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Incentive effects of fiscal federalism: Evidence for France

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Abstract: This paper provides an empirical analysis on the question whether equalization payments across regions and transfers from the central government stimulate regional growth or impede it. Using a panel of 22 French regions from 2002 to 2008, we find that regional economic growth is positively affected by the fiscal equalization system. We employ two indicators of this system: the transfer volume measure (approximated by either tax revenues in other regions or transfers to regions) and the marginal retention rate. Our main finding is that the transfer volume effect is positive for growth in both donor and recipient regions. Hence, we do not find any evidence that regional governments in France allocate transfers inefficiently. This finding contradicts previous empirical studies for federal countries that tend to find adverse incentive effects of fiscal equalization on regional governments and growth. A major explanation behind this result could be that the volume of the transfers in France may appear to be relatively moderate, i.e. small enough to avoid adverse effects.

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ABOUT THE AUTHORS

Boriss Siliverstovs, PhD, specializes in econometric modeling. His research interest cover such areas as forecasting, business cycles, international trade, public finance, and natural gas markets. He published his work in numerous journals including *Journal of Forecasting*, *Empirical Economics*, *Applied Economics*, *Economics Letters*, etc.

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PUBLIC INTEREST STATEMENT

This empirical study shows that fiscal equalization does not appear to distort incentives for regional governments. Using the data for 22 French regions, we find a growth-enhancing impact of intergovernmental transfers on regional growth, with no major differences between donor and recipient regions. Only for the extremely poor recipient regions, we find an insignificant transfer effect. Our findings contradict previous empirical studies for federal countries that tend to find adverse incentive effects of fiscal equalization on regional governments and growth.

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1. Introduction

Recently, the relevance of fiscal equalization systems in strategies for long-run sustainable economic growth has been recognized—particularly as countries grow wealthier while disparities at the regional level continue at the same time. An extreme example for the importance of equalization systems setting the "right" incentives for regional governments was the Argentinian crisis in 1999–2002, where a high degree of decentralization together with a complex tax sharing system not corresponding to economic criteria provided perverse incentives for provincial leaders to overexploit national taxation (Saiegh & Tommasi, 2001). On a supranational level, the importance of fiscal equalization schemes is shown by the current financial crises in Europe since 2008, calling for intergovernmental support to peripheral EU countries on a longer term basis despite article 103 of the Maastricht treaty, which explicitly bans the EU and EU Member States from assuming commitments of any (other) EU Member State (the so-called "no-bail-out" clause). Many other industrial countries have recently introduced reforms of their fiscal equalization systems. Although these reforms differ substantially in their details, they show two common features: they intend to strengthen the incentive effects for local governments and to limit the scale of redistribution relative to GDP (e.g. Arachi & Zanardi, 2004; for Italy, and Mizell, Merk, Charbit, & Blöchliger, 2007, for an overview of OECD countries). Empirical evidence for regional growth effects of fiscal equalization, however, is sorely lacking.

Against this background, we provide an empirical analysis of the effects of intergovernment fiscal arrangements on regional economic growth in France. Several characteristics make France an interesting case, including its tradition of being a rather politically centralized country with considerable regional disparities, but also formula-driven transfers to regions (fiscal redistribution), which exist since 1982. Finally, France has fully fledged subnational governments with a relatively strong "own tax" revenue base, i.e. taxes which the regions can largely determine themselves. In our analysis, we specifically focus on incentive effects for regional governments, where we differentiate between the effects for donor and recipient regions separately. As most previous empirical studies concentrate on the analysis of federal systems, there is a lack of studies on perceived centralized countries such as France. Our empirical results attempt to reduce this gap in the literature.

