

Representation and redistribution in federations

Tiberiu Dragu^{a,1} and Jonathan Rodden^{b,1}

^aDepartment of Political Science, University of Illinois, Champaign, IL 61820; and ^bDepartment of Political Science, Stanford University, Stanford, CA 94305

Edited* by David D. Laitin, Stanford University, Stanford, CA, and approved April 6, 2011 (received for review December 17, 2010)

Many of the world's most populous democracies are political unions composed of states or provinces that are unequally represented in the national legislature. Scattered empirical studies, most of them focusing on the United States, have discovered that overrepresented states appear to receive larger shares of the national budget. Although this relationship is typically attributed to bargaining advantages associated with greater legislative representation, an important threat to empirical identification stems from the fact that the representation scheme was chosen by the provinces. Thus, it is possible that representation and fiscal transfers are both determined by other characteristics of the provinces in a specific country. To obtain an improved estimate of the relationship between representation and redistribution, we collect and analyze provincial-level data from nine federations over several decades, taking advantage of the historical process through which federations formed and expanded. Controlling for a variety of country- and province-level factors and using a variety of estimation techniques, we show that overrepresented provinces in political unions around the world are rather dramatically favored in the distribution of resources.

When independent political units assemble to create larger entities, they often become embroiled in disputes over representation. Should each unit receive equal representation regardless of size or should representation be based on population? These battles are often fierce in nascent political unions because of the belief that the nature of representation will affect the distribution of resources across regions well into the future.

In some of the world's largest democracies, the territorial representation scheme in place today had its roots in a federal bargain from the distant past that left some regions, like New York or Buenos Aires, with far fewer seats per capita than other regions, like Wyoming or La Rioja. In large or diverse nascent political unions like the European Union, Iraq, or Afghanistan, a federal institutional structure that deviates substantially from the principle of "one person, one vote" is often viewed as a requirement for peace and stability.

For these federations old and new, an important but unanswered question lingers: To what extent do asymmetries in representation lead to corresponding asymmetries in government policy? Empirical studies in economics and political science have discovered that overrepresented regions appear to receive substantially larger per capita shares of government expenditures (1–4). This research consists primarily of single-country studies, most of them focusing on the United States (5–11).

The fact that the representation structure emerged from a bargain among provinces, however, presents a fundamental challenge to empirical estimation of the relationship between representation and redistribution. It is possible that the most independently powerful provinces can most effectively extract both fiscal transfers and advantageous legislative representation. Because these sources of power might be subtle, persistent, and difficult to measure, the direct impact of representation structures on interregional fiscal transfers remains unclear.

In this paper, by pooling data from federations around the world, we are able to focus explicitly on provinces that had nothing to do with the negotiation of the initial bargain and had no impact on the representation scheme enshrined in the federal constitution. We create and analyze a unique provincial-level

dataset composed of yearly observations covering several decades in Argentina, Australia, Brazil, Canada, Germany, Mexico, Spain, Switzerland, and the United States. Asymmetric representation based on provinces has roots in the initial bargain that gave rise to the formation of the political union in nearly all of the federations in our sample. Smaller units demanded constitutional protections including equal or near-equal legislative representation in at least one of the legislative chambers because they feared domination by the larger provinces. Once the rules of territorial representation were settled in the initial constitutional bargain, those rules were subsequently applied to new provinces without opportunities for them to reshape the rules at the time of entry. Thus, in this sample of provinces, it is unlikely that legislative representation is endogenous to either political power or other provincial characteristics. Moreover, due to the politics of province formation, the distinction between founding members and provinces that joined the union later provides a plausible historical instrument for contemporary legislative apportionment.

Our analysis indicates that the rules of representation are indeed highly consequential. Controlling for a variety of country- and province-level factors and using a variety of estimation techniques, we show that overrepresented provinces in political unions around the world are rather dramatically favored in the distribution of resources.

Results

The main variable of interest captures the representation of provinces in the national legislature. Because populations and legislatures vary in size across countries, we need to convert each province's legislative representation to a common metric. Following the existing literature (12, 13), we construct a relative representation index as follows: We measure a province's number of legislative seats per capita relative to the total number of seats per capita in the country. Thus, an index value of 1 implies that a province's representation equates the one-person, one-vote standard. Values <1 imply that a province is underrepresented and values >1 indicate that a province is overrepresented. Our dependent variable is the distribution of intergovernmental grants to provinces. Our standardization is analogous to the representation index: We measure a province's yearly inflation-adjusted transfers per capita relative to the total transfers per capita in the country (*Materials and Methods*). Because there is some skew in the distribution of both variables, we convert both measures to logarithms.

