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Fiscal Federalism and Legislative Malapportionment: Causal Evidence from Independent but Related Natural Experiments

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ABSTRACT

We exploit three natural experiments in Argentina in order to determine if legislative malapportionment is the cause of the biases existing in the country's federal tax sharing scheme. We find that legislative malapportionment has had no significant effect on the federal tax sharing scheme during periods when democratic governments were in place; nor did we find any evidence that the tax sharing distribution pattern became less biased under centralized military governments. We argue that these results are attributable to two of Argentina's institutional characteristics: first, the predominance of the executive branch over the legislature; and, second, the lack of any significant difference in the pattern of geographic representation in the executive branch under democratic and autocratic governments. Thus, the observed biases in the distribution of tax revenues among the Argentine provinces are not caused by legislative malapportionment, but are instead the result of a more structural political equilibrium that transcends the geographic distribution of legislative representation and even the nature of the political regime.

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1. Introduction

Many legislatures are not well apportioned, with some constituencies having a larger or smaller share of seats than would be dictated by the relative sizes of their populations. According to the mainstream literature on legislative bargaining, malapportionment should lead to the formulation of biased policies that mirror the overrepresentation or underrepresentation of different constituencies. However, these same biases could also be generated by other economic and institutional factors. This paper explores the question as to whether certain policy biases are actually caused by legislative malapportionment or are the outcome of a more structural type of political equilibrium. In particular, we exploit three natural experiments that occurred in Argentina in order to estimate the extent of the effects of legislative malapportionment on the Argentine federal tax sharing scheme.

Baron and Ferenjohn (1989), in their seminal model of legislative bargaining, show that political outcomes in a legislature are determined by the distribution of bargaining power among different legislators. Consequently, any shift in the balance of bargaining power in favor of (or against) a particular legislator will result in a change in the equilibrium point toward (or against) her constituency's bliss point. If we apply this model to a federal State or, indeed, to any polity made up of several political entities (states, provinces, local governments), the inevitable conclusion is that overrepresented political entities can be expected to receive favorable treatment. This is the malapportionment hypothesis.

Many empirical studies on the malapportionment hypothesis have been conducted. Gibson, Calvo and Falleti (2004) show that malapportionment is associated with distortions in the allocation of funds within countries with federal systems of government. Turgeon and Cavalcante (2012), using a database for all the Brazilian states for 1997-2010, find a positive and significant relationship between degrees of overrepresentation and the amount of federal tax transfers received. In another study on Argentina, Gordin (2010) explores the allocation of resources provided by the Electricity Development Fund (*Fondo de Desarrollo Eléctrico del Interior* (FEDEI)) in 1995. His cross-section analysis shows that overrepresentation in the Argentine Senate correlates positively with an increased share of financing from the Fund. Porto and Sanguinetti (2001) study the determinants of intergovernmental transfers (*coparticipación*) in Argentina. Using a dataset drawn from four different years -1960, 1970, 1980 and 1990- they find that malapportionment in both chambers of Congress is correlated with the amount of transfers each province receives, with overrepresented provinces receiving a higher per capita transfer

than underrepresented ones. These studies' findings regarding the association between legislative malapportionment and the distortions in the allocation of public funds are very interesting, but they do not necessarily identify a causal relationship.

A few papers exploit plausible exogenous variation in legislative representation to test the malapportionment hypothesis. Horiuchi and Saito (2003) find empirical support for the hypothesis that malapportionment leads to policy outcomes that favor overrepresented districts. Using municipal-level data from Japan, they show that municipalities in overrepresented districts received higher subsidies per capita than those located in underrepresented ones. They exploit the fact than in 1994 an electoral reform bill significantly altered the geographical allocation of seats in the national legislature, which provided a source of exogenous variation in the degree of representation of each district. This gave them an opportunity to isolate the effect of malapportionment on the distribution of public funds. Ansolabehere, Gerber and Snyder (2002) provide similar evidence for legislative districts in the United States using court-ordered redistricting in the 1960s as a source of an exogenous variation in the distribution of geographic representation. Dragu and Rodden (2011) focus on resource allocation at the state level in countries with federal governments and find that overrepresentation has a positive effect on the size of fund transfers. In order to overcome potential endogeneity problems, they exploit the fact that new states were added to many federations over time. The idea is that, unlike the states that were originally a part of a federal system, these new states did not participate in the formulation of the representation rule that was put in place and, therefore, their funding allocations can be expected to correspond more to the rule itself rather than to what the authors refer to as the "original bargaining" terms arranged upon by founding states.

Our study introduces three distinguishing features in order to control for potential endogeneity problems. First, we exploit the fact that, in Argentina, on several occasions changes were made in the minimum number of legislators per district. These changes increased the number of seats in the smaller districts and modified the total number of seats, thereby altering the legislative representation of each district. Second, as in Dragu and Rodden (2011), we exploit the fact that new provinces were added to the Argentine federation by focusing on the effect that these additions had on the legislative representation

of the original 15 provinces[5]. Using this strategy, we obtain exogenous variations for the legislative representation of those 15 provinces. Third, we exploit the country's exceptional degree of institutional volatility, which induces a radical exogenous variation in the level of legislative representation. Specifically, during the time covered by our dataset, there were numerous military coups (five in total: 1943, 1955, 1962, 1966 and 1976 – the first coup in Argentina in 1930 is out of our sample) that gave rise to several autocracies. In each of these periods, Congress was shut down and the president, who was appointed by the military, also centralized legislative power. Thus, under military governments, legislative malapportionment was eliminated completely.

We have built up a database that covers the changes that have occurred in the Argentine tax sharing scheme since its inception in 1935 up to 2011. We have also collected data on the legislative representation of the Argentine provinces from 1935 to 2011. Thus, we have a panel dataset that encompasses both trends in the transfers received by each province through the tax sharing scheme and trends in the representation of each province. We use our dataset to estimate the effect of changes in legislative representation on the transfers received by the provinces. We find that there is no statistical evidence to support the idea that legislative malapportionment has a causal effect on the federal tax sharing scheme in the country studied. We also find that there is no evidence to support the thesis that, under centralized military governments, the distribution of revenues under the tax sharing scheme reverted to a more proportional pattern in the absence of malapportionment.

We then also explore potential explanations for our results. First, we develop a very simple politico-economic model based on two socioeconomic groups (the rich and the poor), three political jurisdictions (the federal government and two local government), and one national and two local public goods whose production is financed by a proportional income tax. We consider two political regimes (democracy and autocracy) and, following Acemoglu and Robinson (2006), we assume that, under democracy (autocracy), the poor (rich) are better represented. We show that although democracies and autocracies differ in terms of the level of taxation and provision of public goods (bigger governments under democracy), they may not differ to any significant degree in terms of the distribution of resources among districts. In

[5] Actually they were 14 provinces and the City of Buenos Aires, which is not a province but has a large degree of autonomy, especially after the Constitutional Reform of 1994. Throughout this paper we will refer to them, for the sake of simplicity, as 15 provinces.

particular, we show that the share of public revenues received by each local government is the same under a democracy dominated by the executive branch and under an autocracy, while overrepresented districts receive more resources under a democracy in which a malapportioned Congress wields power than under an autocracy.

Second, we argue that the executive branch has much more power than the legislative branch in Argentina and, hence, malapportionment does not have as great an impact as we would otherwise expect when democratic governments are in place. 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.

The rest of this paper is organized as follows. In Section 2, we summarize historical trends in the Argentine federal tax sharing scheme. In Section 3, we describe the malapportionment of the Argentine Congress. In Section 4, we explain the estimation strategy, and in Section 5, we present and interpret the main results. In Section 6, we develop a very simple politico-economic model of fiscal policy in a federation. In Section 7, we explore the question as to why legislative malapportionment does not have an effect on the federal tax sharing scheme and why the presence of military governments does not significantly change the scheme. Finally, Section 8 concludes.

2. The Argentine Federal Tax Sharing Scheme

In this section we first briefly summarize the institutional development of fiscal federalism in Argentina, focusing on the federal tax sharing scheme that was launched in 1935. We then describe the ways in which the scheme has changed over time.

Following Porto (1990), we can divide the history of fiscal federalism in Argentina into three distinct periods: (i) the *division of tax sources*; (ii) *competitive federalism*; and (iii) the *federal tax sharing scheme*. The first period goes from 1853 –when the modern Argentine Constitution was promulgated- to 1890. During this period, there was a constitutional mandate for a division of tax revenue sources between the national government and the provinces. The national government collected taxes only on foreign trade, while the provinces collected domestic taxes on consumption and production. Between 1890 and 1934, there was a period of "competitive federalism" in which both the national government and the provinces collected taxes on consumption and production. Until that time, intergovernmental transfers had been very limited in scale and were confined to what are nowadays called "national treasury contributions" (*aportes del tesoro nacional*), which are discretionary transfers from the national government to the provinces. The last period, from 1935 until the present day, started with the creation of the federal tax sharing scheme (*coparticipación federal de impuestos*). Under this scheme, specified types of taxes have been centralized and are thus collected by the national government, which then redistributes the revenues among the provinces.

The scheme created in 1935 was originally governed by three different laws. Act No. 12.139 consolidated all the various domestic taxes on consumption and production that the provinces and the national government had been levying separately until then. It also centralized tax collections in a national tax agency, which would then have to distribute the revenues among the provinces. Act No. 12.143 and Act No. 12.147 set out the arrangement for sharing the revenues from the sales tax and income tax, both of which had recently been created and were being collected by the national government.[6] The share of revenue to which the provinces were entitled was 17.5%, with the national government receiving 82.5%; these numbers reflect what is called the "primary distribution" of tax revenues. The "secondary

[6]The collapse of world trade after the 1929 stock market crash practically wiped out the main revenue sources of the central government: tariffs and export taxes. Alternative tax sources had to be found. This was what led to the creation of the income tax in 1933 and to the conversion of the "transaction tax" created in 1891 into a sales tax. The Argentine Constitution establishes that direct taxes can be collected only by the provinces, so in order for the central government to continue collecting these taxes, a sharing scheme had to be arranged.

distribution", i.e., the distribution within provinces, was based on several criteria: 30% of the revenues were distributed according to the size of the population of each province, 30% according to the expenditures of each district for the year 1934, 30% according to the local revenues of each province in the preceding year, and 10% according to the amount of the tax collected in each district. All 14 provinces and the Municipality of the City of Buenos Aires participated in the tax sharing scheme.

In 1943, a military government capped the income tax revenues to be distributed among the provinces at an amount equal to the amount transferred during that year. As a consequence, all the excess revenue was withheld by the national government, tilting the primary distribution even more sharply against the provinces. In 1947, under a democratic government, Congress passed Act No. 12.956, which increased the share of the provinces in the primary distribution to 21%, as well as incorporated new taxes into the scheme. Minor changes were made in the secondary distribution. In 1951, Act No. 14.060 added the newly created inheritance tax to the scheme, albeit with different distribution criteria: each district received exactly the amount that had been collected within that district.

