteristics: federalism, single-member electoral districts, land-holding inequality, and inter-personal inequality. $\epsilon_{i,g}$ is a random error term. All standard errors are robust.

4.2 H2: Explaining Redistribution

Our second hypothesis is that malappportioned political institutions explain lower economic redistribution, as malapportionment is used as a bargain to gain disproportionate conservative voice used to constrain broad redistributive policies in underperforming regions.

First we predict redistribution directly with endogenous measures of malapportionment:

$$R_i = \alpha + \beta M_i + \mu_i + \lambda_t + \gamma' \mathbf{X_i} + \epsilon_i, \tag{2}$$

where i indexes each country. R_i is our interpersonal redistribution. M_i is one our measures of malapportionment. $\mathbf{X_i}$ is a vector of controls for observable characteristics: economic development, leftist control of government, and trade openness. $\epsilon_{i,g}$ is a random error term. All standard errors are robust.

Next we use our measures of sub-national variation in economic geography to instrument for the malapportionment measures to predict government redistribution. M_i is replaced with our measures of sub-national variation in trade access and land suitability for agriculture in a two-staged least squares approach. While national levels of economic endowments (such as agricultural suitability or access to trade) may be directly associated with redistribution in theory, the *sub-national variation* in economic geography only plausibly connects to redistribution through the mechanism we emphasize: conflict over centralization.

Economic geography likely has a direct effect on the level redistribution and an indirect effect, flowing through its codification in malapportionment. Accordingly, we employ mediation analysis to assess the overall, direct, and indirect relationship between these variables (Imai et al., 2010, Hicks and Tingley, 2012). Mediation analysis also helps us to evaluate the exclusion restriction of our instruments in the two-staged least squared regressions.

4.3 H3: Explaining Transfers to Over-Represented Regions and Regional Redistribution

Our third hypothesis is that malapportioned political institutions deliver higher horizontal transfers to less populated sub-national regions. We then demonstrate that these higher level of resources are not associated with greater efforts to reduce inequality. That this, we do not see those transfers improve the economic condition of people in the poorer regions that should ostensibly benefit from transfers.

We test H3 using two existing sub-national datasets featuring measures of apportionment and inter-regional transfers (Dragu and Rodden, 2011, Galiani et al., 2016). Similar to H2, we predict inter-regional transfers directly with endogenous measures of sub-national representation, and then instrument for representation using economic geography characteristics of the region.

$$T_i = \alpha + \beta A_i + \mu_i + \lambda_t + \gamma' \mathbf{X_i} + \epsilon_i, \tag{3}$$

where i indexes each sub-national region. T_i is inter-regional transfers. A_i is a measure of representation of the sub-national region relative to the representation of other regions. $\mathbf{X_i}$ is a vector of controls for observable characteristics: provincial wealth, province size, distance to the capital, and political ties to the president (in the case of Argentina). $\epsilon_{i,g}$ is a random error term. All standard errors are robust.

Next we use our measures of sub-national economic geography to instrument for representation. A_i is replaced with a measure of sub-national land suitability for agriculture in the neighboring region in a two-staged least squares approach. We first show that transfers are higher to malapportioned regions, then we show that those regions do not make better efforts to reduce economic inequality.

$$R_i = \alpha + \beta A_i + \mu_i + \lambda_t + \gamma' \mathbf{X_i} + \epsilon_i, \tag{4}$$

where i indexes each sub-national region. R_i is the relative economic redistribution within that region. A_i is a measure of representation of the sub-national region relative to the representation of other regions. $\mathbf{X_i}$ is a vector of controls for observable characteristics: provincial wealth, province size, distance to the capital, and political ties to the president (in the case of Argentina). $\epsilon_{i,g}$ is a random error term. All standard errors are robust.

We also demonstrate that higher levels of malapportionment are linked to more uneven regional redistribution across the nation.

5 Operationalization

5.1 Dependent Variables

Malapportionment

We employ three measures of legislative malapportionment: lower house malapportionment (Ong et al., 2017), upper house malapportionment (Samuels and Snyder, 2001), and combined malapportionment. The formula for malapportionment is as follows:

$$MAL = (1/2)\Sigma|S - v| \tag{5}$$

where S is the percentage of all seats allocated to district i and v is the percentage of the overall population (or registered voters) belonging to district i. Each variable uses the natural log because the value of malapportionment is skewed to the right.

Upper legislative houses exist in a small percentage of nations, so our models with upper house malapportionment suffer from very small sample sizes.

To test H3, we rely on measures of sub-national representation from Dragu and Rodden (2011) and Galiani et al. (2016). Representation in both datasets refers to a sub-national regions number of legislative seats per capita relative to the total number of seats per capita in the country.

Government Redistribution

To measure inter-personal redistribution, we employ the "relative redistribution" measure from Solt (2009) v.6.2. This measure captures the change in the Gini coefficient of income inequality before (market gini) and after (disposable gini) government tax and transfer policies, divided by the market gini.

$$\frac{Gini\ Market - Gini\ Disposable}{Gini\ Market} * 100 \tag{6}$$

The denominator helps to account for relative changes in the redistributive strategy, acknowledging that increasing redistribution in advanced welfare states with high levels of redistribution is substantively different from increasing redistribution from the lowest levels. We also show our results with Solt's measure of absolute inter-personal redistribution, measured as the change in the Gini coefficient of income inequality before (market Gini) and after (disposable gini) government tax and transfer policies in our Online Appendix.

In our test of linking inter-regional transfers to (weaker) region-specific redistribution, we also apply the relative redistribution concept. We measure these data at the regional unit available from the Luxembourg Income Study (LIS), typically this is the first administrative unit (state, province, NUTS2). We discuss unit selection in more detail below in Section 5.2. We calculate within that region the difference between the market and disposable income inequality. We use these data at the regional level, and as a national coefficient of variation in regional redistribution.

Inter-regional Transfers

To test the link between malapportionment and inter-regional transfers, we employ two datasets at the sub-national level, Dragu and Rodden (2011) and Galiani et al. (2016). Dragu and Rodden (2011) has a cross-national sample of nine federations. Galiani et al. (2016) has a time-series panel of Argentina's provinces (1935-2011).[5] Both datasets calculate a relative share of the sub-national region's transfers per capita (i.e., transfer per capita in that region/transfers per capita in the nation). For Dragu and Rodden, we employ both the cross-section and panel versions of their data.

5.2 Economic Geography

We expect malapportionment to emerge as a coalitional solution to overcome sub-national variation in economic productivity. We measure variation in economic geography using

[5] We only use a sub-sample of their data, 1960-2011, due to availability of the food price index used in the instrumental variables analysis.

coefficients of variation in two main areas: trade access at the sub-national level (distance to the coast, distance to natural harbors, distance to large lakes, and distance to navigable rivers), and soil and climate conditions conducive to agriculture (precipitation, elevation, length of the growing period, land suitability for agriculture) (Sachs, 2003). We focus, in particular, on two variables, regional variation distance to the coast, to capture trade access, and regional variation in the length of the growing period, to capture agricultural suitability.

We transformed data from Henderson et al. (2017) to construct measures of sub-national variation in trade access and agricultural suitability. We fit their data to the first administrative level "GEOLEV1" using GIS to calculate coefficients of variation for these economic geography measures.

We utilize the first-level administrative region as our sub-national 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. Of course, other sub-national 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 because it most closely matches the electoral region.

In our Online Appendix, we follow Galor et al. (2009) to conduct a principal components analysis to construct component variables usable in our regressions.[6] *Trade Access* and *Agricultural suitability* variables are in many cases highly correlated, which may impact the estimates in our analysis, and provide "redundant" information to capture agricultural suitability. In this circumstance, principal components analysis can provide summary indi-

[6]See summary statistics and components loadings from our PCA in Appendix 4.

cators that capture the commonalities between the indicators with variables constructed to be uncorrelated between components (Abdi and Williams, 2010). Our results show that the majority of the variance can be explained with three component variables for *Trade Access* and one component for *Agricultural Suitability*. The first component of trade access picks up mainly variation associated with the access to international trade routes (distance to coast and distance to natural harbor), the second component picks up domestic trade options (distance to big lake, distance to big river), and the third component picks up internal trade on large lakes. The most predictive agricultural suitability measure is the first component, which picks up variation associated with soil quality (land suitability for agriculture and length of the growing period). Online Appendix 4 provides descriptive statistics and results of the principal components analysis. The results of the PCA are highly similar to our results featuring distance to the coast and length of the growing period.