We begin with the full data set ([Dataset S1](#)) and focus primarily on cross-province variation within countries (*Materials and Methods*), regressing average provincial intergovernmental grant receipts on average legislative representation in a model that includes country fixed effects. We find strong evidence that legislative apportionment affects the distribution of long-run

Author contributions: T.D. and J.R. designed research, performed research, analyzed data, and wrote the paper.

The authors declare no conflict of interest.

*This Direct Submission article had a prearranged editor.

¹To whom correspondence may be addressed. E-mail: tdragu@illinois.edu or jrodden@stanford.edu.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.10190611108/-DCSupplemental.

governmental expenditures. The coefficient for the representation variable is large, positive, and strongly significant (Table 1, model 1).

The effect of representation on the distribution of governmental expenditures is robust to controlling for several provincial characteristics (Table 1, model 2). First, a potential worry is that the wealth of a province may determine the amount of governmental funds because in many countries, intergovernmental grants are an important component of the social safety net, and we might expect them to flow disproportionately to poor provinces. Second, there might be lags in the adjustment of governmental transfer programs to demographic shifts, and thus it is possible that provinces that have lost population over time will still receive higher per capita transfer shares. Third, one could argue that geographically large or sparsely populated provinces present diseconomies of scale and therefore require more public resources than small units to obtain the same level of services. Finally, one might argue that the province housing the national capital is in need of more public expenditures to fund infrastructure related to the central government's activities or that the capital has extra influence at the bargaining table. The effect of representation is robust when controlling for population change, provincial wealth, and size, as well as status as the national capital.

We also find that the effect of representation is robust when controlling for additional provincial characteristics, such as location in the economic periphery (Table S1), and when controlling for the effect of various provincial characteristics in a quadratic manner (Table S2). The same is true when we check for interactions between representation and provincial features such as wealth or population change (Table S1), as well as some country-level factors that may potentially generate cross-country heterogeneity in effects, such as presidential versus parliamentary democracy (Table S3). In fact, the relationship is quite strong even in country-by-country analysis (SI Text S1 and Fig. S1).

In addition, we perform a matching analysis to adjust for (observed) biases in covariates and, most importantly, to alleviate concerns that our results depend on the ordinary least-squares (OLS) parametric assumptions and functional form specifications (i.e., the relationship between representation and the distribution of governmental funds is linear). For this analysis, we recode the representation variable as follows: All provinces with index values >1 are coded as overrepresented and provinces with index values <1 are coded as underrepresented (such a dichotomous coding also ensures that the effect of representation is robust to the presence of outliers). The matching analysis

indicates that the matched sample achieved balance (SI Text S2) and a Wilcoxon signed-rank test shows that the difference between the overrepresented and underrepresented provinces in terms of distribution of governmental funds is highly significant (P value = 1.636×10^{-9}).

There are some changes over time in the representation variable due to periodic reapportionments of lower chambers in most of the federations in our sample. (There is also periodic reapportionment in the German upper chamber.) Such reapportionment changes are somewhat valuable in isolating the effect of representation on the distribution of governmental funds. In this context, we estimate a time-series cross-sectional analysis with province and year fixed effects. Table S4 (model 1) presents the results of this estimation and indicates that the effect of representation is once again large and highly significant (the representation coefficient is 0.92 with a SE of 0.08). The effect of representation on the distribution of governmental expenditures is also robust when estimating additional time-series cross-sectional analyses: with province fixed effects or province varying intercepts, with year fixed effects, and with or without a lagged dependent variable (SI Text S2 and Table S4).

These analyses suggest that the positive relationship between representation and redistribution found in a handful of previous single-country studies is quite general in a very diverse set of federations. A lingering concern with the cross-section analysis, however, is that the level of representation is not the source of power in budget negotiations, but rather a mere reflection of some deeper aspect of political power. In the initial negotiations over representation structures, powerful states—for instance, those with better options outside the federation or access to superior trade routes, natural resources, or military power—might demand that they be overrepresented. If this power is persistent over time, it might continue to help such provinces extract a disproportionate share of the federation's resources.

