The Tragedy of the Commons or the Curse of Federalism*

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Abstract

It has been suggested that fiscal federalism is a good way to induce decentralized entities to behave parsimoniously, but this has been largely criticized in the literature, in particular because of the Common-Pool problem. In this paper, we present an extra facet of the latter problem. We present a simple theoretical model confirmed by empirical evidence suggesting that vertical imbalance induces govenments to substitute redistributive spending for non-distributive expenditures. This drives fiscal policies to be less efficient in reducing income inequality.

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1 Introduction

Income inequality has seriously increased since the late 1970s (see Atkinson, 1997 and Gottschalk and Smeeding, 1997, for example) and is probably higher than it has ever been. An emerging literature is investigating the sources of this rising trend, emphasizing the role of skill-biased technological change (see e.g. Piketty, 2000 and Acemoglu, 2003). At the same time, a general trend toward fiscal decentralisation has been observed both in developed and developing countries (see e.g. Pisauro 2002, Wildasin 1997, Ter-Minassian 1997). Are these two features related? Can federalism be seen as one of the causes of increasing income inequality? Data tend to support this link; indeed the average income inequality of countries with federal structures (measured by the Gini index) is around 0.33, while those that have very centralized States average about 0.27 (and the difference is statistically significative)[1].

In the literature, several effects that might explain this relation have been suggested, yet, to the best of our knowledge, the specific role played by a Common-Pool financing on the distribution of incomes has not been identified up to now. What we show in this paper is that central financing of local expenditures, will induce a replacement of (national) redistributive expenditures by (local) non-redistributive ones, affecting the income distribution negatively[2].

[1] Note that results are similar if we look at median instead of average levels of inequality.

[2] The definition of public goods used is the one suggested by Breton (1965): i.e. public goods can be seen as externality-generating goods that have different levels of spatial influence. A good (or a service) is considered as belonging to a given level (e.g. national, regional, etc) if the externalities that it generates benefit individuals of the corresponding dimension. Public goods that generate externalities at the national level are thus called *national* public goods, while those which produce geographically limited externalities are called *local* public goods . As will be shown later, given this definition, only national public goods have redistributive effects.

The intuition for this is that before the budget constraint becomes binding, each entity maintains the national public good at its optimal level and only increases local public goods spending. Once the budget constraint becomes binding, entities will try to freeride on national expenditures demanded by the other jurisdictions and use the available common resources to consume local public goods. Since all of the entities play the same game, a classical prisoner's dilemma will occur implying a suboptimal solution. Indeed the result will be that in case of common financing, there will be an overprovision of local public goods and an underprovision of the national public goods.

The Common-Pool problem was first described by the mathematician Forster Lloyd in 1833. But it was not really explicited until 1968, when Hardin, in his famous article entitled "The Tragedy of the Commons", introduced the idea that when agents make individual decisions on a common property, the result is its overexploitation. The transposition of this idea to the field of public finance led to a thorough economic analysis of the problem. Weingast et al. (1981) formalized this idea and showed that, in federal systems, since decentralized expenditures are financed by the central level, the real cost of goods and services supplied at the local level will be underestimated and there will be an overprovision of public goods. This feature has been confirmed empirically by many authors, among others, Rodden (2003), Stein (1998) and Borge and Rattso (2002). In the corresponding economic literature, there is quite a large consensus on the result given above.

To avoid excessive public spending, it might be argued that the central State could set a maximal spending limit for each decentralized entity. Even if this idea seems efficient, it is extremely difficult to implement in practice. Indeed, decentralized entities, when choosing their budget, anticipate the fact that they

will most likely face a *soft budget constraint* (Kornai et al., 2003) and will overspend anyway. With a similar reasoning, Wildasin (1999) argues that no central State can afford the bankruptcy of any decentralized entity (especially if it is large) because the resulting economic disequilibria would be unsustainable. This likely bailout, in case of fiscal misbehavior, renders the idea of a limitation of the overspending associated with the Common-Pool problem inapplicable. As suggested by Tiebout (1956) and Oates (1972), another possible solution might be to link local expenditures to local revenues. However, even this causes problems: several authors (e.g. Oates and Schwab, 1988, Zodrow and Mieszowkski, 1986 and Wildasin, 1989) suggest that, apart from the potential polarization of wealth, this might result in a *race to the bottom in taxation*, implying that the collected revenues would be too limited, leading to an underprovision of public goods. Even if Keen and Kotsogiannis (2002) somewhat relativize the above-mentioned tax competition problem by stating that vertical externalities pull spending upwards, it seems that the inefficiencies associated with the Common-Pool problem will always appear in a multilevel State. Our idea is that the Common-Pool problem will furthermore *limit* the redistributive effect of fiscal policies since it induces low levels of redistributive spending. Assuming an extreme simplification of government expenditures, i.e. only two types of public goods (one which generates country-level externalities and thus has redistributive effects (national public good) and the other which does not (local public good)), we present a model which shows that, in case of common financing, the national public good will be replaced by local ones.