In our emphasis on consistency for our regional unit, we may mischaracterize the importance of the first administrative level in particular cases. In some countries, for example, the first administrative level is not a meaningful geographic unit for elections, or may not serve a functional purpose for substantive policy administration. We consider such cases to represent data error that biases against our empirical results. We also show the results for our main tables at the second administrative level (GEOLEV2) to demonstrate that our results do not depend on our choice on sub-national unit.

A second issue, discussed in more detail below, is that administrative regions may themselves be endogenous to economic geography (Beramendi et al., 2018), decentralization, or other attributes that may affect preferences for centralization, such as ethnicity (Michalopoulos and Papaioannou, 2013a,b). We address this concern by replacing our measures of variation in trade access and agricultural suitability calculated at "random" borders defined by grid cells.

5.3 Control Variables

The vectors $\mathbf{X_{i,t-1}}$ includes controls for federalism, proportional representation, income inequality, per capita income, partisan control of government, per capita income, and international trade. We employ the "state" and "PR" indicators from the Database of Political Institutions to account for federalism and proportional representation, respectfully. We control for income inequality with the Solt (2009) disposable and market gini indicators (except where these serve as dependent variables). To account for the potential role of partisanship, we include a binary variable that equals 1 for each year that a country has a leftist head of government according to Brambor and Lindvall (2017).[7] To account for the possibility that the overall level and progressivity of taxation may depend on a country's level of economic development, we include GDP per capita from the World Development Indicators. Our trade openness measure comes from the World Development Indicators. Note that most of the controls for interstate warfare, partisan control of government, and per capita income are "bad controls" (Angrist and Pischke, 2009) in the sense that they themselves could (at least in part) be outcomes of malapportionment. For this reason, we will show the results both without and with them.

6 Results

6.1 Uneven Geography Predicts Malapportionment

The first of our three empirical implications of our argument is tested in Table 1. In models M1-M3 we predict lower house malapportionment and models M4-M6 predict upper house malapportionment. For each dependent variable, we show the results with only the association between our economic geography variables (regional variation in distance to the coast and length of the growing period) in the first models (M1, M2, M4, M5) and add covariates (federalism, proportional representation, income inequality) in the second models (M3, M6). Each model shows a strong association between our measures of variation in trade access and agricultural suitability and the measures of malapportionment. The results are not sensitive to excluding or including any particular economic geography component variable. We also show similar results across a range of alternative measures of agricultural suitability and a principal component analysis with trade and agricultural suitability variables in Appendix Section X.

The associations between sub-national variation in economic geography and the measures of malapportionment in Table 1 provide preliminary evidence of the roots in economic geography of this institutional choice. Interestingly, trade access variables appear to be stronger predictors of lower house malapportionment and agricultural suitability indicators

[7]Specifically, this variable equals 1 if the variable *hogideo* takes the value "L."

Table 1: Predicting Legislative Malapportionment

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Dependent variable:	**ln(Lower House Mal)**			**ln(Upper House Mal)**		
Distance to Coast (COV)	0.542***		0.793***	1.304*		0.275
	(0.119)		(0.187)	(0.753)		(1.043)
Length of Growing Period (COV)		0.421*	0.156		2.476***	2.045**
		(0.253)	(0.293)		(0.694)	(0.851)
Federalism			0.001*			0.535
			(0.000)			(0.414)
Proportional Representation			-0.001***			-0.001
			(0.000)			(0.001)
Income Inequality			0.026***			0.028*
			(0.009)			(0.015)
Observations	194	199	128	30	30	21
R-squared	0.079	0.009	0.294	0.137	0.295	0.420
Controls	No	No	Yes	No	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Distance to the Coast and Length of the Growing Period are coefficients of variation in district averages measured the GEOLEV1. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

are more closely associated with upper house apportionment.[8] Typically, apportionment decisions for the upper house are constitutional and thus do not change often. Lower house apportionment, on the other hand, may be subject to frequent change in response to available demographic information. We suggest that trade access, which is a more recent source of productivity for most nations, and one that is more sensitive to changes in technology and transportation costs (Henderson et al., 2017), is more likely to affect the lower house apportionment as it became clear that trade access would be the main economic driver for many regions. Agricultural suitability is a long-running economic driver that would have been present at the constitutional founding.[9]

The strong association between variation and economic geography and malapportionment also lay the foundation for our instrumental variables analysis in the next two sections.

6.2 Malapportionment Predicts Lower Redistribution

In this section we provide evidence that malapportionment is associated with the outcome that we believe to be at the center of the institutional bargain: low redistribution. To do so, we analyze the data in two steps. First, we directly predict government redistribution to reduce inequality with the measures of malapportionment using OLS with and without covariates in Table 2. Our theoretical claim is that malapportionment is endogenous to concerns over redistribution, however, so this analysis can only provide limited support for our claims. In Table 3 we attempt to address the endogeneity concern with an instrumental variables approach in which we use our economic geography variation indicators as instruments for malapportionment.

In Table 2 we show, consistent with Ardanaz and Scartascini (2013) and Beramendi et al. (2017), that legislative malapportionment is associated with lower redistributive effort.[10] Both measures of malapportionment are strongly associated with significantly lower redistribution and the results hold when controlling for common predictors of redistribution: per capita income, leftist control of government, and trade openness.

[8]See models with additional measures of trade access and agricultural suitability in Appendix 3.1

[9]The interaction term between trade access and agricultural suitability is negative while both constituent terms are negatively and significantly related to all three malapportionment measures, suggesting if a nation has both high variation in trade access and high variation in agricultural suitability, malapportionment may be lower than with either individual condition alone.

[10]Ardanaz and Scartascini (2013) measures redistribution indirectly through income tax collection, Beramendi et al. (2017) use the same measures of redistribution that we employ.

Table 2: Predicting Redistribution with Malapportionment (Endogenous)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:		**Relative Redistribution**		
ln(Lower House Malapportionment)	-0.137***	-0.074***		
	(0.020)	(0.021)		
ln(Upper House Malapportionment)			-0.156***	-0.100**
			(0.039)	(0.043)
ln(GDP per capita)		0.078***		0.133***
		(0.013)		(0.024)
Left Government		0.268*		-0.062
		(0.149)		(0.140)
Trade Openness		0.006		0.071
		(0.029)		(0.068)
Observations	199	149	30	21
R-squared	0.224	0.502	0.325	0.694
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

Table 3: Predicting Redistribution with Malapportionment (IV Estimation)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Relative Redistribution**			
ln(Lower House Mal) (Instrumented)	-0.194***	-0.238***		
	(0.058)	(0.060)		
ln(Upper House Mal) (Instrumented)			-0.366***	-0.273***
			(0.081)	(0.091)
ln(GDP per capita)		0.049**		0.133***
		(0.020)		(0.037)
Left Government		0.253		-0.003
		(0.169)		(0.252)
Trade Openness		0.036		-0.047
		(0.040)		(0.065)
Observations	186	138	30	21
Controls	No	Yes	No	Yes
Stock-Yogo Weak ID	16.38	16.38	16.38	16.38
First Stage F Statistic	23.390***	29.490***	12.740***	7.320**
Kleibergen-Paap LM Statistic	16.004***	16.335***	8.882**	5.182**
Hanson J Statistic (p value)	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. First stage results shown in the Appendix. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Agricultural Suitability*. Clustered standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.10$

In Table 3 we employ our economic geography variables to instrument for malapportionment to predict redistribution in a two-stage least squares analysis. Similar to Table 2 we find that the three measures of malapportionment are associated with significantly lower redistribution. The results are robust when including covariates and additional specifications (described in Section 7). In general, the instruments perform reasonably. The first stage F statistic is always significant and in most cases greater than 10 (the common standard for strength). The first stage results are shown in Appendix 5.1 and are always significant predictors of the malapportionment variables. The inflation in the coefficients relate to their base specification in Table 2 (especially the small sample upper house malapportionment) suggest that the direction and significance of the regression output can be assessed with more confidence than the size of the effect. Nonetheless, the consistency of the result suggests that malapportionment is negatively and significantly associated with redistribution.

6.3 Mediation Analysis

One concern with our instrumental variables approach is that economic geography may directly affect redistribution, thus our instruments would violate the exclusion restriction. Economic geography is known to be related to the economic structure of nations, and thus their incentives to invest in public goods as well as the strength of societal support for redistribution. In particular, a high percentage of agricultural production in the economy is associated with lower redistribution. Previous research has not identified a clear casual link between the geographic distribution of economic geography and redistribution. Our argument suggests that economic geography may impact the selection of political institutions that are decisive in redistributive policies. This is the theoretical link that we suggest ties the coefficient of variation in economic geography to malapportionment and provides our motivation to treat it as an instrument for malapportionment. This argument also implies a mediated effect of economic geography on redistribution that flows through malapportionment. In this section we test for the possibility of both direct and indirect relationships between economic geography on redistribution through mediation analysis.