The 1950s brought changes in the federal organization of Argentina: new provinces were created out of what had been known as the "national territories", areas originally inhabited by indigenous populations which were colonized in the late 19th century. The first new provinces were Chaco, in the northeast, and La Pampa, in the center of the country, both created in 1951. Subsequently Misiones, also in the northeast, was created in 1953 and Chubut, Formosa, Neuquén, Río Negro and Santa Cruz were created in 1955. All these new provinces were gradually incorporated into the tax sharing scheme. Act No. 14.390 of 1954 –which replaced Act No. 12.139- established a new criterion for the primary distribution of domestic tax revenues which was based on the size of the populations of the provinces. Ultimately, when all the remaining national territories, except Tierra del Fuego, were provincialized the following year, the share of the provinces went up to 46% and that of the national government was reduced to 54%. In terms of the secondary distribution, 98% of the revenues were distributed according to the population of each district; this proportion fell to 84% in 1955, 82% in 1956 and 80% in 1957, while the proportions based on the geographical location of the production of the taxed goods rose from 16% in 1955, to 18% in 1956 and to 20% in 1957. The remaining was distributed in inverse proportion to the size of the population.

With the advent of a new democratic government, Act No. 14.788 was passed in 1959, which gradually increased the share of the provinces in the primary distribution to 40% (46% including the Municipality of the City of Buenos Aires), up from 21%. The secondary distribution was as follows: 25% was distributed according to the population, 25% according to the expenditures of each district, and 25% on the basis of local revenues, while the other 25% was distributed equally among all the provinces. This regime remained largely in place for more than a decade, although some changes were made in the primary distribution during the military dictatorship of 1966-1973 that reduced the provinces' share to 35%.

A major overhaul of the entire tax sharing scheme came in 1973 with the enactment of Act No. 20.221 by a military government just days before the inauguration of a civilian government. This law created a single scheme which covered all the taxes that had previously been administered separately. Under this new scheme, the revenues from all the different taxes covered by the scheme were pooled into a single fund that was then distributed, firstly, between the national government and the provinces and, secondly, among the provinces. In terms of the primary distribution, the provinces and the national government each received 48.5% of the revenues, while the remaining 3% was transferred to a regional development fund created to finance infrastructure projects. The secondary distribution was based on three parameters: population (65% of the revenues), development gap (25%) and population density (10%). The development gap was defined as the average of the differences between indicators of housing quality, the level of education and the number of motor vehicles relative to the size of the population in each district and those of the Province of Buenos Aires and the City of Buenos Aires (taken together). This arrangement clearly redistributed resources from the Buenos Aires region to the rest of the country. The population density parameter (which measured the difference between each district's population density and the national average) was valid only for those districts whose density level was below the national average, and six provinces (Buenos Aires, Córdoba, Entre Ríos, Misiones, Santa Fe and Tucumán) were therefore excluded. Thus, scarcely populated provinces received a larger share than densely populated ones.

Act No. 20.221 was originally supposed to expire in 1980, but later in the same year that it was enacted (1973), the democratically elected Congress voted to extend it to 1983. The scheme did not undergo any major changes in the following years other than the inclusion of the value added tax, which was

introduced in 1975. However, in 1980, a military government decided to reform the system and reduced the share of the provinces in the primary distribution to 32.6% (down from 48.5%) while, at the same time, it incorporated social security contributions into the scheme. This led to changes in the secondary distribution as well. Acts Nos. 22.923 and 22.924 incorporated these changes into the system, whose expiry date was moved up to December 31st 1984.

In December 1983, a new democratic administration was elected. During 1984, the national government and the provinces -now with elected governors- failed to reach an agreement on the design of a new tax sharing scheme. On the first day of 1985, the scheme legally ceased to exist and the national government had to resort to the use of national treasury contributions to transfer revenues to each province. Both the primary and secondary distributions of tax revenues underwent significant changes. The Province of Buenos Aires, for instance, received 17.1% of the share transferred to the provinces in 1985, while, in 1984, the figure was 27.1%. A new law (Act No. 23.548) was not approved by the Congress until early 1988, and the scheme that was enacted by that law was intended to be temporary. In fact, it was supposed to expire at the end of 1989. In terms of the primary distribution, 43% of the revenues went to the national government, while 57% went to the provinces.

The scheme created by Act No. 23.548 was automatically extended every year after 1989 and is still in force. However, during the 1990s, several laws were passed that modified the scheme. There were also sweeping changes in the relationship between the national government and the provinces, namely, the complete decentralization of educational and health services together with a major reform in the social security system. Thus, the parameters established in Act No. 23.548 provide no more than a very poor indication of the actual shares received by each province in later years.[7] During the 2000s, a further set of regulations introduced more changes into the system. In December 2011, for instance, the revenues covered by Act No. 23.548 represented 78% of the total transfers received by the provinces; the remaining 22% was transferred under the terms of another nine supplementary laws.

[7] Cetrangolo and Jiménez (2004) provide a list of all the laws and decrees that modified the scheme originally set out in Act No. 23.548.

2.1. Historical Trends in the Argentine Federal Tax Sharing Scheme

We have built a database that covers trends in the tax sharing scheme since its inception in 1935 up until 2011, which is the last year for which annual data are available. This includes all 24 subnational districts of the country. In particular, our database registers the amount of money each district has received every year under the tax sharing scheme and the associated laws. Discretionary transfers have not been taken into account.[8] All the information comes from official sources: the annual reports of the Treasury Ministry (*Memorias del Ministerio de Hacienda*) from 1935 to 1958, the statistical yearbooks of the General Tax Administration (*Boletines Estadísticos de la Dirección General Impositiva*) from 1958 to 1979, annual reports of the Treasury Department (*Memorias de la Secretaría de Hacienda*) between 1980 and 1984, and various publications of the National Department for Provincial Fiscal Coordination (*Dirección Nacional de Coordinación Fiscal con las Provincias*) for 1985 -2011. In Appendix A, we provide an overview of all the sources of information that were used.

A convenient and systematic way of summarizing the aggregate biases in the tax sharing scheme is to compute the Gini coefficient associated with the distribution of the transfers per capita. Let $\frac{transfers_{i,t}}{population_{i,t}}$ be the transfers per capita received by province i in year t and suppose that we order provinces according to this ratio, where $i = 1$ indicates the province with the lowest transfers per capita and $i = N$ the one with the highest. Let $\frac{population_{i,t}}{population_t}$ be the proportion of the total population that lives in province i. Then, the Gini coefficient of the transfers per capita can be computed as follows:

$$G_t^{Transfers} = 1 - \frac{\sum_{i=1}^{N}\left(\frac{population_{i,t}}{population_t}\right)(S_{i-1,t}+S_{i,t})}{S_{N,t}}$$

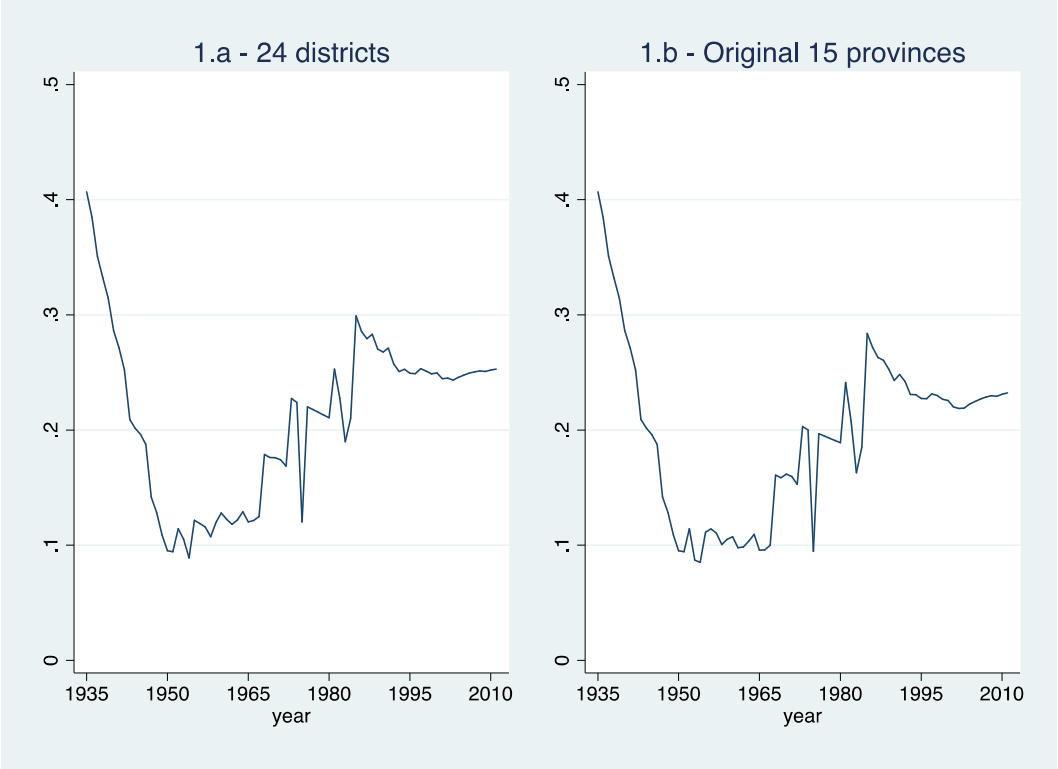
$$\text{where } S_{i,t} = \sum_{j=1}^{i}\left(\frac{population_{j,t}}{population_t}\right)\left(\frac{transfers_{j,t}}{population_{j,t}}\right), \text{ and } S_{0,t} = 0. \qquad (1.)$$

$G_t^{Transfers}$ is a measure of the degree of inequality of the distribution of tax revenues among the provinces under the federal tax sharing system. Note that if each province receives the same transfer per capita, then $G_t^{Transfers} = 0$, while, at the other extreme, if only one province concentrates all the

[8] Strictly speaking, the transfers received by the provinces in the period between 1985 and 1987 –when no tax sharing scheme existed- were discretionary, but we have included them in our database for the sake of consistency.

transfers, then $G_t^{Transfers} = 1$. Figure 1.a shows the trends in $G_t^{Transfers}$ for all the provinces, while Figure 1.b shows $G_t^{Transfers}$ for the original 15 provinces.

Figure 1: Gini Coefficient for Per Capita Transfers



As Figure 1 shows, inequality in per capita transfers decreased during the early years of the federal tax sharing scheme, falling to its lowest point in the early 1950s, and then started to rise again. The same pattern is observed if we restrict the analysis to the original 15 provinces in the scheme.

The trend in $G_t^{Transfers}$ points to major changes in the transfers per capita received by each province relative to the average transfer per capita (some provinces won and others lost as the tax sharing system became more or less unequal). In fact, there has been a great deal of variability in the figures for different provinces. For instance, take the case of Catamarca: from a share of 0.5% of total transfers in 1935, its share rose to 1.1% in 1946, 1.7% in 1959, 1.9% in 1973, 2.5% in 1988 and 2.7% in 2011. Similarly, the share of La Rioja gradually grew from 0.5% in 1935 to 2.1% in 2011. An opposite trend was seen in the case of Mendoza, which had had the largest share of the tax revenues of any province in 1935 (about

20.6%). In 1946, its share dropped to 9.6% and then to 4.9% in 1959; as of 2011, it stood at 4.2%. Santa Fe's share, on the other hand, after falling from 12.5% in 1935 to 9.2% in 1959, has remained stable since then. Meanwhile, Córdoba's share has not changed to any notable degree in the 76 years of the scheme's existence. The share of Buenos Aires (the largest province in the country), after increasing from 20.3% in 1935 to 29.5% in 1946, has decreased almost without interruption since then, reaching 19.6% in 1988 (increasing marginally to 19.8% in 2011). The federal capital's share increased steadily from 3.7% in 1935 to 12.7% in 1959, but then plummeted to 3.7% again in 1973. The question then arises as to whether these changes in the level of transfers per capita have been at least partially caused by modifications in the legislative representation of different districts.