The structure of the paper is the following: after this introduction, in section 2 we present a simple model. In section 3, we detail the methodology we follow and the data we use to test the predictions of the model and in section 4 we

present our main results. In the fifth and final section, we conclude.

2 The Model

Before presenting the model, it is important to explain why national public goods are redistributive. Imagine a world composed of two individuals with unequal incomes. If they do not interact, the national public good consumption of each individual will depend solely on his personal wealth, i.e. the rich one will have more than the poor one. Both individuals would obviously be much better off if they had access to a higher level of public good consumption, but they do not want to spend more than the strict minimum ensuring a sufficient satisfaction level of their preferences. Now, if the individuals decide to interact, the public good consumption of each individual will not only depend on his own wealth, but also on that of the other. This is due to the fact that a national public good generates externalities that will benefit everyone. In case of cooperation, the rich individual will receive an amount equivalent to what he would have been willing to pay, plus something extra generated by the externality coming from the consumption of the poor one. The poor individual, similarly, will receive much more than what he would have been able to afford alone. It is obvious that the externalities directed from the rich toward the poor are much higher those in the opposite direction. A national public good will thus have major redistributive effects. Since local public goods do not generate externalities, they will have no redistributive effect. The main type of national redistributive public good is obviously the welfare state.

The model considered here is an extension of the single-period local public goods model of Persson and Tabellini[3] (2000), in which we introduce both a

[3] Chapter 7, page 161.

national public good and local public goods at the same time, to take into account the possible substitution that might occur between the two types of goods.

Assume a country composed of J distinct regions inside each of which individuals share identical preferences. Preferences may vary between regions. The size of region k ($k = 1, ..., J$) is N^k, with $\sum_{k=1}^{J} N^k = N$, where N is the total population size. There are three types of goods in the economy, a region-specific private good, denoted by c^j in region j, and two types of public goods: a national public good denoted by T and J local public goods[4], denoted in each region j by g^j. The externalities generated by T affect all of the regions in the same way. For the purpose of the model, following Mas-Colell et al. (1995), the national public good T is defined as the sum of all individual demands for it (t^k will denote the demand of any individual of region k for that good).

The utility function w^j of each individual of region j is quasi-linear. It is given by

$$w^j = c^j + H(g^j) + S(T) \tag{1}$$

where c^j represents the private good consumption of an individual of region j, g^j represents the per capita supply of a local public good in region j, and T stands for the aggregate demand of all national public goods i.e. $T = \sum_{k=1}^{J} N^k t^k$. Functions $H(\cdot)$ and $S(\cdot)$ are assumed to be strictly increasing and strictly concave with $H(0) = 0$ and $S(0) = 0$. Individual income (y^j for the individuals of region j) is identical for all individuals within a region but not necessarily between regions. One unit of income (private consumption) can be transformed with no cost either into a unit of one of the J local public goods or into a unit

[4] Without loss of generality, to simplify notations in the model, from here on we will consider that local public goods do not generate any externalities.

of the national public good. Finally, we assume non distortionary taxation.

2.1 First Best Solution: Maximizing Aggregate Utility

As a normative benchmark we consider the utilitarian optimum obtained by maximizing the Benthamite welfare function i.e.

$$\underset{g,\,t}{Max} \sum_{j=1}^{J} \frac{N^j}{N} w^j \tag{2}$$

subject to a resource constraint

$$\sum_{j=1}^{J} N^j g^j + \sum_{j=1}^{J} N^j c^j + \sum_{j=1}^{J} N^j t^j = Ny \tag{3}$$

where y represents the overall average income[5], ensuring that the aggregate revenue in the entire economy is equal to the sum of aggregate consumption of both private and public goods, and to the government's budget constraint

$$\sum_{j=1}^{J} N^j g^j + \sum_{j=1}^{J} N^j t^j \leq \tau Ny \tag{4}$$

where τ represents the maximal proportion of income that the government can levy from the economy[6], ensuring that the government does not spend more than it raises from taxes.