Mediation analysis uses structural equation modeling to estimate direct and mediated effects. In Table 4 we present the results for lower house and upper house malapportionment. These results, first of all, reinforce the evidence presented in the previous section that uneven economic geography and legislative malapportionment are associated with significantly lower redistributive effort. The extent of mediation differs between the specific geography variables. For trade access, the entire effect appears to flow through legislative malapportionment. There is not a significant direct relationship between variation in trade access and redistribution once its connection to malapportionment is accounted for in the models for both lower house and upper house malapportionment. In the models for agricultural suitability, on the other hand, the relationship between variation in agricultural suitability and redistributive effort does not appear to be mediated through lower house malapportionment but flow directly. These result appears to correspond with the close linkage between variation in trade access and lower house malapportionment, and agricultural suitability and upper house apportionment.

Table 4: Results of Mediation Analysis

	Lower House		**Upper House**	
	Trade Access	Ag Suitability	Trade Access	Ag Suitability
ACME	-0.088***	-0.058	-0.208***	-0.161
Direct Effect	-0.043	-0.266***	0.045	-0.738***
Total Effect	-0.132***	-0.324***	-0.162	-0.899***
% Mediated	0.672	0.180	0.744	0.179

Notes. Estimation method is Imai, Keele, and Tingley Tests mediation command (medeff) with 1000 simulations. Highly similar results from Sobel tests calculated from structural equation models using sgmediate command, with bootstrap case resampling shown in the appendix. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

6.4 Malapportionment Predicts Higher Inter-regional Transfers, But Not Redistribution

To test H2 we rely on sub-national datasets because cross-national data on horizontal transfers is not widely available. As mentioned earlier, we use datasets from two recent papers, Dragu and Rodden (2011), with coverage of nine countries, and Galiani et al. (2016) with time-series data on Argentina's provinces. Using both datasets, we test the idea that the level of representation of a sub-national region is associated with horizontal transfers toward that region. As with our approach to H1 and H2, we test the direct (endogenous) association between representation and horizontal transfers, and employ an instrumental variables approach to manage concerns with endogeneity.

We also test the relationship between representation and provision of redistribution at the regional level. One argument in defense of malapportionment and inter-regional transfers are that they are a positive for development because they provide excess representation to the less well-off areas of a nation so that they may use their power in the federal government to improve their economic circumstances. If malapportionment is working "well" to this end, we should see that redistribution is better in the less well off regions, and that the redistributive effort of the nation is more standardized across regions. Moreover, if interregional transfers are serving their purpose, we should see transfers associated with higher redistribution within the region, as transfers are employed to better the circumstances of the poor in poorer places.

Previous research addressing the endogeneity of representation and transfers has relied on either exogenous shocks to apportionment (Horiuchi, 2004, Ansolabehere et al., 2002, Galiani et al., 2016) or on instrumental variables approaches exploiting the introduction of new regions (Dragu and Rodden, 2011, Galiani et al., 2016). It is clearly not possible to find an exogenous shock to apportionment for a large cross-section of nations. In their examinations of Japan (Horiuchi, 2004) and the United States (Ansolabehere et al., 2002) find evidence highly consistent with ours–more representation lead to more transfers to those sub-national regions.[11] We avoid using the instrument of the introduction of new regions because we believe this may be subject to bargaining by existing regions interested in maintaining or increasing their representation.

For our instruments for representation, we use our sub-national data on land suitability for agriculture. In the sampled countries, those sub-national regions with the best land for agriculture tend to be the most developed and most populated, and therefore have the lowest levels of representation in malapportioned legislatures. We recognize that land suitability for agriculture may have direct relationship to horizontal transfers, either because agricultural regions tend to be poorer and less populated and thus recipients of higher horizontal transfers (as in advanced industrial nations) or agricultural regions tend to be richer

[11] We are skeptical of the exogeneity of the apportionment shocks in Argentina as claimed by Galiani et al. (2016). They argue that changes in apportionment brought about by the military were exogenous to transfers because these decisions were made to either thwart interpersonal redistribution or to thwart (leftist) Peronism. Our contention is that transfers are indeed related to interpersonal redistribution and that efforts to thwart Peronism depended on transfers (Eaton, 2001). Peronists later used those same transfers to secure a national coalition of votes and relied heavily on less populated regions (which they paid with transfers) for right-wing reforms under Menem (Gibson and Calvo, 2000).

and more populated (as in developing nations) and thus receive lower horizontal transfers. If this is the case, land suitability would violate the exclusion restriction for instrumental variables analysis. Accordingly, we code the land suitability for the nearest neighbor of each sub-national region. Land suitability of a sub-national neighbors are highly correlated (p=0.8594) but there is no theoretical reason to expect a relationship to transfers of the neighbor region except through representation of that region (and associated productivity and population). In the time-series analysis of Argentina, we follow Galor et al. (2009) by multiplying the land suitability of the nearest provincial neighbor with the global food commodity index to provide exogenous yearly variation.

6.5 Predicting Horizontal Transfers

We begin by examining whether greater representation in the legislature is associated with higher regional transfers. In Table 5 we show results from our cross-sectional analysis. Using a sample of 209 sub-national regions in nine countries, we find support for the idea that higher representation is associated with higher levels of horizontal transfers. We find a positive association in the base model (M1) and in the model with added controls (M2) used by Dragu and Rodden (2011): relative province wealth, land area of the province, and distance to the capital city. In M3 and M3, we show results with representation instrumented by the land suitability of the sub-national region's nearest neighbor. The results are again position and significant with somewhat inflated coefficient estimates. The instrument is reasonably strong based on the first stage F statistics.[12] Overall, given the limited sample and the efforts made to meet the exclusion restriction, we see these results as reasonable evidence that more represented regions gain a benefit in the form of transfers from the central government.

In Table 6 we show results from the time-series analysis for Argentina. In Argentina we have over time variation in representation and can thus employ province fixed effects to control for unobserved heterogeneity between provinces that may explain levels of transfers. Again we show consistent results that higher levels of representation are associated with higher transfers to that region. In M1 and M2 we show the endogenous association with OLS, in a base model and one with controls for provincial wealth and political alignment of the provincial governor with the president (Jones et al., 2000). In M3 and M4 we show representation instrumented with the nearest neighbor's land suitability. The instruments

[12]See results from the first stage in Appendix 6.1.

Table 5: Predicting Horizontal Transfers with Malapportionment (Cross-Section)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Relative Horizontal Transfers**			
	OLS		**2SLS**	
Relative Representation	0.565***	0.566***	0.799***	0.841***
	(0.065)	(0.066)	(0.125)	(0.126)
Province Wealth		-0.025		-0.171
		(0.150)		(0.237)
Province Size		0.032		0.122
		(0.066)		(0.104)
Distance to Capital		0.011		-0.171
		(0.091)		(0.152)
Observations	209	209	209	209
R-squared	0.654	0.654	0.541	0.511
Number of Countries	9	9	9	9
Controls	No	Yes	No	Yes
Stock-Yogo Weak ID	–	–	16.38	16.38
First Stage F Statistic	–	–	12.39***	15.46***
Kleibergen-Paap LM Statistic	–	–	3.060*	3.534*

Notes. Estimation method in M1 and M2 is OLS with province fixed effects. Estimation in M3 and M4 is 2SLS with representation instrumented with the land suitability of a province's nearest neighbor. First stage results shown in the Appendix 6.1. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

in this analysis are quite strong, providing more confidence in both the direction and size of the effect documented.

Table 6: Predicting Horizontal Transfers with Malapportionment in Argentina (Time Series)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Relative Horizontal Transfers**			
	OLS		**2SLS**	
Relative Representation	0.042*	0.031**	0.032***	0.024***
	(0.021)	(0.014)	(0.010)	(0.008)
Province Wealth		0.000***		0.000**
		(0.000)		(0.000)
Political Alignment to Executive		-0.019**		-0.024***
		(0.007)		(0.006)
Observations	1,174	742	1,174	742
Within R-squared	0.057	0.301		
Number of Provinces	24	24	24	24
Controls	No	Yes	No	Yes
Province FE	Yes	Yes	Yes	Yes
Stock-Yogo Weak ID	–	–	16.38	16.38
First Stage F Statistic	–	–	18.44***	19.99***
Kleibergen-Paap LM Statistic	–	–	8.532**	8.713**

Notes. Estimation method in M1 and M2 is OLS with province fixed effects. Estimation in M3 and M4 is 2SLS with representation instrumented with the land suitability of a province's nearest neighbor, multiplied by the global food price index of that year. First stage results shown in the Appendix 6.2. Clustered standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

6.6 Predicting Regional Redistribution

Overall, the results in Table 5 suggest that increased representation in the legislature is associated with higher inter-regional transfers flowing to that region. The big question thus becomes, are those transfers used to improve the conditions for citizens in the less well-off regions? We examine this possibility in the next few tables. We employ Dragu and Rodden's data to test whether legislative malapportionment is associated with more or less even redistributive effort across the territory of the nation. As discussed above, we employ LIS data on the reduction of inequality within geographic regions, using measures of both relative redistribution and absolute redistribution.