3. Malapportionment in the Argentine Congress

In this section we briefly describe the historical trends in malapportionment in the Argentine Congress. As most federal countries, Argentina has a bicameral legislature. The upper house -Senate- is the chamber where the provinces are represented, while the lower house –the Chamber of Deputies- is the chamber where the people are represented. It is clear that, by design, the Senate is prone to malapportionment, since the allocation of seats is not linked to the actual distribution of the population within the country but, rather, to the existence of the subnational entities that compose the federation. Furthermore, in the case of Argentina, all the provinces have been allocated the same number of seats in the Senate: two between 1853 and 1995,[9] and three after 1995. Given the highly unequal geographic distribution of the population,[10] the equal-seat allocation has made the Argentine Senate the most malapportioned legislature in the world, as has been documented by Stepan (1999), Samuels and Snyder (2001) and Gordin (2010).

What is more surprising than the malapportionment seen in the Senate -which, to a certain point, is only to be expected given the characteristics of representation in that chamber- is the high level of malapportionment seen in the Chamber of Deputies. The Argentine Constitution is one of the factors that is at the root of this problem. In fact, although it states that the lower house represents the people of the country, it also establishes that deputies should be allocated by province, which means that all the

[9] Between 1973 and 1976, three seats were allocated to each province. This change was later rolled back.

[10] According to the 2010 census, 38.9% of the country's population lives in the Province of Buenos Aires. The four most populous districts (Buenos Aires, Córdoba, Santa Fe and the City of Buenos Aires) account for 62.3% of the population. Note that there are, in total, 24 districts in the country (23 provinces and the City of Buenos Aires).

provinces should have at least one seat. This would not be particularly noteworthy were it not for the fact that, given the distribution of the population and the total number of seats in the chamber, some provinces would not even qualify for one seat under a fully proportional apportionment system.[11] Moreover, under existing laws, the minimum number of seats per province is five. Samuels and Snyder (2001), using data from the late 1990s, show that Argentina's lower house is the 14th most malapportioned chamber in their sample of 78 countries. In Latin America, only Chile, Ecuador and Bolivia exhibit a higher degree of malapportionment in their lower houses.

The extent of malapportionment in the Argentine Chamber of Deputies has also changed over time, partly as a result of population growth and partly as a result of changes in the number of seats assigned to each province. The first Chamber of Deputies of Argentina, which was established following the promulgation of the Constitution of 1853 and whose scope was extended to include the whole of the country in 1862,[12] had only 50 seats. The number was raised to 86 in 1873 following the results of the country's first census in 1869. In 1898, the number was raised to 120 and, in 1920, to 158, in both cases with some delay, following the censuses of 1895 and 1914, respectively. In 1953, the number was temporarily reduced to 155 and two new provinces –Chaco and La Pampa- were incorporated into the Congress at the expense of seats from the City of Buenos Aires, Corrientes, Entre Ríos, San Luis, Santa Fe and Tucumán. In 1955, two additional seats were introduced for the newly created province of Misiones. In 1958, the total number of seats was raised to 187, and a single seat for each of the new provinces of Chubut, Formosa, Neuquén and Santa Cruz was included. The recently established Province of Río Negro was incorporated into the Chamber with two seats. In 1960, the minimum number of seats per province was raised to two, and the total number of seats in the lower house therefore went up to 192. In 1973, the Chamber saw one of its largest expansions ever, with 51 more seats being added when the minimum number of seats for each constituency was raised to four (except for Tierra del Fuego, which was still a "national territory" and had two seats). The number of seats allocated to the City of Buenos Aires was sharply reduced at the same time (down to 25 from 35). The return of democracy in 1983 brought with it an increase of 11 seats as the minimum number of deputies per province was raised to five. The last change occurred in 1991, when three additional seats were added after Tierra del Fuego became a province in 1990.

[11] In 2010, there were 40.2 million inhabitants in Argentina and 257 seats in the Chamber of Deputies, for an average of 156,097 inhabitants per seat. The Province of Tierra del Fuego, for instance, has a population of 127,205.
[12] The Province of Buenos Aires was virtually independent between 1854 and 1861.

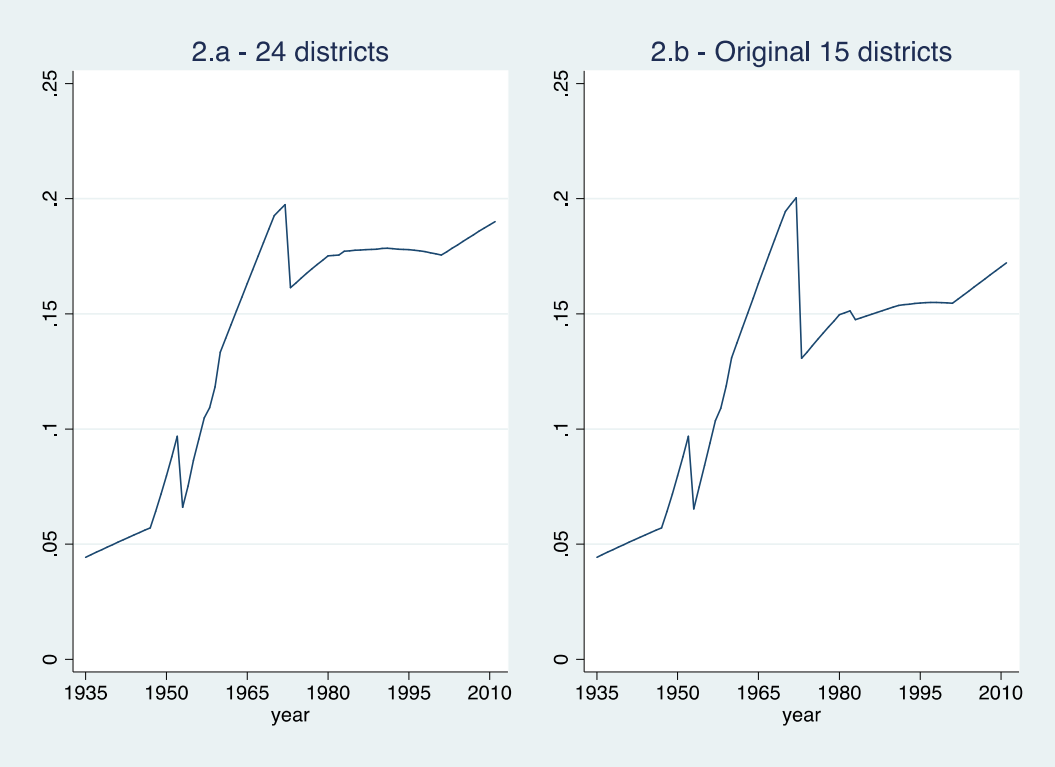
3.1. Historical Trends in Malapportionment in the Argentine Congress

We have collected information on the legislative representation of the provinces from 1935 to 2011. In Appendix A, we list all the sources of information used. A convenient and systematic way of summarizing the trends in the malapportionment of Argentina's Chamber of Deputies is to compute the Gini coefficient associated with the distribution of seats per number of inhabitants. Let $\frac{seats_{i,t}}{population_{i,t}}$ be the seats per inhabitants for province i in year t and suppose that we order provinces according to this ratio, with $i = 1$ indicating the province with the lowest ratio and $i = N$ the one with the highest. Then the Gini coefficient for the seats per number of inhabitants is given by:

$$G_t^{Seats\ per\ Inhab} = 1 - \frac{\sum_{i=1}^{N}\left(\frac{population_{i,t}}{population_t}\right)(S_{i-1,t}+S_{i,t})}{S_{N,t}}, \quad \text{where } S_{i,t} = \sum_{j=1}^{i}\left(\frac{population_{i,t}}{population_t}\right)\left(\frac{seats_{i,t}}{population_{i,t}}\right) \text{ and } S_{0,t} = 0. \tag{2.}$$

$G_t^{Seats\ per\ Inhab}$ is a measure of the degree of inequality of legislative representation in Argentina's Chamber of Deputies. Figure 2.a shows the trend in $G_t^{Seats\ per\ Inhab}$ for all the provinces, while Figure 2.b shows $G_t^{Seats\ per\ Inhab}$ for the original 15 provinces.

Figure 2: Gini Coefficient for Seats per Inhabitants in the Chamber of Deputies



As Figures 2.a and 2.b show, inequality in representation in the Chamber of Deputies has generally been increasing throughout the period under study, with the exception of two episodes, in 1953 and 1973, during which the seat allocation system was reformed.

The trends in $G_t^{Seats\ per\ Inhab}$ point up major changes in the representation of different provinces relative to the average level of representation in the Chamber (some provinces gained in representation and others lost as the overall level of representation in the Chamber became more or less unequal). Were these modifications in the legislative representation of different districts the cause of the changes made in the tax sharing system?

4. Empirical Strategy

In this section, we present our identification strategy. One approach to studying the effects of legislative malapportionment on tax sharing is to rely on a cross-section analysis, i.e., run a regression between an index of the legislative representation of a given district and an outcome variable related to the transfers

received by that district. There are, however, two main issues with this approach. First and foremost, the existence of unobservable variables that may have an impact on the distribution of tax revenues results in a potential omitted-variable bias. These variables could be, for example, qualitative characteristics of the relationship between some provinces and the national government that could make some districts more or less likely to be overrepresented in the legislature and to receive larger or smaller federal transfers. Party affiliation –a regressor usually included in the cross-section regressions- is just one of the possible qualitative dimensions involved. Other aspects of political affinity may not be quantifiable at all. In addition, even if it were possible to include proxy regressors for all the relevant unobservable variables, the existence of a finite number of observations –in a cross-section analysis of Argentina at province level there cannot be more than 24- clearly limits the statistical feasibility of such an analysis.

A possible solution for the problems posed by cross-section studies would be to extend the analysis over time by creating a panel database in which each province is followed over several years. An example of this approach can be found in the work done by Pitlik, Schneider and Strotman (2006) on Germany's intergovernmental transfer system. To the extent that the omitted variables are time-invariant, a fixed-effect analysis using panel data solves the endogeneity problem. However, this is not always the case: whenever an unobservable variable changes over time, the endogeneity problem persists. For instance, if the relationship between political elites in a province and the national government –a variable which is very difficult to quantify- changes over time, this could independently affect both apportionment in Congress and the share of resources channeled to that province. To control for this, an instrumental variable approach needs to be adopted. The potentially endogenous regressor –in our case, the index of legislative representation- has to be instrumented by an exogenous variable.

We use the last approach and exploit exogenous variations in our index of legislative representation. First, during the period under study, there were several changes in the minimum number of seats per district, which produced exogenous variations in the legislative representation of the provinces. Second, new provinces were established, were given seats in the Chamber of Deputies and were incorporated into the tax sharing system, and this induced exogenous variations in the legislative representation of the original provinces.

In line with Porto and Sanguinetti (2001), our dependent variable is the per capita transfers received by each district, expressed as a ratio with respect to the total country value, i.e., the total amount of tax distributed to the provinces divided by the population of the country. The formula is ("i" indicates the district, "N" is total number of provinces and t is the year):

$$y_{i,t} = \frac{\frac{transfers_{i,t}}{population_{i,t}}}{\frac{\sum_{i=1}^{N} transfers_{i,t}}{\sum_{i=1}^{N} population_{i,t}}} = \frac{\frac{transfers_{i,t}}{\sum_{i=1}^{N} transfers_{i,t}}}{\frac{population_{i,t}}{\sum_{i=1}^{N} population_{i,t}}} \quad (3.)$$

For an index of the legislative representation of district i, we use the seats per number of inhabitants in the Chamber of Deputies in district i over the seats per number of inhabitants for the whole country. The formula is:

$$x_{i,t} = \frac{\frac{seats_{i,t}}{population_{i,t}}}{\frac{\sum_{i=1}^{N} seats_{i,t}}{\sum_{i=1}^{N} population_{i,t}}} = \frac{\frac{seats_{i,t}}{\sum_{i=1}^{N} seats_{i,t}}}{\frac{population_{i,t}}{\sum_{i=1}^{N} population_{i,t}}} \quad (4.)$$

In non-democratic regimes, we calculate $x_{i,t}$ using the seat distribution in the last session of Congress.