To alleviate these concerns and better isolate the effect of representation, we present two additional estimations that take advantage of the historical process through which federations have come together and then expanded. Asymmetric representation generally has deep historical roots in the initial bargain that gave rise to the formation of the political union. In each of the federations under analysis, we can identify a moment at which some representatives of autonomous political entities agreed to form or codify a political union, and this bargain required agreement on some basic norms about the representation structure. The smaller units feared exploitation by the large ones, and they insisted on protections including equal or near-equal legis-

Table 1. Representation and the distribution of governmental funds

Variable*	Model 1		Model 2		Model 3		Model 4	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Representation	0.58	(0.05)	0.60	(0.05)	0.46	(0.07)	0.86	(0.12)
Population change	—	—	0.07	(0.08)	0.02	(0.07)	0.10	(0.09)
Province wealth	—	—	-0.04	(0.05)	0.11	(0.10)	-0.06	(0.05)
Province size	—	—	0.07	(0.03)	0.02	(0.04)	0.09	(0.03)
Capital state	—	—	0.14	(0.18)	0.40	(0.23)	0.25	(0.20)
Constant	0.19	(0.09)	0.15	(0.10)	0.43	(0.17)	-0.03	(0.13)
R^2	0.57		0.59		0.82		—	
Observations	209		209		76		209	

*The dependent variable measures the transfers per capita a province obtains relative to the total transfers per capita in a country (averaged over the time period for which we have data). Model 1 estimates an OLS regression with only the representation variable whereas model 2 estimates an OLS regression with the representation variables and several covariates. Model 3 is similar to model 2 but estimates the effect of representation on the sample of provinces that joined the federation after the rules of territorial representation were settled. Model 4 estimates a two-stage least-squares instrumental variables estimation using the original province indicator variable as an instrument for the representation variable. All models include country fixed effects.

lative representation regardless of population in the upper chamber and in some cases both chambers.

However, the story does not end there. Once the rules of the representation scheme were settled, additional states were often added, sometimes much later. New territories were conquered or purchased, the frontier became populated, and territories became full-fledged members of the federation. Holdouts from the initial bargain, like Newfoundland and Vermont, eventually joined. Territories lost in wars, like Saarland and East Germany, eventually rejoined. In each case, the rule of territorial representation enshrined in the initial constitutional bargain was simply applied to the new provinces without their input at the time of entry. Through one or more of these mechanisms, provinces were added after the initial bargain was struck in each of our federations except Spain.

This historical process regarding the formation of federations provides us with a sample of provinces for which legislative representation is not likely endogenous to political power or other provincial characteristics. The constitutional rules of territorial representation were not renegotiated every time a new province was added, and new provinces received the standard representation whether urban or rural, rich or poor, etc., when they entered the union. In this context, we estimate our model only on the sample of provinces in our contemporary dataset that did not yet exist when the fundamental rules of territorial representation were decided. Table 1 (model 3) presents the result of the estimation and indicates that the effect of representation is strong and highly significant. We also find that the effect of representation is robust when controlling for additional provincial characteristics and when performing a matching analysis (*SI Text S2* and *Table S5*).

Existing studies of the process of admitting new provinces to political unions, either through enhancing the status of territories or through carving up existing provinces (e.g., refs. 1, 14, 15), suggest that strategic politicians often attempted to create small, overrepresented provinces to achieve balance in the legislature on a potentially explosive issue like slavery or, more commonly, to build or solidify a legislative majority around some salient issue of the day. Most of these idiosyncratic issues, including specific tariffs, price supports for coffee growers, the power of the military, and of course slavery, have faded from salience. As a result, one source of variation in our contemporary representation variable is related to the timing of a province's full membership in the federation. Specifically, provinces that joined after the initial bargain are more likely to be overrepresented than the founding members.

This process suggests a possible instrument for the representation variable. We create an indicator variable taking the value 1 if the province was at the original constitutional bargain and 0 otherwise. A simple OLS analysis indicates that this original province indicator variable is negatively associated with the representation variable as expected. [The analysis also assuages concerns that the original province indicator might be a weak instrument (*SI Text S2*.)] To be a valid instrument, however, the indicator variable must affect the distribution of funds only through its effect on the representation variable. A possible criticism of our instrument is that provinces that joined the federation later were also less likely to be economically developed relative to the other provinces and were more likely to be located in the periphery, where the cost of providing public goods might be higher. If such economic and physical disparities persist over time, these provinces may still be in need of more transfers through channels other than representation. (However, a simple analysis suggests that there is in fact no difference in the relative wealth of the founding provinces and the provinces that entered the federation later.) To alleviate such indirect effects, we control in the first stage for provincial characteristics such as wealth, distance from the largest city, and geographic expanse. Table 1

(model 4) presents the results of the two-stage least-squares estimation and indicates that the effect of representation is positive and strongly significant. The instrumental variables analysis is robust when controlling for additional provincial characteristics (*Table S5*).