In Table 7 we calculate the coefficient of variation in redistribution across geographic regions within the nation. If legislative malapportionment has a positive effect on the redistribution to the poorer regions, we should see that redistribution is distributed evenly across the regions, rather than focused primarily on the better off regions. We see the opposite in Table 7.Legislative malapportionment is associated with significantly higher variation in redistribution across regions.

Table 7: Predicting Uneven Regional Redistribution (National Cross-Section)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**COV Regional Redistribution (Relative)**		**COV Regional Redistribution (Absolute)**	
	OLS		**2SLS**	
LH Malapportionment	0.147**	0.101**	0.148**	0.100**
	(0.066)	(0.040)	(0.068)	(0.039)
Dependent Population		-0.115***		-0.120***
		(0.021)		(0.023)
Trade		-0.053		-0.042
		(0.060)		(0.063)
Federalism		-0.126		-0.127
		(0.080)		(0.081)
Market Inequality		-0.014*		-0.013*
		(0.007)		(0.007)
Observations	32	25	32	25
R-squared	0.116	0.752	0.109	0.757
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Dependent variable is the coefficient of variation in reduction of inequality at the regional level. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

It is possible that the coefficient of variation in Table 7 is capturing higher redistribution in the over-represented, poorer regions, as they use their legislative advantage to bring more transfers and more resources to citizens. We consider this possibility in Table 8. Recall from Section 3 that our argument has implications for both the money flowing into sub-national regions, and the (associated) impact that government spending has on lowering inequality. In this table, we employ time series data at the regional level, matching representation of the regions and interregional transfers to redistributive effort at the regional level. If malapportionment allows regions to secure higher transfers (as we demonstrate above), they could be using those transfers to fund more generous welfare programs at the regional level. If this is the case, both representation and interregional transfers to the region should be associated with higher redistributive effort. In Table 8 we find no evidence that greater representation is associated with more redistribution at the regional level. The effect of transfers on regional redistribution is in fact negative and sometimes significant at the 0.1 level. While representation brings more resources into the region, it does not appear that those resources are transferred to citizens in such a way to reduce inequality. More likely, those resources are used in budget categories that more clearly serve the electoral interests of sub-national politicians.

Table 8: Predicting Uneven Regional Redistribution (Time Series, Region Level)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Region Level Redistribution**			
	OLS		**2SLS**	
Representation	0.157	0.135	0.000	0.000
	(0.685)	(0.466)	(0.003)	(0.003)
Interregional Transfers$_{t-1}$	-0.634	-1.536*	-0.001	-0.007*
	(1.247)	(0.713)	(0.007)	(0.004)
Province Wealth$_{t-1}$		0.259		0.005
		(1.835)		(0.011)
Relative Population$_{t-1}$		-0.454		-0.003
		(1.385)		(0.007)
Province Market Inequality$_{t-1}$		50.714***		0.363***
		(7.102)		(0.003)
Presidentialism		-0.126		-0.127
		(0.080)		(0.081)
Observations	548	530	548	530
R-squared	0.932	0.952	0.873	0.930
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with year fixed effects. Dependent variable is the coefficient of variation in reduction of inequality at the regional level. Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.10$

In sum, drawing from different, external datasets, and rigorous testing, we see strong evidence that apportionment is associated with transfers disproportionately directed to the over-represented regions, and that those transfers do not appear to reduce inequality in the nation or in the overrepresented regions.

7 Additional Robustness Checks

In our Online Appendix we have taken steps to demonstrate robustness in our results. For Hypotheses 1 and 2, we show: 1) results with unlogged values of malapportionment; 2) results with principal component variables of economic geography; 3) results with global region fixed effects; 4) results with addition controls; 5) results with economic geography calculated at the second administrative level; 6) results with economic geography calculated at "random" grid cells. Additionally, we show the results for an alternative dependent variable, absolute redistribution, for H2. All additional tests show results that are highly consistent with the results in the main text.

8 Alternative Considerations

The coalitional bargain based in malapportionment and regional over-representation is complex and nested within a range of government institutions and political behaviors. We consider alternative considerations to our argument in this section.

8.1 Other Institutions

Malapportionment is only one way to credibly commit to less populated regions. Gordin (2007) describes the range of options for the classic case of regional bargaining in Argentina, "redirecting of economic resources toward the development of backward provinces is the historical alliance among elites from poor provinces and a strong and autonomous central government to prevent one province's (i.e., Buenos Aires) dominating the others in Argentina. This intersection of interests was formalized through the creation of institutions such as the (malapportioned) Senate and the Electoral College that elected the president...provincial governments moved to the institutional center stage, playing an important role in deciding who gets sent to Congress. National senators are chosen by provincial legislatures, not by popular vote. Thus, control over provincial governments means control over the national senate and veto power over fiscal decentralisation legislation (Botana, 1993, 243)." Gordin also points toward related institutions that draw upon the interests of regions, such as party voting rules.

As Gordin (2007) suggests, other institutions such as electoral colleges, bicameralism (Grazzini and Petretto, 2015), senates elected by state legislatures, region-based party selection and control, variation in district magnitude (Calvo and Murillo, 2004), sub-unit proliferation (Gottlieb et al., 2019) are other ways to give political voice to regional elites. In future work, we plan to address the contribution these other institutions may play in limiting redistribution, and how those other institutions may interact with malapportionment to affect the outcomes we explore. From the perspective of this paper, we show strong results with malapportionment alone, that we believe will only be amplified when we consider other region-boosting institutions.

8.2 Long-run Equilibria, Not Institutions

Galiani et al. (2016) argue, based on evidence from a "natural experiment" in apportionment, that legislative malapportionment is not a causal factor explaining inter-regional redistribution (tax sharing) in Argentina. They argue that bias in favor of less populated provinces are the result of long-run equilibrium that favors those regions. "

> However, the predominance of the executive branch cannot by itself account for the persistence of these biases or explain why military governments did not revert to a more proportional pattern of distribution, unless the bargaining process that determines the distribution of tax revenues among the provinces does not differ very much from one political regime to the next. In order to further explore this vein, we build an index of geographic representation in the executive branch under democracy and under military governments. We find that there is no significant difference between democratic and autocratic government in the ratings, but there is a significant difference between the degree of geographic representativeness of the executive and legislative branches. This leads us to conjecture that the biases evident in the Argentine tax sharing system are not a function of legislative malapportionment, but are instead the outcome of a deeper equilibrium which is robust to the geographic distribution of legislative representation

> and the political regime. Nevertheless, further research will be needed to shed light on this issue; in particular, to establish a causal link between changes in the ultimate economic and institutional factors that form this deep-seated equilibrium and the observed changes in the Argentine tax sharing system (Galiani et al., 2016, p136).

We broadly agree that the coalition of elites in rich and poor places is a political equilibrium in many nations. As discussed in the previous section, malapportionment is one of a range of institutions that can be used to solidify this bargain, or that may result from this bargain. This equilibrium is likely to persist even with changes to the institution in the short term.

However, we take issue with the claims of a natural experiment in apportionment in the case of Argentina that are the basis for rejecting the role of malapportionment in their analysis. They claim that apportionment decisions were exogenous to transfers because: 1) they were made in response to concerns with inter-personal redistribution, or 2) they were made my military governments. On the first point, they argue "Even if, as argued by Ardanaz and Scartascini (2013), changes in minimum seat representation where done to overrepresent conservative tendencies, these changes respond to a social class conflict that is orthogonal to our main dimension of interest, which is the geographical redistribution of tax transfers not the social redistribution of tax revenues." (Galiani et al., 2016). We strongly argue that geographic redistribution of tax transfers in the case of Argentina (and elsewhere) is fundamentally related to (blocking) interpersonal redistribution and therefore cannot be considered exogenous.

On military governments and apportionment, Eaton (2001) convincingly demonstrates that approportionment decisions by the military (and later by status-quo oriented Peronists) was fundamentally about maintaining the status quo for party and economic elites. The military governments increased malapportionment for the purpose of empowering conservative rural elites to offset redistributionist demands.