The first order conditions of the maximization problem yield

$$H'(g^p_{FB}) = 1 + \lambda,\ \forall p = 1, ..., J \tag{5}$$

$$S'(T_{FB}) = \frac{1}{N}(1 + \lambda),\ \forall p = 1, ..., J \tag{6}$$

where λ is a Lagrange multiplier and subscript FB means "First Best".

[5] Implying that Ny represents the aggregate income of all individuals in the country.

[6] Something comparable to the notion of maximum *tolerable level of taxation* defined by Peacock and Wiseman (1961).

These results are quite standard: the usual optimality condition for local public goods holds (i.e. marginal utility is equal to marginal social cost) and for the national public good, the Samuelson (1954, 1955) condition for Benthamite utility holds.

2.2 Common-Pool Solution: Maximizing Local Utility

Under fiscal federalism, decentralized entities can choose some expenditures on the basis of their preferences. As stated by many scholars (e.g. Oates, 1972 and Musgrave, 1959) taxes cannot be completely decentralized (especially those associated with mobile bases) otherwise a massive move of the population and even of firms would occur. This would lead to an unsustainable situation, since it would create a progressive polarization of wealth. A degree of decentralization of expenditures higher than that of revenues will thus generally be observed. This creates what is called the "Common-Pool problem".

Under decentralization, each jurisdiction will maximize its individual utility function under a global budget constraint. The functions to maximize are

$$w^j = c^j + H(g^j) + S(T) \qquad j = 1, ..., J \tag{7}$$

where private consumption is the available income[7], i.e. the difference between income y^j and lump-sum taxation α.

$$c^j = y^j - \alpha \tag{8}$$

under the same aggregate budget constraint as in the First-Best problem i.e.

$$\sum_{i=1}^{J} N^i g^i + \sum_{i=1}^{J} N^i t^i \leq \tau N y \tag{9}$$

[7] Due to quasi-linear preferences.

and the budget constraint associated to the Common-Pool problem[8]

$$\sum_{i=1}^{J} N^i g^i + \sum_{i=1}^{J} N^i t^i = N\alpha \tag{10}$$

guaranteeing that the global amount which is spent is equal to the total resources of the government. In other words, "everybody pays for everybody".

The first-order conditions of the maximization problems yield

$$H'(g^p_{CP}) = (1+\gamma^p)\frac{N^p}{N} \qquad \forall p = 1, ..., J \tag{11}$$

$$S'(T_{CP}) = (1+\gamma^p)\frac{1}{N} \qquad \forall p = 1, ..., J \tag{12}$$

where the γ^ps are Lagrange multipliers and subscript CP means "Common-Pool".

2.3 Discussion

>From the first-order conditions, we will show that, in the Common-Pool case, once the budget constraint becomes binding, decentralized entities will tend to substitute national public goods for local ones . On the other hand, if the budget constraint is not binding, there will be overspending and we will show that it will only be directed toward local public goods. These results are proven hereunder on the basis of three lemmas. The first one shows that only a subset of the possible values of the Lagrange multipliers of the First-Best and Common-Pool problems are mathematically pertinent. The second and third lemmas detail and interpret the feasible cases.

Lemma 1 *$\lambda < \gamma^p$ or $\lambda = \gamma^p = 0$ for each p.*

[8] It can easily be shown that under (9) and (10) the resource constraint is necessarily satisfied and can thus be omitted in this maximization problem.

Proof. By (12) it is clear that all γ^ps are identical.

Assume first that $\lambda > \gamma^p$.

As $\lambda > 0$, the budget constraint of the First-Best solution is binding, i.e. $\sum_{j=1}^{J} \frac{N^j}{N} g^j_{FB} + \frac{1}{N} T_{FB} = \tau y$.

For each p, we have $H'(g^p_{FB}) = 1 + \lambda$ which, by our initial assumption, is larger than $(1 + \gamma^p)\frac{N^p}{N}$, i.e. $H'(g^p_{CP})$.