In an observational study, it is impossible to completely rule out the possibility of hidden bias that might challenge the conclusions. It is possible, however, to assess the degree to which the findings are susceptible to such bias. In this spirit, we conduct a Rosenbaum-type sensitivity analysis to indicate the magnitude of hidden bias that would need to be present to alter the qualitative conclusion of our instrumental variables estimation (16). The sensitivity analysis suggests that the qualitative results of our estimation are quite robust to the possibility of hidden bias (*SI Text S2*).

Discussion

The ubiquity and magnitude of the relationship between representation and fiscal transfers among federations is quite striking. In our most conservative model (model 3, Table 1), one of the overrepresented states in the Brazilian Northeast (Amapa or Roraima) can expect (at least) five times the amount of per-capita transfers of Sao Paulo, the most underrepresented state in Brazil. The effect is just as dramatic in Argentina. The extent of malapportionment is somewhat less severe outside of South America, but even so, our analysis indicates that the most underrepresented units (e.g., Nordrhein-Westfalen, California, or New South Wales) can expect less than half of the per-capita transfers of the most overrepresented units (e.g., Bremen, Wyoming, or Tasmania).

Our analysis dovetails with other recent studies that seek to deal with the possible endogeneity of legislative representation by taking advantage of specific instances of reapportionment within countries (12, 17, 18) or the expansion of the European Union (19). Each of these studies finds that exogenous changes in apportionment are associated with changes in fiscal flows. Taken together, these results provide comprehensive evidence for a proposition emerging from formal theories of legislative bargaining in which overrepresented regions are favored in the process of building legislative coalitions, both because they are more likely to have the opportunity to set the agenda and because they are more attractive coalition partners for others (20).

One might expect that a story driven by legislative bargaining among self-interested provincial representatives is less powerful in more cohesive political unions with strong and disciplined political parties. However, our analysis demonstrates that the impact of legislative representation holds up in parliamentary democracies with disciplined political parties, like Australia, Germany, and Canada, as well as in the presidential democracies of the Americas with their less cohesive political parties (*Table S3*, model 3). An avenue for further research is to examine whether the relationship also holds up in more centralized, hierarchical democracies (e.g., France) without histories of regional autonomy.

As autocratic regimes topple and ethnically diverse countries experiment with more representative forms of government, scholars are debating the merits of federalism with strong asymmetric territorial representation as a tool for encouraging peace and stability (21). Although this paper makes no normative claims, its findings can inform these debates. In most of the federations in our sample, despite their contravention of basic norms of democratic fairness, institutions of territorial representation had already gained widespread acceptance well before substantial interregional fiscal redistribution became a possibility. Whereas representation schemes often had their origins in the 19th century or earlier, central governments gained substantial powers to tax and redistribute resources across regions only well into the 20th century (22). In contrast, it is possible that in an unstable new

federation characterized by mutual mistrust and hostility, highly visible and disproportionate fiscal flows to overrepresented regions could generate a challenge to the legitimacy of the union.

Materials and Methods

Data. The provinces in our sample and the time period for which we have data for the distribution of governmental funds are as follows: 24 Argentine provinces (1983–1996), 6 Australian states and two territories (1990–2001), 27 Brazilian states (1986–2000), 10 Canadian provinces (1968–1997), 10 German Laender before unification (1970–1995) and 16 thereafter (1995–2003), 32 Mexican states (1993–2006), 17 Autonomous Communities in Spain (1984–2001), 26 Swiss Cantons (1998–2007), and 50 US states (1977–1997). Our dependent variable measures the transfers per capita a province receives (in a given year) relative to the total transfers per capita in the country (in a given year). This measure of governmental grants aggregates over all transfer programs. Because we are interested in long-term developments including one-off investment projects and periodic negotiations of formulaic programs like coparticipation in Latin American federations or equalization in Germany and the Commonwealth federations, we make no distinction between formulaic and discretionary transfers. The representation variable measures the legislative seats per capita for a given province (in a given year) relative to the total number of legislative seats per capita in the country (in a given year). The upper chamber plays a significant role in the budget process in all of the federations under analysis except for Canada and Spain. Thus, in the reported analyses, we used lower-chamber representation in those two countries and the two-chamber average for

each of the other federations. The province wealth variable measures the per capita income (gross state product) of a province expressed as a share of the national average. The population change variable measures the difference between the relative population of a province (the population of a province divided by the average provincial population in the country) in the first year for which we have information about governmental grants and the relative population of a province approximately 10 y before the first year for which we have information about governmental grants. The province size variable measures the area of a region in square kilometers as a share of the national average area of the country (the size of the country divided by the number of provinces). The capital variable is an indicator variable that takes the value 1 if the province is the capital of the country and the value 0 otherwise.