Despite a rapidly growing literature on fiscal federalism and its popular subtopic fiscal decentralization, the explicit empirical analysis of incentive effects caused by fiscal equalization appears to be still in its infancy: in one of the first publications on these effects, Smart and Bird (1997) showed for the Canadian system that intergovernmental transfers tended to result in increased local tax rates in relatively poor regions because the tax revenue-lowering effect of higher tax rates was partly compensated by the transfers. Building on this work and on Bordignon, Manasse, and Tabellini (2001), Baretti, Huber, and Lichtblau (2002) performed a pioneering theoretical and empirical analysis for Germany. Their study is the first to distinguish between donor and recipient regions—both donor and recipient regions face very high marginal "tax rates" (well above 90%) on their regional revenues or, in other words, very low "marginal retention rates" (RETs), which is the notation used in this paper. Plausibly, the authors find that these high marginal tax rates had statistically significant negative effects on regional performance indicators such as economic growth and tax revenues.[1] In this paper, we will show for 22 French regions contrasting impacts of the retention rates on regional economic growth.

For 19 high-income OECD countries, Feld and Dede (2005) report that the tax autonomy of subnational governments does not appear to have a robust effect on economic growth. But they also detect a negative association between the communal share in tax revenues and economic growth. Balaguer-Coll, Prior, and Tortosa-Ausina (2007) provide evidence for local public expenditures in Spain that inefficiencies were primarily of the allocative type, i.e. that a suboptimal relation of input factors is chosen. Thus, a "simple" change of the relation of inputs could increase efficiency—a finding that confirms the importance of incentives provided to subnational governments. Having

recognized the importance of incentive effects for local governments to achieve sustainable and high growth, our study puts a focus on those incentive effects triggered by fiscal equalization schemes.

For transition countries, however, there already exist some empirical studies that focus on incentives effects. Several analyses concern Russia and, to the best of our knowledge, there is one each on China and Ukraine. Russia is interesting because it implemented intergovernmental fiscal reforms in the early 2000s that largely followed western scientific advice (formula-driven transfers, clear separation of political and spending responsibilities, etc.). A recent paper by Freinkman, Kholodilin, and Thießen (2011) argues that these reforms resulted in improved incentives.[2] For China, Jin, Qian, and Weingast (2004) focus on incentives for local governments to develop an own revenue base. They find that there are substantial regional differences in these incentives and that stronger revenue incentives tend to be beneficial for economic development. In his study on the Ukraine, Thiessen (2004) argues that the equalization system did not appear to have adverse growth effects because regional redistribution of revenues was only moderate. Also in this paper for the developed OECD country France, we will finally come to the conclusion that it is the moderate level of redistribution across French regions that is responsible that no adverse incentive effects for regional growth are observable.

The paper is structured as follows: Section 2 discusses briefly the theoretical literature of fiscal equalization and economic growth. Section 3 provides a small model of the incentive effects of equalization and describes major characteristics of France's equalization system. Section 4 explains our empirical model, estimation method, and introduces the data, while Section 5 discusses the empirical results. Section 6 provides policy advice and concludes.

2. Theoretical background: fiscal equalization and growth

The theoretical case for fiscal equalization is well established and largely undisputed (e.g. Boadway & Keen, 1996; Bordignon et al., 2001; Dahlby & Wilson, 2003). The theory is continuously broadened by considering additional and important externalities between regions such as recently the case of harmful tax competition, which fiscal equalization can help to contain (Bucovetsky & Smart, 2006; Grazzini & Petretto, 2006; Köthenbürger, 2002). However, it is also true that fiscal equalization may have unforeseen detrimental effects—for example, on growth—which should be carefully considered so as to ensure that the benefits of a given fiscal equalization system exceed its costs.

2.1. Government redistribution and economic growth

Perhaps, the largest body of the theoretical literature on fiscal equalization is concerned with the influence of government redistribution on economic growth. There are, first, models of endogenous economic growth that assume redistribution by the central government across heterogeneous private agents rather than local governments.[3] A well-known example is the model of Alesina and Rodrik (1994), where redistributive government policies affect the production by heterogeneous firms, who differ in their relative capital–labor endowments. The welfare-maximizing government taxes capital to produce a government service and to transfer income to the factor labor. Ceteris paribus, government transfers to labor are predicted to hamper growth but at the same time, the tax on capital promotes economic growth—because of the productivity-enhancing effect of public spending—as long as tax rates on capital remain sufficiently small. This is because for small capital tax rates the productivity-enhancing effect dominates the after tax return on capital. Even though this model redistributes income across private agents and not across local governments, it helps our research question of the growth effects of interregional transfers: Assuming two heterogeneous regions, one more endowed with labor and one more with capital, we would expect government transfers financed by moderate capital taxes to exert negative effects on growth in the poor, labor-rich regions, but still positive effects in the richer, capital-rich regions.