The instrument we use for $x_{i,t}$ is simple. We recalculate $\frac{seats_{i,t}}{\sum_{i=1}^{N} seats_{i,t}}$, tracking the initial values in 1935, and change them only when there is a change in the minimum numbers of seats per district or when the Chamber expands due to the entry of new provinces. Similarly, we recalculate $\frac{population_{i,t}}{\sum_{i=1}^{N} population_{i,t}}$, tracking the initial values in 1935, and change them only when the Chamber expands due to the entry of new provinces. We use the 1935 population levels so as to exclude the distortion created by population growth between the first year of the scheme and the year when the new provinces are created. Finally, we divide the two recalculated versions of $\frac{seats_{i,t}}{\sum_{i=1}^{N} seats_{i,t}}$ and $\frac{population_{i,t}}{\sum_{i=1}^{N} population_{i,t}}$ to obtain our instrument of $x_{i,t}$, which we denote by $z_{i,t}$.

A change in the minimum number of seats per district has three significant properties. First and foremost, it is exogenous to our analysis. In particular, it is not related to population growth in the provinces. Second, it affects the legislative representation of every district, increasing the representation of districts with a number of seats below the newly established minimum and reducing the representation of the others. Third, the magnitudes of the changes in representation within each group of districts (winners and losers) are generally different. Thus, a change in the minimum number of seats generates exogenous variations of diverse magnitudes in the legislative representation of different districts.

The entry of a new province also has similar properties. First, since we are restricting our analysis to the 15 original provinces, it is an exogenous change. Second, it affects the legislative representation of every district. In particular, if the new province obtains a number of seats relative to its population that is higher (lower) than the national pre-entry ratio, the legislative representation of all the older provinces decreases (increases). Third, although the direction of the change is the same for every older province, the magnitude of the changes are generally different. Thus, the entry of a new province also generates exogenous variations of varying magnitudes in the levels of legislative representation of the different districts.

Instead, an example of an endogenous change in legislative representation is a change in the number of seats that is associated with the publication of census results, which, of course, are clearly a reflection of changes in the size of the population of each district.

Finally, in our analysis we also exploit the political volatility of the country throughout the years covered in our database; between 1935 and 2011, there were five separate military regimes that lasted from two to seven years. Given the complete absence of an independent legislative power –the *locus* of malapportionment- during military governments, each change in the political regime (from democracy to military dictatorship or vice versa) produced a radical variation in the extent of legislative representation. Since the changes in the political regime were not related to legislative malapportionment or to the tax sharing system, we can regard these variations as exogenous for the purposes of our analysis. In fact, we use the changes in the political regime to estimate whether military

governments tend to increase (decrease) their transfers to previously underrepresented (overrepresented) districts, at least partially reverting the biases in the tax revenue transfers.

Table 1 presents the first-stage regressions. In Column (1), we present the first-stage regression of $x_{i,t}$, interacted with $demo$ (a dummy variable that indicates whether the political regime in year t was a democracy) with respect to $z_{i,t}$, interacted with $demo$. Similarly, Column (2) of Table 1 presents the first-stage regression of $x_{i,t}$, interacted with $dicta$ (a dummy variable that indicates whether the political regime in year t was a dictatorship) with respect to $z_{i,t}$, interacted with $dicta$.

In order to be conservative, we use two alternative methods to conduct statistical inference throughout the paper. We first report robust standard errors clustered at the province level, which allow for arbitrary within-country correlation. There are 15 provinces in our sample. Standard asymptotic tests might over-reject the null hypothesis under the presence of few clusters. Thus, as a robustness check, we also report p-values of the null hypothesis of no effect using the wild bootstrap-t procedure in Cameron et al. (2008). This method produces with approximately the desired size even in the presence of a very small number of clusters. Reassuringly, in our case, either approach yields very similar statistical inferences.

Table 1: First-Stage Regression

	Dependent Variable			
	All Provinces		Excluding the City of Buenos Aires	
	$x_{i,t} * demo$	$x_{i,t} * dicta$	$x_{i,t} * demo$	$x_{i,t} * dicta$
	(1)	(2)	(3)	(4)
$z_{i,t} * demo$	0.986***	-0.003	0.972***	-0.037
	(0.121)	(0.094)	(0.121)	(0.090)
	[0.008]	*[0.928]*	*[0.008]*	*[0.644]*
$z_{i,t} * dicta$	0.140***	1.003***	0.107**	0.978***
	(0.050)	(0.098)	(0.049)	(0.097)
	[0.008]	*[0.000]*	*[0.036]*	*[0.000]*
F-Test	66.83	97.79	64.02	96.43
Observations	1155	1155	1078	1078

Note: All regressions include year effects, province effects and province linear trends. These regressors are partialled out in the estimation.[13] Province-clustered standard errors in parentheses; Wild clustered bootstrap p-values for t-statistics computed as proposed by Cameron et al. (2008) in italics. * significantly different from zero at 10%, ** at 5%, *** at 1%.

4.1. Regression Model

We estimate the following model:

$$y_{i,t} = \beta_1 * x_{i,t} * dicta_t + \beta_2 * x_{i,t} * demo_t + \delta_i + \lambda_t + \mu_i * provtrend + \varepsilon_{i,t} \quad (5.)$$

where *demo (dicta)* is a dummy variable that indicates whether the political regime in year t was a democracy (dictatorship) or not, δ_i and λ_t are province and year effects, respectively, and $provtrend$ is a province-specific linear trend.

Several remarks about this specification apply. First, we estimate this model for the 15 original districts in the scheme. Second, the standard malapportionment theory would predict a positive sign for β_2. The higher the $x_{i,t}$ of the district, the more represented the district is relative to other districts and, hence, the more transfers per inhabitant relative to the average transfer per inhabitant it can be expected to receive. Under non-democratic regimes, we calculate $x_{i,t}$ using the seat distribution in the latest session of

[13] See C. F. Baum, M. E. Schaffer, and S. Stillman (2007).

Congress. Therefore, the standard malapportionment theory would suggest a negative sign for β_1. Given the absence of legislative malapportionment in military governments, we would expect that they try to shift the tax sharing scheme toward a less biased distribution. Thus, the higher the $x_{i,t}$ of a district in a non-democratic period, the better represented the district would have been in the previous democratic period and the more funds it can be expected to receive now.

5. Main Results

Table 2 presents the main results. Note that the coefficients associated with $x_{i,t} * dicta$ and $x_{i,t} * demo$ are statistically significant when they are not instrumented by $z_{i,t} * dicta$ and $z_{i,t} * demo$ (column 1). However, once $x_{i,t} * dicta$ and $x_{i,t} * demo$ are instrumented by $z_{i,t} * dicta$ and $z_{i,t} * demo$, the coefficients drop steeply toward zero and are not statistically significant (column 3). Indeed, the 2SLS point estimates are very small and also economically insignificant.

Table 2: Main Results

			Instrumental Variable Regressions	
	All Provinces	Excluding the City of Buenos Aires	All Provinces	Excluding the City of Buenos Aires
	(1)	(2)	(3)	(4)
$x_{i,t} * dicta$	0.498***	0.491***	0.166	0.113
	(0.141)	(0.159)	(0.188)	(0.201)
	[0.064]	*[0.088]*	*[0.464]*	*[0.612]*
$x_{i,t} * demo$	0.513***	0.495***	0.102	0.031
	(0.135)	(0.152)	(0.208)	(0.220)
	[0.044]	*[0.056]*	*[0.608]*	*[0.848]*
F-Test (Kleinberg-Paap)			42.88	45.12
Observations	1155	1078	1155	1078

Note: All regressions include year effects, province effects and province linear trends. These regressors are partialled out in the IV estimation. Province-clustered standard errors are shown in parentheses; * significantly different from zero at 10%, ** at 5%, *** at 1%. Wild clustered bootstrap p-values for t-statistics computed as proposed by Cameron et al. (2008) in italics.

One issue of concern in relation to the results in column (3) of Table 2 may be the potentially spurious effect created by outliers such as the City of Buenos Aires, which is a district that has been overrepresented since the late 1980s and, at the same time, receives a very small portion of tax revenues. This negative effect of overrepresentation may potentially balance out a positive effect seen in other provinces and, therefore, lead to a non-significant overall effect such as the one that is shown in our results. We re-estimate our main regressions after excluding the City of Buenos Aires from our sample. As columns (2) and (4) in Table 2 show, the results do not change.

Another potential concern is that when the federal tax sharing scheme was put in place in 1935, some provinces depended heavily on domestic tax receipts; Mendoza and San Juan, for instance, relied on the revenue of taxes on alcohol, since they were (and still are) the main wine-producing regions in the country, while Tucumán Province relied on the receipts from taxes on sugar production. To accommodate this situation and to avoid disrupting these provinces' budgets, the law provided for a transitional period in which these provinces would have a special status and receive a considerable share of total revenues. In order to factor out any bias that might be generated by this transitional period, we re-estimated our regressions while excluding the observations for the first years of the tax sharing scheme (1935-1940). The results did not change.[14]

To sum up, overall there is no robust statistical evidence to back up the argument that legislative malapportionment has a causal effect on the distribution of federal tax revenues. Moreover, there is no evidence to support the thesis that, under centralized military governments, the tax sharing arrangement reverted to a less biased distribution because of the absence of malapportionment.

6. A Simple Model

In this section we develop a very simple politico-economic model of a tax sharing system. We show that a democracy with a dominant executive branch and an autocracy can generate the same shares for each district, while a democracy with a powerful, malapportioned Congress induces a bias toward overrepresented districts. The model provides some theoretical foundations for our empirical results.

[14] The coefficients of $x_{i,t} * dicta$ and $x_{i,t} * dicta$ are 0.373 and 0.497, respectively. The first one is statistically significant at 5%, while the second is statistically significant at 1%. However, once $x_{i,t} * dicta$ and $x_{i,t} * dicta$ are instrumented by $z_{i,t} * dicta$ and $z_{i,t} * demo$, the coefficients are not statistically significant.

The model also illustrates the importance of considering the interactions among different institutions. Legislative malapportionment could thus act as a key political factor in shaping fiscal relationships among different jurisdictions when power is shared by Congress and the Executive, while it may be an almost negligible consideration in countries with a strong executive branch.

6.1 The Economy

Consider an economy that is made up of two districts indexed by $j = 1, 2$. Each district is home to two socioeconomic groups, the poor and the rich, which are indexed by $i = P, R$. The population in district j is N^j, and we normalize $N_1 + N_2 = 1$. The proportion of poor agents in each district is n_P. Denote by y_i^j the income of a member of socioeconomic group i in district j and assume that rich (poor) people in district 1 are wealthier than rich (poor) people in district 2. Specifically, assume $y_R^1 = (1 + \beta)y_R^2$ and $y_P^1 = (1 + \gamma)y_P^2$, where $0 < \beta < \gamma < \frac{y_R^2 - y_P^2}{y_P^2}$. $\beta > 0$ and $\gamma > 0$ assures that district 1 is richer than district 2; $\beta < \gamma$ implies that the level of inequality is lower in district 1 than in district 2; and $\gamma < \frac{y_R^2 - y_P^2}{y_P^2}$ implies that rich agents in district 2 are richer than poor agents in district 1.