On the introduction of new regions as an exogenous jolt to distribution in Argentina, we suggest two points. Granted, these regions were brought in with uniform apportionment (with the temporary exception of Tierra del Fuego), implying a varied effect on the representation of existing regions. However, our first point is that the inclusion of those regions was negotiated with existing regional actors. As Galiani et al. (2016) argue, some stood to gain from these regions and others stood to lose. It is difficult to imagine that the introduction of new regions was not politically debated for its effects on apportionment and support for status quo policies. This was the case for U.S. states, and was the case for Argentina's regions. Second, the introduction of regions is not one in which new regions emerged with exogenous boundaries. Rather, the selection of the number and border of regions was again more likely a political process negotiated with concerns about apportionment and political balance at the forefront.

8.3 Endogenous Borders

An important consideration of electoral border endogeneity emerges with our question, and our specification of the sub-national unit of analysis. It is feasible that nations with the same natural distribution of economic endowments show very different values of sub-national economic inequality due to differences in the drawing of sub-national borders. If the sub-national borders are endogenous to the natural economic endowments we measure, and perhaps concern with government redistribution itself, we cannot easily establish the direction of the effect in our analysis. Indeed, we are not establishing causality of the configuration of borders as exogenous to the question, but rather a correlation between how governments have established their borders, given the distribution of their natural endowments, with malapportionment and government redistribution.

We expect border endogeneity to be critical to the question of malapportionment and redistribution. Government borders are established with consideration of natural features, but also conflict over economic resources (Alesina and Spolaore, 2005, Michalopoulos and Papaioannou, 2013a, Beramendi and Rogers, 2018). Valuable natural endowments are highly sought by economic elites with the intent to keep the best territory for themselves. Inequality in the distribution of natural resources is therefore a function of both natural geography and historical power imbalances that allowed concentration of resources amongst a subset of elites.

If borders are indeed drawn with consideration of natural endowments, we assert this strengthens our claims relating sub-national regions and distributive conflict over redistribution. If elites were not concerned with resource sharing and centralization, the power to draw boundaries would be minimal. When all power is endowed to the central government, or when there is no connection between natural endowments and productivity, elites need not be concerned with segmenting their interiors, aside from transportation costs and economies of scale. Instead, the concern that elites would need to subsidize less fortunate individuals and economic sectors may induce elites to exclude those areas from their control.

We have taken steps above to address border endogeneity in our empirics. We run all of our analysis at two additional geographic aggregations, the second administrative level and 3x3 gridcells, to show that the results are broadly consistent with those from the first administrative level. In future versions of the paper we will also use economic geography data from the specific electoral constituency level of each nation. We are also working on a methodology to measure the endogeneity of regional borders to endowments in economic geography (Beramendi et al., 2018). We will be able to directly test whether border endogeneity is associated with legislative malapportionment and other relevant institutional features and political outcomes.

9 Discussion

Our argument and analysis suggests natural features of nations may have enduring effects that are solidified through political institutions. In the absence of those institutions and their distributive effects, the effects of these natural features may give way over time as economic trends change the cost and value of factors such as transportation costs, agricultural productivity, and climate. With these institutions in place, we may see stubborn sub-national differences that are sub-optimal from a political and economic perspective.

Among the worrisome externalities (or perhaps intentions) of legislative malapportionment are continued stifled development in less populated regions, sub-national authoritarian enclaves and continued patronage politics, and perverse federalism in malapportioned nations. Gordin (2007) describes the last point for the case of Argentina:

> The political framework in which intergovernmental fiscal relations occur is an endogenous influence that may well account for subnational variation in fiscal decentralization policy outputs. Despite federalism's ostensible 'market-preserving' quality, malfunctioning institutions can lead to suboptimal fiscal results and even to economic catastrophes, as the experience of several federal developing countries makes it apparent. When the sorting out of subnational fiscal relations takes

> place in malapportioned legislative institutions, we can see a mutually reinforcing relationship between decentralization and regionalized patronage, as transpires from the Argentine experience. That is, the policy of transferring revenue and revenue authority to subnational governments not only renders possible the entrenchment of patronage-ridden regional enclaves but, also, the latter can exploit institutional and political opportunities to sabotage fiscal decentralization projects (Gordin, 2007, p8).

Our results suggest that malapportionment is not helping the over-represented regions to improve the condition of the less well off in their nation, nor in their less populated regions. By stifling national redistribution, the lower classes in all regions stay far behind the upper income classes. The inter-regional transfers that take resources away from national redistribution do not appear to tangibly help the lower classes in the poorer regions. Combined with evidence that regions are not converging on income, and that interregional transfers are associated with fiscal profligacy yet no improvement in productivity, it is difficult to defend the economic or redistributive value of these transfers. Their political value for incumbent elites in the less endowed regions is more apparent.

This draft has many shortcomings that we intend to improve with additional data collection and contemplation. Specifically, we plan to: 1) improve the coverage of the upper house malapportionment data to work with a larger sample; 2) develop the argument and exposition around the coalitional bargain of votes for transfers in our beginning sections; 3) test the endogeneity of regional borders to economic geography. We are open to all suggestions for improvements.

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Economic Geography, Industrialization, and Redistribution: Malapportionment as Compensation

Online Appendix

Pablo Beramendi* Soomin Oh† Melissa Rogers‡

*Duke University; pb45@duke.edu

†Duke University; soo.min.oh@duke.edu

‡Claremont Graduate University; melissa.rogers@cgu.edu

Contents

1 Data Sources and Statistics

1.1 Data Description and Sources

1.2 Summary Statistics

Table 1: Summary Statistics- Hypotheses 1 and 2

Variable Name	N	Mean	SD	Minimum	Maximum
Sub-national Variation in Economic Geography (COV)					
Distance to the Coast	247	.660	428	0.000	3.000
Distance to Natural Harbor	247	0.451	0.245	0.000	1.381
Distance to Big Lake	247	.196	0.243	0.000	1.460
Distance to Navigable River	247	0.286	0.262	0.000	1.082
Precipitation	247	0.245	0.192	0.000	1.135
Elevation	247	0.576	0.316	0.000	2.119
Length of Growing Period	247	0.192	0.201	0.000	1.044
Land Suitability	247	0.390	0.377	0.000	2.941
Trade Access 1	247	.044	1.345	-2.628	4.038
Trade Access 2	247	-.047	1.126	-2.303	4.148
Trade Access 3	247	.022	.851	-2.337	3.594
Agricultural Suitability 1	247	-.065	1.492	-2.274	6.566
Agricultural Suitability 2	247	0.055	0.919	-7.294	4.250
Agricultural Suitability 3	247	0.002	0.884	-4.970	1.616
Malapportionment					
ln(Lower House Malapportionment)	210	-2.709	0.854	-5.809	-0.914
ln(Upper House Malapportionment)	30	-1.663	0.934	-3.661	-0.723
Redistribution					
Relative Redistribution	239	0.220	0.247	-0.154	1.101
Absolute Redistribution	239	6.896	6.688	-6.700	31.600
Control Variables					
Federalism	136	0.811	0.806	0.000	2.000
Proportional Representation	129	0.654	0.471	0.000	1.000
Household Inequality (Disposable)	239	38.408	8.555	20.904	58.836
ln(GDP per Capita)	205	7.952	1.505	5.149	11.688
ln(Land Area)	254	11.446	2.559	0.693	16.612
Left Government	239	0.030	0.110	0.000	0.667
Trade Openness	197	4.223	0.523	1.990	5.788
State Capacity	184	.016	0.874	-1.846	1.771
Household Inequality (Market)	239	45.304	6.550	26.614	66.068
Tax Revenue (% GDP)	240	16.784	8.075	0.796	45.492
Natural Resource Rents	206	7.698	10.879	0.000	49.674
Democracy	216	-1.684	6.008	-10.000	10.000

Table 2: Summary Statistics- Hypothesis 3

Variable Name	N	Mean	SD	Minimum	Maximum
Cross-Section Analysis					
Inter-regional Transfers	209	1.461	1.475	0.180	11.307
Relative Representation	209	1.877	2.111	0.378	17.760
Land Suitability of Nearest Neighbor	209	0.520	0.273	0.000	0.973
Province Wealth	209	0.994	0.617	0.250	6.746
Province Size (km^2)	209	0.966	0.989	.002	7.686
Distance to the Capital	209	0.966	0.737	0.000	4.533
Regional Redistribution Analysis					
COV Regional Redistribution	2992	0.428	1.456	0.065	16.805
Argentina Time Series Analysis					
Inter-regional Transfers	1,176	0.519	0.074	0.360	0.577
Relative Representation	1,246	1.705	0.851	0	6.251
Land Suitability of Nearest Neighbor	1,248	47.631	36.112	0.311	171.971
Province Wealth	1,200	6235.459	4710.379	1014.800	38590.300
Governor-President Political Alignment	864	0.606	0.488	0.000	1.000