Given that $H(\cdot)$ is assumed to be strictly increasing and strictly concave, we have $g^p_{FB} < g^p_{CP}$ for each p, thus

$$\sum_{j=1}^{J} \frac{N^j}{N} g^j_{FB} < \sum_{j=1}^{J} \frac{N^j}{N} g^j_{CP} \tag{13}$$

We also have $S'(T_{FB}) = \frac{1}{N}(1 + \lambda)$. The assumption $\lambda > \gamma^p$ for each p thus implies that $S'(T_{FB})$ is larger than $\frac{1}{N}(1 + \gamma^p)$ i.e. $S'(T_{CP})$. Given the assumptions we made on $S(\cdot)$, we get

$$T_{FB} < T_{CP} \tag{14}$$

The budget constraint along with (13) and (14) imply $\sum_{j=1}^{J} \frac{N^j}{N} g^j_{FB} + \frac{1}{N} T_{FB} = \tau y < \sum_{j=1}^{J} \frac{N^j}{N} g^j_{CP} + \frac{1}{N} T_{CP} \leq \tau y$, a contradiction.

A similar proof shows that $\lambda = \gamma^p > 0$ is impossible. ■

Having shown that either $\lambda = 0 = \gamma^p$ or $\lambda < \gamma^p$ for each p, we now turn to the interpretation of these two cases.

Lemma 2 *If $\lambda = 0 = \gamma^p$ for each p, there will be overprovision of local public goods in the Common-Pool set-up with respect to the First-Best situation, while the national public good will be efficiently provided, i.e. $g^p_{FB} < g^p_{CP}$ for each p and $T_{FB} = T_{CP}$.*

Proof. >From $\lambda = 0 = \gamma^p$, (5) and (11), we have $H'(g^p_{FB}) = 1$ and $H'(g^p_{CP}) = \frac{N^p}{N}$ implying that $H'(g^p_{FB}) > H'(g^p_{CP})$. Given the initial assumptions on $H(\cdot)$, this implies that $g^p_{FB} < g^p_{CP}$.

Similarly, $\lambda = 0 = \gamma^p$, (6) and (12) imply that $S'(T_{FB}) = \frac{1}{N}$ and $S'(T_{CP}) = \frac{1}{N}$, thus $S'(T_{FB}) = S'(T_{CP})$ which implies $T_{FB} = T_{CP}$. ■

When $\lambda = 0 = \gamma^p$, either one or both of the constraints are binding which, as in the proof of Lemma 1, results in a contradiction, or neither of the constraints is binding and the overspending associated with the Common-Pool problem is entirely directed toward local public goods.

Lemma 3 *If $\lambda < \gamma^p$, in the Common-Pool case there will be an overprovision of local public goods and an underprovision of the national public good with respect to the First-Best situation i.e. $g^p_{FB} < g^p_{CP}$ and $T_{FB} > T_{CP}$.*

Proof. We first show that if $\lambda < \gamma^p$, then necessarily $\gamma^p < \frac{N}{N^p}(1+\lambda) - 1$.

If not, then, on the one hand, $\frac{N^p}{N}(\gamma^p + 1) \geq 1 + \lambda$, thus $H'(g^p_{CP}) \geq H'(g^p_{FB})$ which implies $g^p_{CP} \leq g^p_{FB}$ for each p, thus

$$\sum_{j=1}^{J} \frac{N^j}{N} g^j_{CP} \leq \sum_{j=1}^{J} \frac{N^j}{N} g^j_{FB} \tag{15}$$

On the other hand, since $S'(T_{FB}) = \frac{1}{N}(1+\lambda)$ and $S'(T_{CP}) = \frac{1}{N}(1+\gamma^p)$, $\lambda < \gamma^p$ implies $S'(T_{FB}) < S'(T_{CP})$. Then, given the initial assumptions on $S(\cdot)$, we have

$$T_{CP} < T_{FB} \tag{16}$$

Summing (15) and (16) yields $\sum\limits_{j=1}^{J} \frac{N^j}{N} g^j_{CP} + T_{CP} < \sum\limits_{j=1}^{J} \frac{N^j}{N} g^j_{FB} + T_{FB}$ which means that a central funding for local spending would lead to a lower aggregate

demand for local and national public goods by decentralized entities. This contradicts all of the existing literature on the Common-Pool problem.