We assume that there are four goods: a private good (c_i^j), one national public good (g), and two local public goods (g^1 and g^2). Public goods are financed by a proportional income tax (τ). As a consequence, the individual budget constraint is simply:

$$c_i^j = (1 - \tau)y_i^j \tag{6.}$$

and the government budget constraint is given by:

$$\tau y = g + g^1 + g^2 \tag{7.}$$

where $y = n_P(1 + \gamma N_1)y_P^2 + (1 - n_P)(1 + \beta N_1)y_R^2$ is the aggregate income.

Agents value the private good, the national public good, and the local public goods in their district. Specifically, for $i = P, R$ and $j = 1, 2$ and, after introducing the individual and government budget constraints, we have:

$$v_i^j(g, g^1, g^2) = \left(1 - \frac{g + g^1 + g^2}{y}\right) y_i^j + H\left(g, g^j\right) \tag{8.}$$

where $H\left(g, g^j\right)$ is strictly quasi-concave and satisfies the Inada conditions. For example,

$$H\left(g, g^j\right) = \begin{cases} \alpha \dfrac{(g)^{1-\sigma}}{1-\sigma} + (1-\alpha)\dfrac{\left(g^j\right)^{1-\upsilon}}{1-\upsilon}, & if\ \sigma \neq 1\ and\ \upsilon \neq 1 \\ (g)^{\alpha}\left(g^j\right)^{1-\alpha}, & if\ \sigma = \upsilon = 1 \end{cases} \tag{9.}$$

6.2 The Polity

We consider two possible political regimes: democracy and autocracy. Following Acemoglu and Robinson (2006), we assume that, under democracy, the government represents the poor people, i.e., it maximizes a social welfare function that gives greater weight to the welfare of the two poor groups.[15] More formally:

$$\max_{(\tau, g, g^1, g^2)} \left\{ W(D) = \omega^1(D) v_P^1 + \left(1 - \omega^1(D)\right) v_P^2 \right\} \tag{10.}$$

where $\omega^1(D) = \frac{n_P N_1 + \varphi^1}{n_P} < 1$. For a democracy in which the executive branch predominates over the legislature or where there is no malapportionment in the legislature, the government assigns weights to each poor group solely on the basis of its size, i.e., $\varphi^1 = 0$. For a democracy in which the legislature wields power and there is malapportionment, then $\varphi^1 > 0$ if district 1 is overrepresented and $\varphi^1 < 0$ if district 1 is underrepresented.

Under an autocracy, the government represents the rich groups, i.e., it maximizes a social welfare function that assigns weights only to the welfare of the two rich groups.[16] More formally,

[15] It is possible to build a detailed electoral model that leads to this welfare function. For example, we can employ a probabilistic voting model (Grossman and Helpman 2001).

$$\max_{(\tau,g,g^1,g^2)} \left\{ W(A) = \omega^1(A) v_R^1 + \left(1 - \omega^1(A)\right) v_R^2 \right\} \tag{11.}$$

where $\omega^1(A) = N_1 < 1$.

6.3 Fiscal Policy under Different Political Regimes

Denote by $\left(g(REG), g^1(REG), g^2(REG)\right)$ the allocation of public goods under political regime $REG = \{D, A\}$, where D is a democracy and A is an autocracy. Denote by $s^j(REG)$ the share of each district of the resources that finance local public goods and by $s^F(REG)$ the share of the federal government. Then:

$$s^j(REG) = \frac{g^j(REG)}{g^1(REG) + g^2(REG)} \, , s^F(REG) = \frac{g(REG)}{g^1(REG) + g^2(REG) + g(REG)} \tag{12.}$$

The following propositions characterize fiscal policy under different political regimes.

Proposition 1: *Suppose that $H\left(g, g^j\right)$ is homogeneous of some degree. Then, the revenue shares of each jurisdiction under a democracy in which there is a dominant executive branch or there is no legislative malapportionment will be the same as under an autocracy. Moreover, an overrepresented district under a democracy not dominated by the Executive will receive a larger share of the revenues than it will under an autocracy. Formally:*

$$\begin{gathered} s^1(D)(\varphi^1 < 0) < s^1(D)(\varphi^1 = 0) = s^1(A) < s^1(D)(\varphi^1 > 0) \\ s^F(D)(\varphi^1 = 0) = s^F(A) \end{gathered} \tag{13.}$$

Proof: See Appendix B. ■

Proposition 2: *Suppose that $H_2\left(g, \lambda g^j\right) = \lambda^\theta H_2\left(g, g^j\right)$ for some $\theta < 0$ and every $\lambda > 0$. Then, the revenue share of each local district under a democracy with a dominant executive branch or in which there is no*

[16] The welfare function can be the outcome of a bargaining process between the two rich groups.

legislative malapportionment will be the same as under an autocracy. Moreover, the overrepresented district under a democracy not dominated by the Executive will obtain a larger share of the revenues than it will under an autocracy. Formally:

$$s^1(D)(\varphi^1 < 0) < s^1(D)(\varphi^1 = 0) = s^1(A) < s^1(D)(\varphi^1 > 0) \tag{14.}$$

Proof: See Appendix B. ■

Formally, Propositions 1 and 2 give two different sets of conditions for preferences under which the distribution of tax revenues among the districts does not vary with the political regime. Conceptually, Propositions 1 and 2 show that military coups may not affect the distribution of tax revenues among districts in countries with a strong executive branch during periods when a democratic system of government is in power. In other words, changes in the political regime can modify the distribution between the poor and the rich without affecting the relative position of different districts.

Example 1: Assume $H\left(g, g^j\right) = (g)^{\alpha}\left(g^j\right)^{1-\alpha}$, which is homogeneous of degree 1. Then, we can use Proposition 1. Under democracy, $s^1(D) = \left[1 + \left(\frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1}\right)^{\frac{1}{\alpha}}\right]^{-1}$ and $s^F(D) = \alpha$, while under autocracy $s^1(A) = \left[1 + \left(\frac{1-N_1}{N_1}\right)^{\frac{1}{\alpha}}\right]^{-1}$ and $s^F(A) = \alpha$. However, under democracy, taxes and, hence, the level of public goods, will be higher, i.e., $\tau(D) > \tau(A)$.

Example 2: Assume $H\left(g, g^j\right) = \alpha\frac{(g)^{1-\sigma}}{1-\sigma} + (1-\alpha)\frac{\left(g^j\right)^{1-v}}{1-v}$ with $\sigma,\ v \in (0,1)$. If $\sigma = v$, then H is homogenous of degree $1-\sigma = 1-v$ and we can apply Proposition 1. Under democracy, we have $s^1(D) = \left[1 + \left(\frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1}\right)^{\frac{1}{\sigma}}\right]^{-1}$ and $s^F(D) = \left\{1 + \left[\frac{(1-\alpha)N_1}{\alpha}\right]^{\frac{1}{\sigma}}\left(\frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1}\right)^{\frac{1}{\sigma}} + \left[\frac{(1-\alpha)N_1}{\alpha}\right]^{\frac{1}{\sigma}}\right\}^{-1}$, while under autocracy, we have $s^1(A) = \left[1 + \left(\frac{1-N_1}{N_1}\right)^{\frac{1}{\sigma}}\right]^{-1}$ and $s^F(A) = \left\{1 + \left[\frac{(1-\alpha)}{\alpha}\right]^{\frac{1}{\sigma}}\left[(1-N_1)^{\frac{1}{\sigma}} + (N_1)^{\frac{1}{\sigma}}\right]\right\}^{-1}$. Again, when $\varphi^1 = 0$, the shares of each jurisdiction under democracy and autocracy are the same, but under democracy, taxes and, hence, the level of public goods, will be higher, i.e., $\tau(D) > \tau(A)$. If $\sigma \neq v$, note that

$H_2\left(g, \lambda g^j\right) = (1-\alpha)\left(\lambda g^j\right)^{-\upsilon} = (\lambda)^{-\upsilon}(1-\alpha)\left(g^j\right)^{-\upsilon} = (\lambda)^{-\upsilon} H_2\left(g, g^j\right)$. Hence, we can apply Proposition 2. Let $\Delta_A = \frac{(1+\beta N_1) y_R^2}{n_P(1+\gamma N_1) y_P^2 + (1-n_P)(1+\beta N_1) y_R^2}$ and $\Delta_D = \frac{[n_P + n_P N_1 \gamma + \varphi^1 \gamma] y_P^2}{n_P(1+\gamma N_1) y_P^2 + (1-n_P)(1+\beta N_1) y_R^2}$. Then, under democracy, we have $s^1(D) = \left[1 + \left(\frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1}\right)^{\frac{1}{\upsilon}}\right]^{-1}$ and $(n_P N_1 + \varphi^1)(1-\alpha)\left(g^1(D)\right)^{-\upsilon} = n_P \alpha \left(g(D)\right)^{-\sigma} = \Delta_D$, while under autocracy, we have $s^1(A) = \left[1 + \left(\frac{1-N_1}{N_1}\right)^{\frac{1}{\sigma}}\right]^{-1}$ and $N_1 n_P (1-\alpha)\left(g^1(A)\right)^{-\upsilon} = n_P \alpha \left(g(A)\right)^{-\sigma} = \Delta_A$. Note that, since $\sigma \neq \upsilon$, $s^F(D)$ will depend on Δ_D and $s^F(A)$ on Δ_A, $s^F(D) \neq s^F(A)$ even when $\varphi^1 = 0$. However, for $\varphi^1 = 0$, we have $s^1(D) = s^1(A)$.

So far, we have implicitly assumed that an autocracy assigns the same weight to a rich person regardless of his or her location. Analogously, a democracy dominated by the executive branch assigns the same weight to every poor citizen. Of course, this is not necessarily the case. For example, in some districts, patronage could be more likely to occur. The key point is, however, that the districts whose support is easier for a strong president in a democratic system to buy are probably also the same districts that will be more willing to sell their support to military governments. The supposition that democracies represent a coalition of poor citizens and autocracies represent a coalition of rich people does not imply that democracies and autocracies produce a different geographic pattern of representation. As a consequence, changes in the political regime can be associated with changeovers in policy that may have a significant effect on the relative well-being of poor and rich people without producing any major change in the shares of resources obtained by each jurisdiction. Thus, biases in the geographic distribution of resources can persist in the absence of a strong Congress because an autocrat that represents the rich must deal with more or less the same political constraints between districts as a dominant Executive that represents the poor. Formally, we can rework Propositions 1 and 2 with $\omega^1(D) = \frac{n_P N_1 + \mu^1 + \varphi^1}{n_P}$ and $\omega^1(A) = N_1 + \mu^1$, where μ^1 is a measure of the overrepresentation of district 1 that is unrelated to legislative malapportionment. It is easy to show that the same results will be obtained.