1.3 Data Maps

2 World Maps of Trade Access and Agricultural Suitability

Figure 1: Sub-National Variation in Distance to the Coast

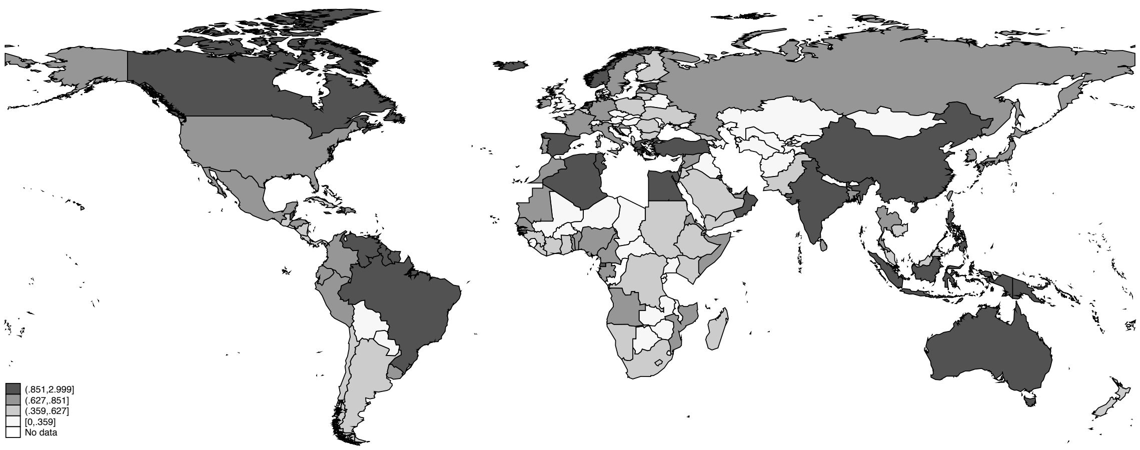
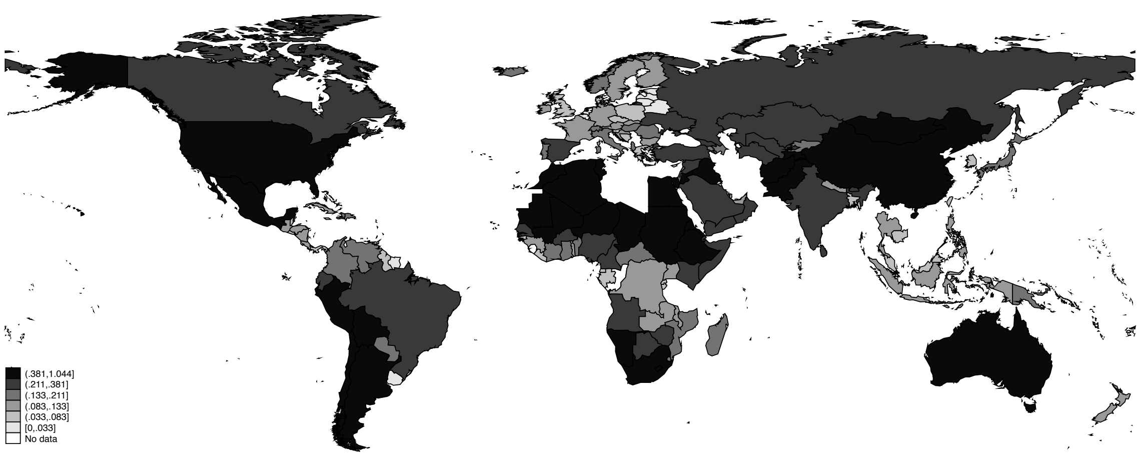


Figure 2: Sub-National Variation in Length of Growing Period



3 Hypothesis 1: Alternative Specifications

3.1 Results with Alternative Economic Geography Variables

Table 3: Predicting Legislative Malapportionment

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)				
Dependent variable:		**Lower House Malapportionment**					**Upper House Malapportionment**			
Dist. to Natural Harbor (COV)	0.727***					2.330***				
	(0.244)					(0.840)				
Land Size (COV)		0.661***					3.886**			
		(0.172)					(1.580)			
Precipitation (COV)			0.779***					2.342***		
			(0.259)					(0.847)		
Elevation (COV)				0.481***					0.815	
				(0.176)					(0.735)	
Terrain Ruggedness (COV)					0.397***					0.879
					(0.112)					(0.711)
Observations	199	199	199	199	194	30	30	30	30	30
R-square	No	No	No	No	No	No	No	No	No	No

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.10$

3.2 Results with Region FE

Table 4: Predicting Legislative Malapportionment

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Distance to Coast (COV)	0.439**	0.701***	1.329	0.370
	(0.171)	(0.210)	(0.843)	(1.656)
Length of Growing Period (COV)	0.053	0.005	1.196*	1.102
	(0.270)	(0.299)	(0.679)	(1.547)
Federalism		0.000		0.403
		(0.000)		(0.559)
Proportional Representation		-0.001**		-0.002
		(0.001)		(0.002)
Income Inequality		0.018		0.046
		(0.017)		(0.057)
Observations	175	119	30	21
R-squared	0.330	0.365	0.539	0.518
Controls	No	Yes	No	Yes
Region FE	Yes	Yes	Yes	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

3.3 Results with GEOLEV2 and "Random" Grid Cells

Table 5: Predicting Legislative Malapportionment (Second Administrative Level)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Distance to Coast (COV)	0.434***	0.560***	0.740	0.160
	(0.087)	(0.112)	(0.535)	(0.700)
Length of Growing Period (COV)	0.638**	0.133	2.635***	2.637*
	(0.311)	(0.350)	(0.761)	(1.490)
Federalism		0.001**		0.568*
		(0.000)		(0.318)
Proportional Representation		-0.001***		-0.001
		(0.000)		(0.001)
Income Inequality		0.030***		0.022
		(0.009)		(0.021)
Observations	197	130	30	21
R-squared	0.074	0.273	0.366	0.419
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Distance to the Coast and Growing Period are measured at GEOLEV2. Clustered standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

Table 6: Predicting Legislative Malapportionment (Grid Cell Values)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Distance to Coast (COV)	0.406***	0.558***	0.532	-0.155
	(0.106)	(0.137)	(0.714)	(0.941)
Length of Growing Period (COV)	0.264*	0.054	1.519**	1.345
	(0.156)	(0.168)	(0.592)	(0.799)
Federalism		0.001*		0.554*
		(0.000)		(0.299)
Proportional Representation		-0.001**		-0.002
		(0.000)		(0.001)
Income Inequality		0.031***		0.036
		(0.010)		(0.021)
Observations	196	129	30	21
R-squared	0.050	0.235	0.267	0.374
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Distance to the Coast and Growing Period are measured at 3x3 grid cells. Clustered standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.10$

4 Results with Principal Components Analysis

Table 7: Predicting Legislative Malapportionment- Principal Components Analysis

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Trade Access 1	0.132***	0.192***	0.273*	0.113
	(0.043)	(0.060)	(0.139)	(0.289)
Trade Access 2	-0.159**	-0.166**		
	(0.065)	(0.070)		
Trade Access 3	0.162***	0.148**	0.383**	0.278
	(0.059)	(0.063)	(0.146)	(0.236)
Agricultural Suitability 1	0.143***	0.084**	0.201**	0.205
	(0.040)	(0.042)	(0.078)	(0.165)
Federalism		0.001**		0.440
		(0.000)		(0.431)
Proportional Representation		-0.001***		-0.001
		(0.000)		(0.001)
Income Inequality		0.025**		0.021
		(0.010)		(0.015)
Observations	190	126	30	21
R-squared	0.146	0.319	0.462	0.417
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. *Agricultural Suitability 1-3* are PCA components of the coefficient of variation of soil quality, elevation, precipitation, length of the growing period, and land suitability for agriculture at GEOLEV1. *Trade Access 1* are PCA components of the coefficient of variation of distance to the coast, distance to natural harbor, distance to big lake, and distance to navigable river at GEOLEV1. Robust standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