As a result, recalling that $H'(g^p_{FB}) = 1 + \lambda$ and $H'(g^p_{CP}) = (1 + \gamma^p)\frac{N^p}{N}$, from $\gamma^p < \frac{N}{N^p}(1 + \lambda) - 1$, we have $H'(g^p_{FB}) > H'(g^p_{CP})$ implying $g^p_{FB} < g^p_{CP}$. Similarly, recalling that $S'(T_{FB}) = \frac{1}{N}(1 + \lambda)$ and $S'(T_{CP}) = \frac{1}{N}(1 + \gamma^p)$, from $\lambda < \gamma^p$, we get $S'(T_{FB}) < S'(T_{CP})$ implying $T_{FB} > T_{CP}$.

This means that when the budget constraint is binding, there will be a replacement of the national good by local ones. ■

Proposition: *If the budget constraint is not binding, there will be an overprovision of public goods in case of common financing. This overprovision will be due to an excessively high level of local expenditures, while national public expenditures will be provided at the optimal level. If the budget constraint is binding, there will be an overprovision of local public goods and an underprovision of the national public good.*

Proof. *By Lemmas* 1, *2 and 3.* ■

Given that, as stated above, national public goods have redistributive effects, from the results of the model, we expect that when local public expenditures rely heavily on central funding (i.e. in the presence of the Common-Pool problem), fiscal policies will be much less efficient in reducing income inequality. In the following section, we test this empirically.

3 Data and Methodology

Before presenting the data in detail, it is important to highlight that, in practice, it is almost impossible to separate, in the government finance statistics, goods that have national externalities from those that do not. For instance, if we look at education expenditures, it is obvious that part of them, such as the building of schools, might not generate any national externality at all, while another, such as a general public subvention for school fees, does. Similarly, health expenditures can be used to build a local hospital, but can also be used to partially intervene in the private provision of a drug. Several attempts have been made to distinguish local from national goods (see e.g. Persson and Tabellini, 1999 or Milesi-Ferretti et al., 2002) but, even if the problem is somehow mitigated, no clear-cut solution has been provided and we remain convinced that there is no simple way to separate national from local public goods, if we rely on government finance statistics. Our idea here is different. Instead of trying to proxy local and national public goods by an exotic measure, we simply do not consider them directly, but rather look at income inequality before and after taxes and redistribution and check if there is a link between the reduction of income inequality due to fiscal policies and the intensity of the vertical imbalance (measured as the degree of dependence of local expenditure *vis-à-vis* central financing).

3.1 The Data

In this paper, we want to test if, because of the Common-Pool problem, fiscal policies in federal systems are less efficient in reducing income inequality than those in centralized systems. To do so, it is necessary to calculate an index of income inequality before and after taxes and redistribution, to check if the inequality reduction is related to the degree of vertical imbalance of local financ-

ing. To the best of our knowledge, the only high quality dataset that can be used for this purpose, as explained in Roland and Verardi (2005), is the Luxembourg Income Study (LIS) project database. The latter covers 29 (OECD) countries and, on average, 4 years for each country. Given that micro-level data are available for income, many inequality measures can be envisaged. In this paper, we have chosen to use two indices: the well-known Gini index and the Theil entropy index[9] defined as $T = \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\ln\left(\frac{y_i}{\bar{y}}\right)$. The former is chosen for its easy interpretation, the latter because, while providing similar information as the Gini index, it fulfills all the necessary conditions to be considered as a good measure of inequality[10] (see Litchfield, 1999). To measure the vertical imbalance, i.e. the degree of dependence of decentralized expenditures on central State financing, we simply calculate the ratio of decentralized expenditures over decentralized revenues. A value of one means that decentralized revenues finance all local expenditures, while a value above one means that local revenues only finance part of them.

It is important to be cautious here in order to avoid mixing different effects of federalism: to clearly separate the Common-Pool effect from others, we introduce a measure of the degree of federalization of the State. Two variables are considered: the first is a dummy, equal to one if the State is constitutionally federal and zero otherwise, the second is a measure of the degree of decentralization calculated as the percentage of decentralized expenditures with respect to total expenditures. The data we use are taken from the Government Finance Statistics (GFS) of the International Monetary Fund and the Database of Political Institutions (DPI) of the World Bank.

[9] Where y_i represents the income of person i, and $\bar{y}$ represents the average income.

[10] The Gini index, on the other hand, does not satisfy the decomposability property.