7. Why Is Legislative Malapportionment Immaterial in Argentina?

As we have shown in Section 5, we cannot attribute the biases in the tax sharing system to malapportionment during democratic periods. Why have changes in legislative malapportionment had no

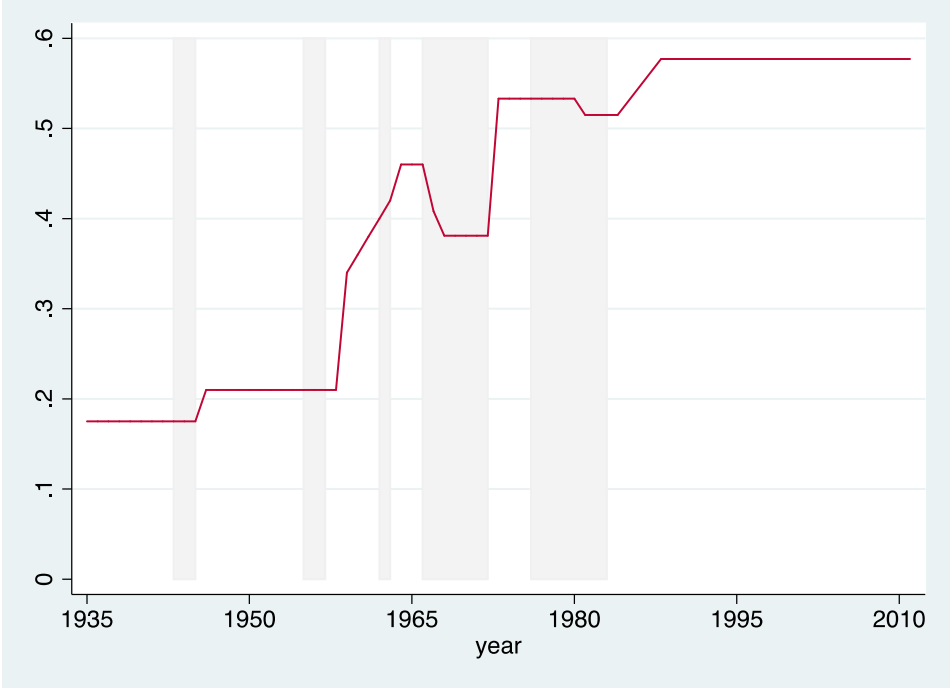
effect on the shares of the different provinces? The model we have developed in Section 6 suggests that, in democracies dominated by the executive branch, legislative malapportionment is not very relevant. In Section 5, we have also shown that military governments did not reverse the distribution of federal tax revenues among the provinces. Since military governments closed the Congress and concentrated legislative power in their own hands, this result also deserves a more detailed explanation. Why did biased distributions persist under non-democratic regimes? The model we have developed in Section 6 suggests that geographic representation may not be very sensitive to the type of political regime that is in place. In this section we further explore these questions.

7.1. The Argentine Federal Budget

Although the tax sharing system is the main mechanism for the geographical distribution of revenues among the Argentine provinces, it is not the only one. The federal government can also use its budget to channel resources to certain districts (through infrastructure projects, for example). Thus, we cannot theoretically exclude the possibility that legislative malapportionment affects the federal budget rather than the shares of the provinces in the tax sharing system. However, the available evidence suggests that this is not the case.

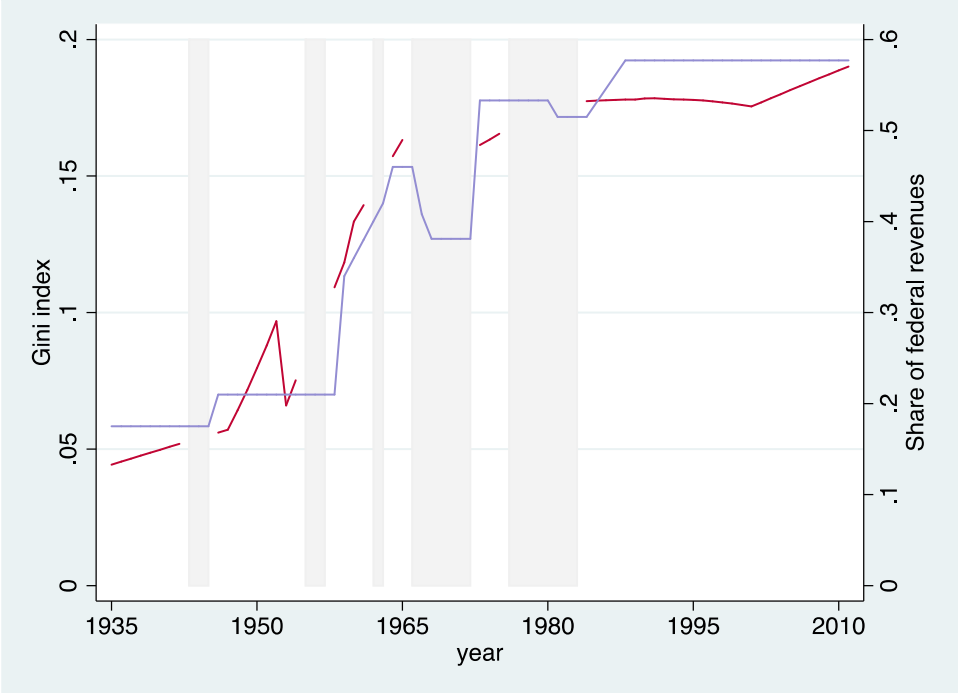
As Figure 3 shows, the proportion of revenues that the tax sharing system channels to the provinces (primary distribution) has invariably increased except on two occasions: 1967-1968 and 1981. Military governments were in power at both of these times. The proportion of revenues going to the provinces has never decreased under a democratic government. Moreover, as Figure 4 shows, democratic periods in which there were high levels of malapportionment (a higher Gini coefficient for inhabitants per seat) are associated with periods in which a larger proportion of revenues went to the provinces. Thus, it seems that the evidence does not support the hypothesis that higher levels of legislative malapportionment lead to stronger biases in the allocation of revenues among provinces via the federal budget for the simple reason that higher levels of legislative malapportionment are not associated with a larger share of revenues staying with the federal government. Although it is beyond the scope of this paper, we conjecture that a more detailed study of the geographical impact of the federal budget will also reveal the absence of a causal relationship between legislative malapportionment and any bias in the geographic allocation of revenues.

Figure 3: Percentage of Federal Revenues in the Tax Sharing System Going to the Provinces



Note: Shaded areas represent military governments.

Figure 4: Percentage of Federal Revenues in the Tax Sharing System Going to the Provinces (blue line, right axis); Gini Index for Seats per Number of Inhabitants (red line, left axis)



Note: Shaded areas represent military governments.

7.2. Legislator Behavior, Party Discipline and Parliamentary Coalitions

A necessary condition in order for changes in malapportionment to have an effect on policy outcomes is the existence of a correlation between legislator behavior and the preferences of the constituents whom they represent at the district level. If party discipline is strong, then the geographic origin of legislators may not be relevant, since their party affiliation is what will matter the most.

The evidence, however, shows that legislators respond to subnational interests, although in very different ways. Members of the U.S. Congress exhibit a great deal of autonomy in choosing whether or not to follow the party line on many issues, as Snyder and Groseclose (2000) show. Only on national issues such as the debt ceiling, tax policy and budget resolutions is the vote mostly partisan. On issues which usually have a clear geographic dimension, such as transportation, public works or agriculture, the party whip wields much less power. The main reason for such behavior may be that U.S. legislators are very responsive to electoral incentives at the constituency level because of the uninominal nature of congressional districts. Concerning the case of Japan, Kato (1998) analyzes the split of the Liberal Democratic Party in 1993 and shows that legislators with local support bases tended to be part of the "rebel" group that separated from the party at that time. The internal tensions that preceded the rupture of the other long-standing Japanese party –the Social Democratic Party– in 1996 also had to do with legislators' responsiveness to local interests: as the breakup of the party was particularly unpopular among its rank and file, Diet members who were elected by single-seat constituencies tended to side against the "rebel" group during party debates in 1994.

Jones et al. (2002) analyze the situation in Argentina and show that the link between subnational interests and legislators' behavior is mediated by the fact that deputies are generally beholden to provincial governors. Unlike the situation in the U.S., a seat in Congress is seen as a temporary stage in a person's political career. Indeed, most of the Argentine legislators remain in office for only one term: the reelection rate in the Chamber of Deputies is around 20%. The careers of Argentine politicians are mostly province-based and, as a result, legislators in Congress will tend to cater to the regional interests espoused by local party bosses – especially governors. As Levitsky's work (2003) has shown, this

"territorialization" of political incentives is clearly discernible in the most important party in Argentina – the Peronist (or "Justicialista") Party, which has governed Argentina during most of its periods of democracy since 1945.

A more subtle condition that is required in order for changes in malapportionment to have a significant effect on the pattern of policy biases is that the changes must be large enough to destabilize the majority coalition in Congress. For example, we could attribute the key biases of the Argentine tax sharing system to the existence of a majority congressional coalition composed of poor provinces that have won out over the richer Buenos Aires Province and capital district. Although the changes in the degree of legislative malapportionment that have occurred during the existence of the tax sharing system have probably not been dramatic enough to pose a challenge to this majority coalition, it is more difficult to argue convincingly that the observed changes in legislative malapportionment have not been large enough to at least modify the distribution of revenues among the members of that coalition. And yet, our results show that legislative malapportionment has had no causal impact on the shares received by the various provinces.

7.3. The Predominance of the Executive Branch

A more compelling hypothesis to explain why legislative malapportionment does not matter is that, in Argentina, key political decisions are the outcome of a bargaining process among executive authorities -- more specifically, between the president and the governors. In fact, Braun and Tommasi (2002) document the fact that legislative representation of subnational entities in Argentina is relatively poor and that the relationship between the central government and the provinces is scarcely institutionalized at all and instead consists mainly in a direct dialogue between the national executive authority (the president) and the provincial executives (the governors). In other words, Congress is not the *locus* of bargaining and, by the time a bill reaches Congress, it has already been discussed with the governors. As a consequence, there is no need to form a coalition to give expression to provincial interests in Congress because the preferences of the provinces have already been taken into account.

The predominance of the Argentine executive branch can be traced back to a variety of factors. For example, on several occasions, the Argentine Congress has delegated part of its legislative authority to the executive branch. National legislators frequently leave their seats in order to become part of the

executive branch or to run for office at a local level, implicitly revealing their assessment of the relative importance of a seat in Congress vis-à-vis a position in a ministry or the possibility of running for mayor. Even in the case where a president has resigned, political power rests with the governors of the provinces rather than with Congress. In point of fact, in 2001, during a profound economic and political crisis, the president of Argentina did resign. Although, nominally, Congress was in charge of designating a new president, the actual bargaining involved in that appointment was carried out among the governors. As it happened, Congress temporarily selected the governor of San Luis as the president, but, in less than a week, he fell out of favor with the other governors and was replaced by the governor of Buenos Aires.

7.4. Geographic Representativeness of the Executive Branch

The predominance of the executive branch is potentially a convincing explanation for why legislative malapportionment does not affect the tax sharing system under democracies in Argentina. The predominance of the executive branch cannot by itself explain why military governments have not significantly altered the allocation of revenues among provinces, however. After all, we would tend to expect that the powers of the executive branch under autocracies and democracies would differ in many ways. Yet, in Argentina, the geographic representativeness of the federal executive branch does not appear to change significantly from one political regime to the other.

In order to measure the geographic representativeness of the executive branch, we have created a database with information on the province of birth of the main members of all the governments between 1935 and 2011.[17] For democratic governments, we have gathered information referring to the president, vice-president, minister of economic affairs and minister of the interior. For military governments, the information corresponds to the military junta[18] (the chiefs of the army, the navy and the air force), the minister of economic affairs and the minister of the interior.