Table 8: Predicting Legislative Malapportionment (Second Administrative Level)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Trade Access 1	0.110***	0.186***	0.260**	0.134
	(0.041)	(0.052)	(0.123)	(0.219)
Trade Access 2	-0.111	-0.102		
	(0.067)	(0.070)		
Trade Access 3	0.137**	0.106*	0.419**	0.269
	(0.061)	(0.062)	(0.193)	(0.316)
Agricultural Suitability 1	0.127***	0.082*	0.233**	0.232
	(0.041)	(0.042)	(0.110)	(0.201)
Federalism		0.001**		0.462
		(0.000)		(0.361)
Proportional Representation		-0.001***		-0.001
		(0.000)		(0.001)
Income Inequality		0.030***		0.021
		(0.010)		(0.019)
Observations	193	128	30	21
R-squared	0.086	0.274	0.424	0.409
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. *Agricultural Suitability 1-3* are PCA components of the coefficient of variation of soil quality, elevation, precipitation, length of the growing period, and land suitability for agriculture at GEOLEV2. *Trade Access 1* are PCA components of the coefficient of variation of distance to the coast, distance to natural harbor, distance to big lake, and distance to navigable river at GEOLEV2. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

Table 9: Predicting Legislative Malapportionment (Grid Cell Values)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Trade Access 1	0.083*	0.175***	0.097	-0.146
	(0.043)	(0.049)	(0.187)	(0.312)
Trade Access 2	-0.067	-0.071		
	(0.061)	(0.069)		
Trade Access 3	0.118*	0.077	0.425**	0.400
	(0.068)	(0.066)	(0.187)	(0.302)
Agricultural Suitability 1	0.061*	0.044	0.178	0.192
	(0.033)	(0.035)	(0.134)	(0.194)
Federalism		0.001**		0.674**
		(0.000)		(0.297)
Proportional Representation		-0.001**		-0.002
		(0.000)		(0.001)
Income Inequality		0.032***		0.026
		(0.010)		(0.024)
Observations	196	129	30	21
R-squared	0.040	0.235	0.331	0.398
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. *Agricultural Suitability 1-3* are PCA components of the coefficient of variation of soil quality, elevation, precipitation, length of the growing period, and land suitability for agriculture at 3x3 gridcells. *Trade Access 1* are PCA components of the coefficient of variation of distance to the coast, distance to natural harbor, distance to big lake, and distance to navigable river at 3x3 gridcells. Robust standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

4.1 Region Access to Trade

Table 10: Descriptive Statistics, Principal Components Analysis

Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Component 1	1.715	0.484	0.429	0.429
Component 2	1.231	0.446	0.308	0.737
Component 3	0.785	0.516	0.196	0.933
Component 4	0.269	–	0.067	1.000

Table 11: Correlations of PCA Components with Trade Access

Variable Name	**Trade Access 1**	**Trade Access 2**	**Trade Access 3**
Distance to Coast (COV)	0.891	-0.220	0.222
Distance to Natural Harbor (COV)	0.916	0.113	0.109
Distance to Big Lake (COV)	-0.112	0.783	0.619
Distance to Navigable River (COV)	0.259	0.746	-0.586

Table 12: Correlations Between Trade Access Variation Indicators

	Coast	Natural Harbor	Big Lake	Navigable River
Distance to Coast	1.000			
Distance to Natural Harbor	0.679	1.000		
Distance to Big Lake	-0.136	0.022	1.000	
Distance to Navigable River	-0.019	0.239	0.189	1.000

4.2 Land Suitability for Agriculture

Table 13: Descriptive Statistics, Principal Components Analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Component 1	2.284	1.262	0.457	0.457
Component 2	1.023	0.109	0.205	0.661
Component 3	0.914	0.246	0.183	0.844
Component 4	0.668	0.557	0.134	0.977
Component 5	0.111	–	0.022	1.000

Table 14: Correlations of PCA Components with Agricultural Suitability

Variable Name	Ag Suitability 1	Ag Suitability 2	Ag Suitability 3
Length of Growing Period (COV)	0.924	-0.052	0.101
Precipitation (COV)	0.922	0.015	0.003
Elevation (COV)	0.373	0.5964	-0.739
Land Suitability (COV)	0.662	-0.208	0.170
Temperature (COV)	0.050	0.838	0.577

Table 15: Correlations Between Agricultural Suitability Variation Indicators

	Growing Period	Precipitation	Elevation	Land Suit.	Temperature
Length of Growing Period	1.000				
Precipitation	0.882	1.000			
Elevation	0.195	0.201	1.000		
Land Suitability	0.451	0.404	0.094	1.000	
Temperature	0.042	0.044	0.040	-0.029	1.000

5 Hypothesis 2: Alternative Specifications

5.1 First Stage Results

Table 16: Predicting Redistribution with Malapportionment, First Stage IV Estimates

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Distance to Coast	0.683***	0.769***		
	(0.141)	(0.142)		
Growing Period			2.475***	2.268***
			(0.694)	(0.838)
ln(GDP per capita)		-0.256***	0.114	
		(0.055)		(0.192)
Left Government		0.357		-0.440
		(0.457)		(1.710)
Trade Openness		0.077		-0.415
		(0.140)		(0.366)
Observations	186	138	30	21
First Stage F Statistics	23.390***	29.490***	12.740***	7.320**
Controls	No	Yes	No	Yes

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period*. Clustered standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

5.2 Results with Unlogged Values

Table 17: Predicting Redistribution with Malapportionment (Endogenous)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:		**Relative Redistribution**		
Lower House Malapportionment	-1.448***	-0.721***		
	(0.205)	(0.214)		
Upper House Malapportionment			-0.156***	-0.100**
			(0.039)	(0.043)
ln(GDP per capita)		0.080***		0.133***
		(0.013)		(0.024)
Left Government		0.280*		-0.062
		(0.146)		(0.140)
Trade Openness		0.018		0.071
		(0.029)		(0.068)
Observations	217	159	30	21
R-squared	0.170	0.465	0.325	0.694
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

5.3 Results with Alternative Dependent Variables

Table 18: Predicting Absolute Redistribution with Malapportionment (Endogenous)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Absolute Redistribution**			
ln(Lower House Malapportionment)	-3.627***	-2.002***		
	(0.514)	(0.547)		
ln(Upper House Malapportionment)			-3.342***	-2.248**
			(0.821)	(0.944)
ln(GDP per capita)		1.979***		3.731***
		(0.372)		(0.587)
Left Government		5.055		-2.732
		(3.758)		(3.816)
Trade Openness		-0.395		1.342
		(0.785)		(1.870)
Observations	199	149	30	21
R-squared	0.216	0.448	0.238	0.669
Controls	No	Yes	No	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

Table 19: Predicting Absolute Redistribution with Malapportionment (IV Estimate)

	(M1)	(M2)	(M3)	(M4)
Second stage Dependent variable:	**Absolute Redistribution (% GDP)**			
ln(Lower House Mal) (Instrumented)	-4.782***	-6.078***		
	(1.599)	(1.649)		
ln(Upper House Mal) (Instrumented)			-9.183***	-7.032***
			(2.322)	(2.659)
ln(GDP per Capita)		1.281**		3.738***
		(0.531)		(0.951)
Left Government		4.596		-1.079
		(4.302)		(7.107)
Trade Openness		0.346		-1.922
		(1.029)		(2.286)
First stage Dependent variable:	**ln(Lower House Mal)**		**ln(Upper House Mal)**	
Distance to Coast	0.683***	0.769***		
	(0.141)	(0.142)		
Growing Day			2.475***	2.268**
			(0.694)	(0.838)
ln(GDP per Capita)		-0.257***		0.115
		(0.055)		(0.192)
Left Government		0.347		-0.440
		(0.457)		(1.171)
Trade Openness		0.077***		-0.415***
		(0.140)		(0.366)
Observations	186	138	30	21
Controls	No	Yes	No	Yes
Stock-Yogo Weak ID	16.38	16.38	16.38	16.38
First Stage F Statistic	23.390***	29.490***	8.882**	7.320**
Kleibergen-Paap LM Statistic	16.004***	16.335***	8.882**	5.182**
Hanson J Statistic (p value)	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period*. Clustered standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

5.4 Results with Added Controls

Table 20: Predicting Redistribution with Lower House Malapportionment (Endogenous)

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Dependent variable:			**Relative Redistribution**			
ln(Lower House Malapportionment)	-0.056**	-0.074***	-0.040*	-0.070***	-0.059**	-0.077***
	(0.024)	(0.021)	(0.021)	(0.020)	(0.023)	(0.022)
ln(GDP per capita)	0.053**	0.077***	0.064***	0.072***	0.090***	0.085***
	(0.024)	(0.014)	(0.013)	(0.013)	(0.017)	(0.014)
Left Government	0.230	0.274*	0.158	0.280*	0.181	0.237
	(0.154)	(0.151)	(0.130)	(0.147)	(0.159)	(0.149)
Trade Openness	0.020	0.007	-0.021	0.012	0.026	0.013
	(0.032)	(0.029)	(0.028)	(0.030)	(0.032)	(0.032)
State Capacity	0.060					
	(0.041)					
Market Inequality		-0.001				
		(0.002)				
Tax Revenue (%GDP)			0.009***			
			(0.002)			
Natural Resource Rents				-0.003**		
				(0.001)		
Democracy					-0.002	
					(0.003)	
Federalism						-0.000
						(0.000)
Observations	187	137	28	19	187	137
R-squared	0.218	0.476	0.327	0.691	0.252	0.472
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