3.2 The Methodology

The specification of the regression model is simple and of the following type

$$\ln(RI_{it}) = \theta_0 + \theta_1 \ln(Fed_{it}) + \theta_2 \ln(VI_{it}) + \bar{\theta}_3 Z_{it} + \theta_4 \ln(I_{m_{it}}) + \varepsilon_{it} \qquad (17)$$

where RI_{it} is the rate of reduction of inequality as defined above, Fed_{it} is a measure of federalism, VI_{it} is a measure of vertical imbalance, Z_{it} is a set of control variables (and thus $\bar{\theta}_3$ is a vector of coefficients) and $I_{m_{it}}$ is the level of inequality calculated on market prices. Indices i and t respectively represent the country and the year. $I_{m_{it}}$ is considered among the exogenous variables, to correct for the different initial levels of income inequality. In such a way, we identify the effect of decentralization on the reduction of inequality from gross to net incomes, independently of the initial level (or in other words, setting all of the countries at the same market price income inequality). The dependent variable is in logarithm in order to work with elasticities[11].

The control variables are those which are generally used in regressions in which inequality is the dependent variable. The first two are GDP per capita and GDP per capita squared, since Kuznets (1955) and Lewis (1954) suggest that there should be an inverted U relation between development and inequality. The third control variable captures the age structure of the population (percentage of people older than 65) considered because Deaton (1997) argues that inequality should increase with the age of the population, the reason being that young people have more similar incomes than older ones (Deaton and Paxson (1994)). The incorporation in the regression of the fourth control variable (secondary school or higher diploma obtained by people older than 25) is motivated by Tinbergen (1975), Lodoño et al. (1997) and Li et al. (1998), who suggest that

[11] Note that RI will never be negative.

a higher educational attainment is expected to decrease inequality. Taking into account the degree of openness of the country (measured as the logarithm of the sum of exports and imports in percentage of GDP) is aimed at controlling for the link between trade openness and inequality (as described in the World Bank Assessing Globalization Briefing Paper, 2000). Finally, a dummy identifying presidential regimes and a variable measuring the degree of proportionality of the electoral rule are incorporated to take into account the political effects predicted and estimated by Roland and Verardi (2005). Note that we also control for regional fixed effects, ethnic fractionalization, the British legal origin (to remove an eventual Anglo-Saxon effect) and the degree of democracy (as measured by Jaggers and Marshall, 2002). We tried to control for time effects, but it turns out that the only significant time effect is for 1980. To avoid losing too many degrees of freedom, we only control for that specific year. It is important to note that we only consider periods and countries for which the level of democracy is high (larger than 0, as measured by Jaggers and Marshall, 2002).

All of the data come from Roland and Verardi (2005). Even if the data on income inequality are of a high quality and highly comparable over countries and years, small differences remain between and within countries, but these differences should not affect the results. For example, even if there is a change over time in the survey on which inequalities are calculated in France, Germany and the Netherlands, the definitions of the variables remain the same. Since we do not consider changes over time but only between systems, this should not affect the results. Finally some calculations include net income variables only and some data on taxes are incomplete. To correct for this, we created two dummies identifying each case and included them on the right hand side of the regression. For the sake of clarity, we do not present the coefficients associated

with these variables in the table of results.

4 Results

To start the analysis, we need to choose the most appropriate estimation model. The first thing to do is to check if variations of the dependent variable (reduction in inequality due to fiscal policies) are better explained by cross-country or by time variations. This will yield information on which model will provide the best information. For this purpose, we run an ANOVA analysis and present the results in Table 1. This analysis also allows to understand if the small differences in definitions mentioned above affect the results. As can be seen in Table 1, they do not.

Table 1: Analysis of Variance of Reduction in Inequality Measurements

Index	Source	Partial SS	DF	F	P-value	% of Total
Theil	Model	24.35	27	97.14	0.00	97.21
	Country	23.62	24	106.01	0.00	94.29
	Time	0.11	1	12.15	0.00	0.44
	Income	0.00	1	0.06	0.80	0.00
	Taxes	0.00	1	0.30	0.59	0.00
	Residual	0.70	75			
	Total	25.05	102			
Gini	Model	32.17	27	93.33	0.00	97.10
	Country	31.19	24	101.79	0.00	94.14
	Time	0.29	1	22.55	0.00	0.88
	Income	0.00	1	0.01	0.94	0.00
	Taxes	0.00	1	0.13	0.72	0.00
	Residual	0.96	75			
	Total	33.13	102			