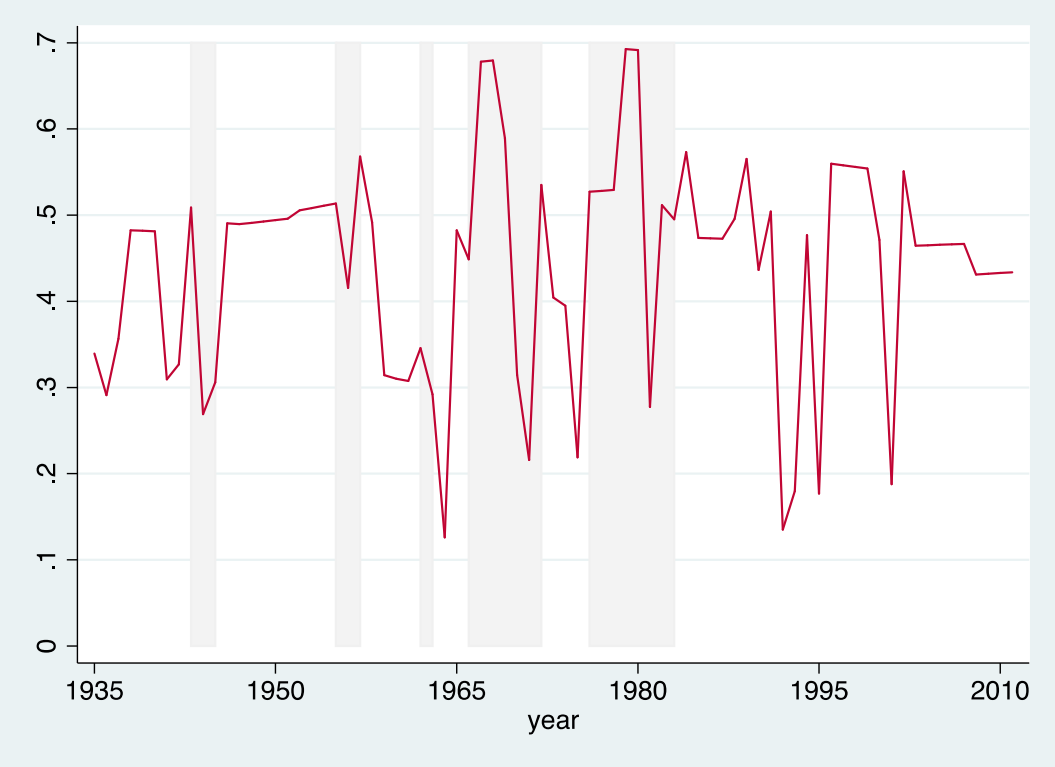
We have used this information to develop an index that quantifies the degree of geographic representativeness of each government (i.e., how much of the population is actually "represented" in the

[17] All the data refer to the members of the government as of June 30th of each year.
[18] Some military governments used formal procedures to choose a president and vice-president. In those cases, the above information corresponds to those two positions.

executive branch). To this end, we add up the proportions of the population corresponding to the districts of origin of the above-mentioned government authorities.

Figure 5 shows our index of geographic representation. As can be seen from the graph, there have been periods when the government has not been very representative in geographical terms. Take, for instance, 1992, when the President and the (acting) Vice-President were both from tiny La Rioja, the Minister of Economic Affairs was from Córdoba and the Minister of the Interior was from Mendoza. The populations of those three districts added up to only 13.5% of the population of Argentina. In contrast, in 1979, during the last military government, the Chief of Staff of the Army was from Buenos Aires Province, the Chief of Staff of the Navy was from the City of Buenos Aires, the Chief of Staff of the Air Force was from Santa Fe, the Minister of Economic Affairs was from Salta and the Minister of the Interior was from Córdoba. The populations of those districts added up to 69.3% of the total national population.

Figure 5: Geographic Representation Index



Note: Shaded areas represent military governments.

Using our index of geographic representation, we can construct a test to see whether military governments are more representative in geographical terms than democratic ones. In Table 3 we present the results of an equal means test for democratic and military governments. As can be seen from the table, there is no statistically significant difference between the mean values on our index for the two types of political regimes.

Table 3: Equal Means Test Based on the Geographic Representation Index

	Democracy	Military Government	Difference
GRI	0.429	0.474	0.045
	(0.115)	(0.149)	(0.032)
T-test p-value			0.160
Observations	55	22	

Note: Standard Deviations in parenthesis for Democracy and Military Government and Standard Error for the Mean Difference.

To sum up, it appears that a non-institutionalized bargaining process determines the distribution of tax revenues among the provinces, which is why that distribution does not differ to any appreciable extent under different political regimes. This is why changes in the extent of malapportionment do not affect the distribution pattern associated with the tax sharing scheme under democracy; it also explains why military governments did not reverse the distribution pattern. The persistence of these biases in the tax sharing scheme suggests that there is a deep-seated political equilibrium that remains unaltered in the face of regime change and that is what ultimately accounts for the differing levels of bargaining power of each district in the informal negotiations and, hence, the observed pattern of geographical redistribution.

8. Conclusions

In this paper we have explored the question as to whether legislative malapportionment in the Argentine Congress is the cause of the observed biases in the country's federal tax sharing scheme. Using three quasi-natural experiments, we have shown that legislative malapportionment has had no significant effect on the federal tax sharing scheme under democratic governments and that there is no evidence that centralized military governments reduced the bias of the distribution pattern associated with the tax sharing scheme. We have also developed a simple model of how fiscal policy is determined in a federal system of government. The model suggests that the share of public revenues received by each local government is not altered by changes in the political regime when democratic governments are in place that are dominated by the executive branch but that, conversely, districts that are overrepresented in the legislature obtain a larger share of revenues under a democracy than under an autocracy when Congress is not dominated by the executive branch. Finally, we have also argued that the executive branch of the Argentine government predominates over the legislature and have shown that the extent of the geographic representativeness of the executive branch of military and democratic governments does not differ to any significant extent.

These six findings, when taken together, point toward the existence of a more structural type of equilibrium that determines the distribution of tax revenues among Argentina's provinces. This equilibrium is not destabilized by changes in the distribution of the legislative representation of the provinces or by the nature of the political regime. Our findings also point up some methodological issues. First, for developing countries, consideration needs to be given to the fact that formal institutions (those that hold de jure political power) might not be the key determinants of political outcomes and that

informal institutions (those holding de facto political power) could be more influential. Indeed, as Acemoglu and Robinson (2008) show, it may be that the distribution of political power will remain the same after a major change in the formal institutional framework because those changes can be easily neutralized by existing informal institutions. In the same vein, our findings suggest that the way in which the different institutions interact may be a very important factor. Legislative malapportionment could be an innocuous factor while there is a strong executive branch but could become a key factor (as well as a source of social conflict) if Congress is empowered.

Second, why do the districts that are net losers accept the biases in the system? In other words, if legislative malapportionment is the main cause of a biased distribution of resources, why do the losers agree or allow themselves to be underrepresented? If other institutions (e.g., informal bargaining between the president and the governors) are generating the biases, why are these informal institutions allowed to continue to exist? All this suggests that, ultimately, there must be some more deep-seated type of equilibrium that determines the distribution of tax revenues among subnational entities. We conjecture that, in developed countries, this equilibrium is reflected in a country's formal institutions, (e.g., the number of representatives that each district has in the legislature), while, in developing countries, this equilibrium is reflected in the bargaining power of each district in the informal negotiations that determine the geographic distribution of resources.

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Appendix A

In this appendix we provide an overview of the sources of information on the relevant fiscal, political and demographic variables that were used for this study.

For the fiscal variables, the sources were the annual reports of the Treasury Ministry ("Memorias del Ministerio de Hacienda") from 1935 to 1958, the statistical yearbooks of the General Tax Directorate ("Boletines Estadísticos de la Dirección General Impositiva") from 1958 to 1979, the annual reports of the Treasury Department ("Memorias de la Secretaría de Hacienda") from 1980 to 1984, and various publications of the National Directorate for Provincial Fiscal Coordination ("Dirección Nacional de Coordinación Fiscal con las Provincias") from 1985 to 2011.

For every year, we computed the total amount of transfers received by each province under the terms of the relevant legislation (see Table A.1) – that is, we excluded those transfers that corresponded to what are known as "national treasury contributions" (*aportes del tesoro nacional* (ATN)), which are discretionary. An exception was made for 1985-1987 when, because no tax sharing law was in force, all the revenues were formally shared via national treasury contributions.

In the years between 1935 and 1940, the so-called "definitive" amounts of transfers were used. In that period, the central government transferred a "provisional" amount of revenues during each year and, on two occasions (1936 and 1942), later readjusted those amounts. These corrections were not significant in most of the cases, however. In the 1990s, the amount of revenue transfers made under laws other than Revenue Sharing Act No. 23.548 began to increase so significantly that, by the late 2000s, about 20% of the tax revenue shared with the provinces were accounted for by those supplementary laws. We included all these transfers in our computations since they are part of the overall tax sharing scheme.

Table A.1: Laws Included in the Tax Sharing Scheme

Law Number	Year	Tax Revenues Shared
12139	1934	Domestic Taxes
12143	1934	Income Tax
12147	1934	Sales Tax
12956	1946	Incidental and Extraordinary Profits Taxes
14060	1951	Inheritance Tax

14390	1954	Domestic Taxes
14788	1959	Incidental and Extraordinary Profits Taxes, Inheritance Tax, Income Tax, Sales Tax
20221	1973	All national taxes*
20633	1973	Value Added Tax
22293	1980	All national taxes*
22294	1980	All national taxes*
23548	1988	All national taxes*
23906	1991	Asset Tax
23966	1992	Value Added Tax
24049	1992	All national taxes*
24065	1992	Wholesale Energy Tax
24073	1992	Income Tax
24130	1992	All national taxes*
24464	1995	Fuel Tax
24699	1996	All national taxes*
24977	1998	Self-employed Income Tax
25235	1999	All national taxes*
25400	2000	All national taxes*
25570	2002	All national taxes*
26075	2006	All national taxes*

*Except taxes on foreign trade.

For the political and demographic variables, the sources used were:

Table A.2: Political and Demographic Variables

Variable	**Source**
Dictatorship: dummy equal to 1 if, on June 30th of the corresponding year, the government was a military dictatorship.	
Democracy: dummy equal to 1 if, on June 30th of the corresponding year, the government was a democracy.	
Population, by province	Yearly estimates by INDEC (National Institute of Statistics and Censuses).
Seats in the Chamber of Deputies, by province	Molinelli et al. (1999).
Province of origin of members of government	Molinelli et al. (1999).

Appendix B

In this appendix we prove Propositions 1 and 2. We first prove two lemmas that characterize the solution of the government's problem under democracy and autocracy, respectively. Propositions 1 and 2 are simple corollaries of these lemmas.