Table 21: Predicting Redistribution with Lower House Malapportionment (IV Estimation)

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Dependent variable:			**Relative Redistribution**			
ln(Lower House Mal) (Instrumented)	-0.225***	-0.248***	-0.206**	-0.234***	-0.191***	-0.192***
	(0.079)	(0.073)	(0.087)	(0.072)	(0.070)	(0.051)
ln(GDP per capita)	0.052*	0.047**	0.054***	0.047**	0.068***	0.065***
	(0.031)	(0.021)	(0.017)	(0.021)	(0.023)	(0.018)
Left Government	0.300	0.251	0.188	0.257	0.189	0.216
	(0.184)	(0.178)	(0.172)	(0.169)	(0.164)	(0.158)
Trade Openness	0.024	0.036	0.023	0.040	0.045	0.049
	(0.038)	(0.042)	(0.045)	(0.040)	(0.035)	(0.038)
State Capacity	-0.015					
	(0.059)					
Market Inequality		0.001				
		(0.004)				
Tax Revenue (%GDP)			0.002			
			(0.005)			
Natural Resource Rents				-0.002		
				(0.002)		
Democracy					-0.006	
					(0.004)	
Federalism						0.000
						(0.000)
Observations	127	138	128	138	113	128
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Stock-Yogo Weak ID	16.38	16.38	16.38	16.38	16.38	16.38
First Stage F Statistic	16.778***	18.681***	11.219***	18.244***	14.727***	33.608***
Kleibergen-Paap LM Statistic	9.875**	12.520***	8.659**	11.257***	9.546***	17.588***
Hanson J Statistic (p value)	–	–	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period*. Clustered standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

5.5 Results with Region FE

Table 22: Predicting Redistribution with Malapportionment (Endogenous)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Relative Redistribution**			
ln(Lower House Malapportionment)	-0.070***	-0.038**		
	(0.021)	(0.019)		
ln(Upper House Malapportionment)			-0.091*	-0.041
			(0.049)	(0.050)
ln(GDP per capita)		0.074***		0.155*
		(0.015)		(0.082)
Left Government		0.251**		0.353*
		(0.119)		(0.186)
Trade Openness		-0.005		0.029
		(0.024)		(0.094)
Observations	182	136	30	21
R-squared	0.575	0.723	0.740	0.815
Controls	No	Yes	No	Yes
Region FE	Yes	Yes	Yes	Yes

Notes. Estimation method is OLS with data collapsed by country. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

Table 23: Predicting Redistribution with Malapportionment (IV Estimation)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**Relative Redistribution**			
ln(Lower House Mal) (Instrumented)	-0.178**	-0.194**		
	(0.073)	(0.076)		
ln(Upper House Mal) (Instrumented)			-0.344*	-0.280*
			(0.185)	(0.165)
ln(GDP per capita)		0.041*		0.060
		(0.025)		(0.093)
Left Government		0.231		-0.022
		(0.157)		(0.509)
Trade Openness		0.030		-0.110
		(0.040)		(0.087)
Observations	171	127	30	21
Controls	No	Yes	No	Yes
Region FE	Yes	Yes	Yes	Yes
R-squared	0.481	0.539	0.211	0.366
Stock-Yogo Weak ID	16.38	16.38	16.38	16.38
First Stage F Statistic	10.620***	12.290***	2.180	2.660
Kleibergen-Paap LM Statistic	8.404**	9.722***	2.804*	3.267*
Hanson J Statistic (p value)	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period*. Clustered standard errors in parentheses. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.10$

5.6 Results with GEOLEV2 and "Random" Grid Cells

Table 24: Predicting Redistribution with Malapportionment, GEOLEV2 (IV Estimation)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:		**Relative Redistribution**		
ln(Lower House Mal) (Instrumented)	-0.128*	-0.225***		
	(0.071)	(0.056)		
ln(Upper House Mal) (Instrumented)			-0.381***	-0.281***
			(0.084)	(0.091)
ln(GDP per capita)		0.051***		0.133***
		(0.019)		(0.038)
Left Government		0.252		0.000
		(0.167)		(0.257)
Trade Openness		0.020		-0.052
		(0.040)		(0.069)
Observations	189	140	30	21
Controls	No	Yes	No	Yes
Stock-Yogo Weak ID	19.93	19.93	19.93	19.93
First Stage F Statistic	19.460***	23.790***	12.860***	7.200**
Kleibergen-Paap LM Statistic	10.862***	14.303***	8.784**	5.810**
Hanson J Statistic (p value)	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period* at GEOLEV2. Clustered standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

Table 25: Predicting Redistribution with Malapportionment, Grid Cells (IV Estimation)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:		**Relative Redistribution**		
ln(Lower House Mal) (Instrumented)	-0.038	-0.203***		
	(0.104)	(0.068)		
ln(Upper House Mal) (Instrumented)			-0.353***	-0.301***
			(0.094)	(0.114)
ln(GDP per capita)		0.056***		0.133***
		(0.019)		(0.041)
Left Government		0.248		0.007
		(0.162)		(0.279)
Trade Openness		0.018		-0.066
		(0.038)		(0.083)
Observations	189	140	30	21
Controls	No	Yes	No	Yes
Stock-Yogo Weak ID	19.93	19.93	19.93	19.93
First Stage F Statistic	11.000***	22.25***	12.19***	5.590**
Kleibergen-Paap LM Statistic	7.033**	12.276***	8.333**	5.545**
Hanson J Statistic (p value)	–	–	–	–

Notes. Estimation method in 2SLS with data collapsed by country. *Lower House Malapportionment* instrumented with *COV Distance to the Coast*, *Upper House Malapportionment* instrumented with *COV Growing Period* at GEOLEV2. Clustered standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10

6 Hypothesis 3: Alternative Specifications

6.1 First Stage Results: Cross-section Analysis

Table 26: Predicting Inter-Regional Transfers with Representation, First Stage IV Cross-Section Analysis

	(M1)	(M2)
Dependent variable:	**Relative Representation**	
Land Suitability of Nearest Neighbor	-1.894***	-1.665***
	(0.538)	(0.424)
Province Wealth		0.485
		(0.507)
Province Size		-0.368*
		(0.203)
Distance to the Capital		0.514*
		(0.293)
Observations	209	209
First Stage F Statistics	12.390***	15.460***
Controls	No	Yes

Notes. Results of first stage estimates for Table 4 in the main text. Estimation method in 2SLS. *Relative Representation* is intrumented with the land suitability of the sub-national region's nearest neighbor. Robust standard errors in parentheses. ***p$<$0.01, **p$<$0.05, *p$<$0.10

6.2 Time Series Analysis of Regional Redistribution

Table 27: Predicting Uneven Regional Redistribution (National Level Time Series)

	(M1)	(M2)	(M3)	(M4)
Dependent variable:	**COV in Regional Redistribution (Rel)**		**COV in Regional Redistribution (Abs)**	
OLS		**2SLS**		
LH Malapportionment	0.101***	0.055***	0.101***	0.056***
	(0.008)	(0.006)	(0.009)	(0.006)
ln(GDPPC)		-0.110***		-0.109***
		(0.007)		(0.007)
Dependent Population		-0.090***		-0.102***
		(0.002)		(0.002)
Trade		-0.013*		-0.001
		(0.007)		(0.008)
Federalism		-0.126		-0.127
		(0.080)		(0.081)
Market Inequality		-0.012***		-0.010***
		(0.001)		(0.001)
Observations	2,889	2,316	2,889	2,316
R-squared	0.308	0.837	0.280	0.831
Controls	No	Yes	No	Yes

6.3 First Stage Results: Argentina Time Series

Table 28: Predicting Inter-Regional Transfers with Representation, First Stage IV Argentina Analysis

	(M1)	(M2)
Dependent variable:	**Relative Representation**	
Land Suitability of Nearest Neighbor	-0.013***	-0.013***
	(0.003)	(0.003)
Province Wealth		0.000
		(0.000)
Governor-President Partisan Alignment		0.087
		(0.101)
Observations	209	209
First Stage F Statistics	18.440***	19.990***
Controls	No	Yes

Notes. Results of first stage estimates for Table 5 in the main text. Estimation method in 2SLS. *Relative Representation* is intrumented with the land suitability of the province's nearest neighbor. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10