Notes: DF: Degrees of Freedom, SS:Sum of Squares, F: F-statistic

Considering that the dataset is unbalanced, we find that 97% of the variance of the reduction in inequality is explained by cross-country variations and less than 1% by within country variations. The slight differences in net income and taxes (as described above) do not affect the variance of the reduction of inequal-

ity since the F-statistic associated with the two last variables is lower than its critical value at 5%. This supports our idea that these small imprecisions do not affect the generality of the results. Given these results, cross-sectional models will be preferred. In addition, it is important to stress that changes in the degree of decentralization are too limited to get accurate "within" country estimations given the short time span available. As far as cross-sectional models are concerned, we prefer to use pooled estimations instead of between estimations for several reasons. First, the availability of the data changes quite a lot over time from country to country. It does not make much sense then to compare averages calculated over time, since this would amount to comparing different time periods. Second, some time shocks must be accounted for (such as, for instance, the big drop of 1980 highlighted in the analysis). Finally, this allows to keep the number of degrees of freedom sufficiently high. A random-effect model is not considered at all, because it is difficult to believe in the strict independence of right hand side variables with the permanent component of the error term, when working with countries.

In Table 2, we present the estimation of (17), with pooled least-squares. The general result is that common financing induces less efficient anti-inequality policies[12]. This can be easily explained by the model presented in Section 2: when the budget constraint is binding, there will be an overprovision of local public goods and an underprovision of the national public good in the Common-Pool problem. As explained previously, a national public good has redistributive effects; its underprovision under Common-Pool funding will influence the income

[12] Fixed-effect models yield similar results for the decentralization variable, but are not considered here since the ANOVA analysis shows that between country estimations allow to explain a larger share of the variance of the dependent variable. Futhermore, classical Chow and Lagrange multiplier tests show that a pooled model should be preferred.

distribution negatively. Furthermore, the higher the dependence on the central State for local expenditures, the more critical the problem becomes. Indeed, if we double the degree of dependence of local expenditures on central revenues, the effectiveness of fiscal policies in reducing income inequality will decrease by 20 to 25% [13]. Knowing that fiscal policies reduce, in average, income inequality by 50%, we understand that this effect is extremely important.

[13] In all of the specifications, the White test for homeskedasticity strongly rejects the presence of heteroskedasticity. Note that residuals are normally distributed in all specifications.

Table 2: Reduction in Inequality and Decentralization

	Theil		Gini	
Federal Dummy	-0.18***		-0.22***	
	(3.73)		(3.79)	
Ln (Decentralization Indicator)		-0.24***		-0.27***
		(5.20)		(4.64)
Ln (Vertical Imbalance)	-0.20***	-0.20***	-0.26***	-0.24***
	(3.44)	(3.85)	(3.76)	(3.84)
Ln (Mean District Magnitude)	0.09***	0.12***	0.14***	0.18***
	(4.09)	(6.97)	(5.42)	(7.76)
Presidential Democracy	-0.24**	-0.45***	-0.46***	-0.66***
	(2.19)	(4.35)	(3.30)	(4.80)
British Colony	-0.16	-0.15	-0.39***	-0.32***
	(1.63)	(1.66)	(3.08)	(2.68)
Schooling	-0.01***	-0.00***	-0.01***	-0.01***
	(4.06)	(3.50)	(5.88)	(4.83)
Ethnic	-0.39***	-0.71***	-0.50***	-0.86***
	(3.52)	(7.40)	(3.70)	(7.14)
Ln (Openness)	0.15***	0.06	0.29***	0.17***
	(3.13)	(1.25)	(5.18)	(2.86)
Elderly	0.66	0.37	-0.27	-0.05
	(0.58)	(0.35)	(0.18)	(0.04)
Democracy	0.03	0.05	0.06	0.07
	(0.72)	(1.27)	(1.21)	(1.42)
Ln (Market Price Inequality)	0.20***	0.17***	1.42***	1.17***
	(6.53)	(5.93)	(7.08)	(5.92)
Dummy Year 1980	-0.33***	-0.51***	-0.45***	-0.63***
	(2.79)	(4.40)	(3.24)	(4.43)
Constant	3.55***	4.42***	4.38***	5.09***
	(8.37)	(10.68)	(7.68)	(9.12)
Observations	71	71	71	71
R-squared	0.95	0.96	0.95	0.95

Absolute value of t-statistics in parentheses
Note: * significant at 10%; ** significant at 5%; *** significant at 1%
Regional dummies are considered in all regressions

Among other results associated with fiscal federalism, let us mention that the coefficient associated with the decentralization indicator is negative; its absolute value is approximately 0.25. This means that if the degree of decentralization doubles, the reduction of inequality will be reduced by 25%. The coefficient associated with the federalist dummy is negative in all specifications; its absolute

value is approximately 0.20. We find that in federal States[14], the reduction in income inequality due to fiscal policies is about 18% lower than in centralized States.