Lemma 1: Consider the public finance problem under democracy.

a. Suppose that $H\left(g, g^j\right)$ is homogeneous of some degree. Then, $s^1(D)$ and $s^F(D)$ depend only on (n_P, N_1, φ^1). Moreover, they are implicitly given by (Note: We omit the D in the next two equations):

$$\left[\frac{1-s^1(D)}{s^1(D)}\right]^{1-\sigma}\left[\frac{H_2\left(\frac{s^F(D)}{s^1(D)\left(1-s^F(D)\right)},1\right)}{H_2\left(\frac{s^F(D)}{\left(1-s^1(D)\right)\left(1-s^F(D)\right)},1\right)}\right]-\frac{n_P-n_PN_1-\varphi^1}{n_PN_1+\varphi^1}=0$$

$$\left[\frac{1-s^1(D)}{s^1(D)}\right]^{1-\sigma}\left[\frac{H_2\left(\frac{s^F(D)}{s^1(D)\left(1-s^F(D)\right)},1\right)-H_1\left(\frac{s^F(D)}{s^1(D)\left(1-s^F(D)\right)},1\right)}{H_1\left(\frac{s^F(D)}{\left(1-s^1(D)\right)\left(1-s^F(D)\right)},1\right)}\right]-\frac{n_P-n_PN_1-\varphi^1}{n_PN_1+\varphi^1}=0 \quad (15.)$$

b. Suppose that $H_2\left(g, \lambda g^j\right)=\lambda^\theta H_2\left(g, g^j\right)$ for some θ and every $\lambda>0$. Then, $s^1(D)$ depends only on (n_P, N_1, φ^1), but $s^F(D)$ might depend on $\left(y_P^2, y_R^{2,}, \gamma, \beta\right)$ as well. Moreover, $s^1(D)$ is given by:

$$s^1(D)=\left[1+\left(\frac{n_PN_1+\varphi^1}{n_P-n_PN_1-\varphi^1}\right)^{\frac{1}{\theta}}\right]^{-1} \quad (16.)$$

Proof: Under democracy, the government's problem is:

$$\max_{(\tau,g,g^1,g^2)}\left\{W(D)=\omega^1(D)v_P^1+\left(1-\omega^1(D)\right)v_P^2\right\}$$

where $\omega^1(D)=\frac{n_PN_1+\varphi^1}{n_P}$. The first-order conditions for welfare maximization are:

$$\frac{\partial W}{\partial g^1} = 0 \Rightarrow (n_P N_1 + \varphi^1) H_2\big(g(D), g^1(D)\big) = \Delta_D$$

$$\frac{\partial W}{\partial g^2} = 0 \Rightarrow (n_P - n_P N_1 - \varphi^1) H_2\big(g(D), g^2(D)\big) = \Delta_D$$

$$\frac{\partial W}{\partial g} = 0 \Rightarrow (n_P N_1 + \varphi^1) H_1\big(g(D), g^1(D)\big) + (n_P - n_P N_1 - \varphi^1) H_1\big(g(D), g^2(D)\big) = \Delta_D$$

where $\Delta_D = \frac{[n_P + n_P N_1 \gamma + \varphi^1 \gamma] y_P^2}{n_P(1+\gamma N_1) y_P^2 + (1-n_P)(1+\beta N_1) y_R^2}$. Since H is strictly quasi-concave and satisfies the Inada conditions, the first-order conditions are sufficient for a unique global maximum. After simple algebra we obtain:

$$(n_P N_1 + \varphi^1) H_2\big(g(D), g^1(D)\big) = (n_P - n_P N_1 - \varphi^1) H_2\big(g(D), g^2(D)\big) =$$
$$= (n_P N_1 + \varphi^1) H_1\big(g(D), g^1(D)\big) + (n_P - n_P N_1 - \varphi^1) H_1\big(g(D), g^2(D)\big)$$

a. Suppose that H is homogeneous of degree σ. Then:

$$(n_P N_1 + \varphi^1)[g^1(D)]^{\sigma-1} H_2\left(\frac{g(D)}{g^1(D)}, 1\right) = (n_P - n_P N_1 - \varphi^1)[g^2(D)]^{\sigma-1} H_2\left(\frac{g(D)}{g^2(D)}, 1\right) =$$
$$= (n_P N_1 + \varphi^1)[g^1(D)]^{\sigma-1} H_1\left(\frac{g(D)}{g^1(D)}, 1\right) + (n_P - n_P N_1 - \varphi^1)[g^2(D)]^{\sigma-1} H_1\left(\frac{g(D)}{g^2(D)}, 1\right)$$

Therefore, $s^F(D)$ and $s^1(D)$ are implicitly determined by the following two equations:

$$\left[\frac{1 - s^1(D)}{s^1(D)}\right]^{1-\sigma} \left[\frac{H_2\left(\frac{s^F(D)}{s^1(D)\left(1 - s^F(D)\right)}, 1\right)}{H_2\left(\frac{s^F(D)}{\left(1 - s^1(D)\right)\left(1 - s^F(D)\right)}, 1\right)}\right] - \frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1} = 0$$

$$\left[\frac{1 - s^1(D)}{s^1(D)}\right]^{1-\sigma} \left[\frac{H_2\left(\frac{s^F(D)}{s^1(D)\left(1 - s^F(D)\right)}, 1\right) - H_1\left(\frac{s^F(D)}{s^1(D)\left(1 - s^F(D)\right)}, 1\right)}{H_1\left(\frac{s^F(D)}{\left(1 - s^1(D)\right)\left(1 - s^F(D)\right)}, 1\right)}\right] - \frac{n_P - n_P N_1 - \varphi^1}{n_P N_1 + \varphi^1} = 0$$

b. If $H_2\left(g, \lambda g^j\right) = \lambda^\theta H_2\left(g, g^j\right)$ from the first equality, we have:

$$(n_P N_1 + \varphi^1)\left(g^1(D)\right)^\theta H_2(g(D), 1) = (n_P - n_P N_1 - \varphi^1)\left(g^2(D)\right)^\theta H_2(g(D), 1)$$

Therefore, $s^1(D)$ is given by:

$$s^1(D) = \left[1 + \left(\frac{n_P N_1 + \varphi^1}{n_P - n_P N_1 - \varphi^1}\right)^{\frac{1}{\theta}}\right]^{-1}$$

This completes the proof of Lemma 1. ■

Lemma 2: Consider the public finance problem under an autocracy.

a. Suppose that $H\left(g, g^j\right)$ is homogeneous of some degree. Then, $s^1(A)$ and $s^F(A)$ depend only on N_1. Moreover, they are implicitly given by:

$$\begin{gathered}\left[\frac{1 - s^1(A)}{s^1(A)}\right]^{1-\sigma} \frac{H_2\left(\frac{s^F(A)}{s^1(A)\left(1 - s^F(A)\right)}, 1\right)}{H_2\left(\frac{s^F(A)}{\left(1 - s^1(A)\right)\left(1 - s^F(A)\right)}, 1\right)} - \frac{1 - N_1}{N_1} = 0 \\ \left[\frac{1 - s^1(A)}{s^1(A)}\right]^{1-\sigma} \left\{\frac{H_2\left(\frac{s^F(A)}{s^1(A)\left(1 - s^F(A)\right)}, 1\right) - H_1\left(\frac{s^F(A)}{s^1(A)\left(1 - s^F(A)\right)}, 1\right)}{H_1\left(\frac{s^F(A)}{\left(1 - s^1(A)\right)\left(1 - s^F(A)\right)}, 1\right)}\right\} - \frac{1 - N_1}{N_1} = 0\end{gathered} \tag{17.}$$

b. Suppose that $H_2\left(g, \lambda g^j\right) = \lambda^\theta H_2\left(g, g^j\right)$ for some θ and every $\lambda > 0$. Then, $s^1(D)$ depends only on (n_P, N_1, φ^1), but $s^F(D)$ might depend on $\left(y_P^2, y_R^{2,}, \gamma, \beta\right)$ as well. Moreover, $s^1(A)$ is given by:

$$s^1(A) = \left[1 + \left(\frac{N_1}{1-N_1}\right)^{\frac{1}{\theta}}\right]^{-1} \tag{18.}$$

Proof: Under autocracy, the government's problem is:

$$\max_{(\tau, g, g^1, g^2)} \{W(A) = (1-n_P)N_1 v_R^1 + (1-n_P)N_2 v_R^2\}$$

The first-order conditions for this problem are:

$$\frac{\partial W}{\partial g^1} = 0 \Rightarrow N_1 H_2\big(g(A), g^1(A)\big) = \Delta_A$$

$$\frac{\partial W}{\partial g^2} = 0 \Rightarrow (1-N_1) H_2\big(g(A), g^2(A)\big) = \Delta_A$$

$$\frac{\partial W}{\partial g} = 0 \Rightarrow N_1 H_1\big(g(A), g^1(A)\big) + (1-N_1) H_1\big(g(A), g^2(A)\big) = \Delta_A$$

where $\Delta_A = \frac{(1+\beta N_1) y_R^2}{n_P(1+\gamma N_1) y_P^2 + (1-n_P)(1+\beta N_1) y_R^2}$. Therefore:

$$N_1 H_2\big(g(A), g^1(A)\big) = (1-N_1) H_2\big(g(A), g^2(A)\big) = N_1 H_1\big(g(A), g^1(A)\big) + (1-N_1) H_1\big(g(A), g^2(A)\big)$$

a. Suppose that H is homogeneous of degree σ. Then:

$$N_1 [g^1(A)]^{\sigma-1} H_2\left(\frac{g(A)}{g^1(A)}, 1\right) = (1-N_1)[g^2(A)]^{\sigma-1} H_2\left(\frac{g(A)}{g^2(A)}, 1\right) =$$

$$= N_1 [g^1(A)]^{\sigma-1} H_1\left(\frac{g(A)}{g^1(A)}, 1\right) + (1-N_1)[g^2(A)]^{\sigma-1} H_1\left(\frac{g(A)}{g^2(A)}, 1\right)$$

Therefore, $s^F(A)$ and $s^1(A)$ are implicitly determined by the following two equations:

$$\left[\frac{1-s^1(A)}{s^1(A)}\right]^{1-\sigma}\frac{H_2\left(\frac{s^F(A)}{s^1(A)\left(1-s^F(A)\right)},1\right)}{H_2\left(\frac{s^F(A)}{\left(1-s^1(A)\right)\left(1-s^F(A)\right)},1\right)}-\frac{1-N_1}{N_1}=0$$

$$\left[\frac{1-s^1(A)}{s^1(A)}\right]^{1-\sigma}\left\{\frac{H_2\left(\frac{s^F(A)}{s^1(A)\left(1-s^F(A)\right)},1\right)-H_1\left(\frac{s^F(A)}{s^1(A)\left(1-s^F(A)\right)},1\right)}{H_1\left(\frac{s^F(A)}{\left(1-s^1(A)\right)\left(1-s^F(A)\right)},1\right)}\right\}-\frac{1-N_1}{N_1}=0$$

b. If $H_2\left(g,\lambda g^j\right)=\lambda^\theta H_2\left(g,g^j\right)$, from the first equality, we have:

$$N_1\left(g^1(A)\right)^\theta H_2(g(A),1)=(1-N_1)\left(g^2(A)\right)^\theta H_2(g(A),1)$$

Therefore, $s^1(A)$ is given by:

$$s^1(A)=\left[1+\left(\frac{N_1}{1-N_1}\right)^{\frac{1}{\theta}}\right]^{-1}$$

This completes the proof of Lemma 2. ■

In order to prove Proposition 1, note that if $\varphi^1=0$, then expressions (15) and (17) are exactly the same. An algebraically tedious, but simple, application of the implicit function theorem to expression (15) proves that $s^1(D)$ is increasing in φ^1, provided that $\theta<0$. In order to prove Proposition 2, note that when $\varphi^1=0$, expressions (16) and (18) are the same and that $s^1(D)=\left[1+\left(\frac{n_P-n_PN_1-\varphi^1}{n_PN_1+\varphi^1}\right)^{\frac{1}{\theta}}\right]^{-1}$ is increasing in φ^1. ■