Analysis. For our cross-sectional analyses, from our sample, we construct a dataset with 209 observations by taking averages over the time period for all variables. On this dataset, we estimate a simple OLS regression (Table 1, models 1–3). For our instrumental variable analysis (Table 1, model 4), we estimate a two-stage least-squares regression by using the function *tsls* in the R-package *sem*. See *SI Text S2* for description of additional analyses.

ACKNOWLEDGMENTS. We thank Jose Cheibub, Gary Cox, Xiaochen Fan, Mark Fredrickson, and James Kuklinski for helpful comments and suggestions. This research was supported by National Science Foundation Grant SES-0241523 and by research grants from the Hoover Institution and the Institut d'Economia de Barcelona.

- Gibson E (2004) *Federalism and Democracy in Latin America* (Johns Hopkins Univ Press, Baltimore).
- Lee FE (2000) Senate representation and coalition building in distributive politics. *Am Pol Sci Rev* 94:59–72.
- Pitlik H, Schneider F, Strotman H (2006) Legislative malapportionment and the politicization of Germany's intergovernmental transfer system. *Public Finance Rev* 34: 637–662.
- Rodden J (2002) Strength in numbers? Representation and redistribution in the European Union. *Eur Union Polit* 3:151–175.
- Anderson G, Tollison R (1991) Congressional influence and patterns of New Deal spending, 1933–1939. *J Law Econ* 34:161–175.
- Atlas CM, Gilligan TW, Hendershott RJ, Zupan MA (1995) Slicing the federal government net spending pie: Who wins, who loses, and why. *Am Econ Rev* 85: 624–629.
- Chen J, Malhotra N (2007) The law of k/n : The effect of chamber size on government spending in bicameral legislatures. *Am Pol Sci Rev* 101:657–676.
- Hauk W, Wacziarg R (2007) Small states, big pork. *Q J Pol Sci* 2:95–106.
- Hoover G, Pecorino P (2005) The political determinants of federal expenditure at the state level. *Public Choice* 123:95–113.
- Lee FE (2003) Geographic politics in the US House of Representatives: Coalition building and distribution of benefits. *Am J Pol Sci* 47:714–728.
- Wright G (1974) The political economy of New Deal spending: An econometric analysis. *Rev Econ Stat* 56:30–38.
- Ansola-behere S, Gerber A, Snyder JM (2002) Equal votes, equal money: Court-ordered redistricting and public expenditures in the American states. *Am Pol Sci Rev* 96: 767–777.
- David PT, Eisenberg R (1961) *Devaluation of the Urban and Suburban Vote* (Univ of Virginia Press, Charlottesville, VA).
- McCarty N, Poole K, Rosenthal H (2002) *Congress and the Territorial Expansion of the United States in Party, Process and Policy: Studies of the History of Congress*, eds Brady D, McCubbins M (Stanford Univ Press, Stanford, CA).
- Stewart C, Weingast BR (1992) Stacking the Senate, changing the nation: Republican rotten boroughs, statehood politics, and American political development. *Stud Am Pol Dev* 6:223–271.
- Rosenbaum PR (2002) *Observational Studies* (Springer, New York).
- Elis R, Malhotra N, Meredith M (2009) Apportionment cycles as natural experiments. *Pol Anal* 17:358–376.
- Horiuchi Y, Saito J (2003) Reapportionment and redistribution: Consequences of electoral reform in Japan. *Am J Pol Sci* 47:669–682.
- Aksoy D, Rodden J (2009) Getting into the game: Legislative bargaining, distributive politics, and EU enlargement. *Public Finance Manage* 9(4):613–643.
- Baron D, Ferejohn J (1989) Bargaining in legislatures. *Am Pol Sci Rev* 83:1181–1206.
- Bakke K, Wibbels E (2006) Diversity, disparity and civil conflict in federal states. *World Polit* 59:1–50.
- Beramendi P (2010) *Inequality, Geography, and Redistribution* (Cambridge Univ Press, Cambridge, UK).