Given the small size and the unbalancedness of the sample, several problems might occur in the estimation stage. To tackle these potential problems, we present a simple sensitivity analysis. The first problem is that the panel is unbalanced. Running a classical pooled regression leads to attributing the same weight to all observations. In case more data is available for one country than for another, we award more weight to the former. To correct for this, we run a weighted regression, where the weight of each country is inversely proportional to the number of available observations. This regression is called Weighted in Table 3. It might then be argued that OLS is very sensitive to the presence of outliers, and that our results might be created by some abnormal points. To control for this, we first identify the outliers using the very robust least-median of squares estimator introduced by Rousseeuw (1987) (and then run a weighted regression, giving them a weight zero (we call this Robust in Table 3). This is the most drastic test we can perform and if the results do not change, the results are clearly not driven by outliers. The results of our sensitivity analysis on the variables we are interested in are presented in Table 3.

[14] As we are in a semi-logarithmic framework, we take the anti-log of this value and subtract one.

Table 3: Sensitivity Analysis

	Theil		Gini	
Weighted				
Federal Dummy	-0.23***		-0.26***	
	(3.94)		(4.51)	
Ln (Decentralization Indicator)		-0.26***		-0.28***
		(4.57)		(4.07)
Ln (Vertical Balance)	-0.19***	-0.21***	-0.26***	-0.25***
	(3.04)	(3.15)	(3.66)	(3.22)
Robust				
Federal Dummy	-0.17***		-0.24***	
	(3.62)		(3.92)	
Ln (Decentralization Indicator)		-0.24***		-0.27***
		(4.50)		(3.89)
Ln (Vertical Balance)	-0.19***	-0.19***	-0.23***	-0.25***
	(3.25)	(4.29)	(4.13)	(4.00)

The sensitivity analysis clearly shows that the results are robust both to the eventual presence of outliers and to a potential overrepresentation of some of the countries.

5 Conclusions

It has been suggested that fiscal federalism is a good way to induce decentralized entities to behave parsimoniously. Some recent literature tends to criticize this vision, suggesting that the expected positive effects are often overruled by negative ones. The famous Common-Pool problem is at the heart of the discussion. The idea is that when local expenditures are centrally funded, decentralized entities will tend to overspend since they do not have to face the entire fiscal burden of their budgetary decisions. Our intuition is that this overprovision of public goods will not affect all of the spending in the same way. Indeed, since some goods generate externalities, a strategic behavior will emerge: each jurisdiction will concentrate its spending on local public goods and freeride on the externalities generated by the national public good demanded by its neighbors. If the budget constraint is not binding, this results in an overprovision of local public goods but the national public good will be provided at its optimal level. If the budget constraint is binding (which is what we believe really happens), there will be a substitution of the national good by local ones. Since positive externalities have redistributive effects, the Common-Pool reduces the effectiveness of fiscal policies in reducing income inequalities.

The predictions of the model are not easy to test, since it is almost impossible (in government finance statistics) to differentiate goods that generate externalities from those that do not. For this reason, we decided to tackle the problem in an indirect way: on the basis of a database on individual incomes, we calculated income inequality before and after taxes and redistribution. If the predictions of our theoretical model are correct, the reduction in inequality should turn out to be inversely related to the degree of vertical imbalance (measured as the degree of dependence of local expenditures on central funding). Our results are con-

clusive: we find that when the degree of vertical imbalance increases, the effect of inequality reducing fiscal policies decreases substantially. Regarding the size of the effect, we find that when the degree of dependence of local expenditures on central financing doubles, the effectiveness of these policies is reduced by approximately 25%.

For several reasons highlighted in the literature on fiscal federalism, it is rather problematic to allow local entities to levy all of the taxes themselves, so the Common-Pool problem is inevitable in federal States. Since a good fiscal system relies heavily on the criteria of justice (and efficiency), we fear that the *tragedy of the commons* is the curse of federalism.

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