Alternative growth models with redistributing governments focus on human capital investment as the channel of government influence: for example, they assume that the poorer agent is income- or

credit-constrained, and therefore underinvests in her/his capital. Consequently, moderate wealth redistribution may be overall growth enhancing. And redistribution is also shown to be overall growth promoting in models where a relatively high degree of income inequality deters even the rich agent from investing, in expectation of future income redistribution (e.g. Deininger & Squire, 1998; Galor & Zeira, 1993; Perotti, 1993). Perotti (1996) equally supports a human-capital investment channel of a negative relation between income inequality and economic growth, but he finds no empirical evidence that more equality results in higher long-run economic growth.

The existing theoretical growth literature that explicitly incorporates vertical or horizontal transfers across government tiers is scant. One of the few contributions is the endogenous growth model by Ogawa and Yakita (2009): they assume a fiscally decentralized country with two subfederal regions where the central government redistributes to equalize the local tax revenue. Local governments pursue welfare-maximizing policies and the central government only maximizes overall growth. The model predicts that higher interregional transfers trigger an incentive for local governments to undertax their tax base—what the authors call a "disincentive effect" to raise their own revenue. Note that this finding challenged the seminal finding of Smart (1998) that cross-regional transfers decrease the marginal costs of the recipient government to raise public funds of her own, creating an incentive to overspend, to increase local tax rates beyond their optimal level, and to focus on production of such public goods that are purely consumptive and non-productive. Additional findings of the model of Ogawa and Yakita (2009) are that fiscal equalization does not affect relative regional economic growth and that the overall growth maximizing size of redistribution is not welfare maximizing but that there is a specific low degree of redistribution which is both growth and welfare increasing. Thus, for our research question, the theoretical model by Ogawa and Yakita (2009) implies that, even though transfers themselves may create a disincentive for regions to raise their own tax revenue, there is a range where they may still be overall growth enhancing.

2.2. Fiscal decentralization and economic growth

That fiscal decentralization, the transfer of spending power to local government, may be conducive to economic growth because of efficiency gains in how government money is allocated in response to local needs, was already hypothesized by Oates (1972, 1993). Hence, the traditional decentralization theory predicts a positive impact of unconditional grants from the central government on regional growth. Nevertheless, as there are also theories that predict that decentralization hampers growth (e.g. because of a possibly higher level of corruption at the local government level, see Prud'homme, 1995; Tanzi, 1996), so may transfers to subfederal regions. We thus need to refer to the still very scant theoretical models that explicitly incorporate subnational governments providing public goods:

Brueckner (2006) constructs an endogenous growth model, in which public goods—financed by a head tax—are provided either centrally, averaging people's preferences, or locally, taking into account regional heterogeneity. His comparative statics suggest that in federalist states private savings and human capital investments are higher, thus triggering more economic growth. Assuming a complementary public goods' production by two government tiers in a federalist country, the theoretical model of Akai, Nishimura, and Sakata (2007) predicts a hump-shaped relationship between fiscal decentralization and overall economic growth: for low levels of decentralization, decentralization increases economic growth. Similarly, the model by Nishimura (2006) suggests that a moderate degree of decentralized public goods provision may lead to higher economic growth that is also less volatile compared to when public goods are centrally provided. The models by Akai et al. and Nishimura thus established an explicit theoretical basis for the earlier empirical finding that for OECD countries there appears to exist a hump-shaped relationship between fiscal decentralization and economic growth (see Iimi, 2005; Thiessen, 2003). Leading to a contrasting prediction, Lundholm (2008) constructs a general equilibrium framework with a centralized tax revenue collection to show that decentralized public goods' production can lead to inefficiencies that hamper economic growth.

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2.3. Incentive effects of intergovernmental transfers

However, most relevant for our research question is the explicit modeling of the incentive effects of transfers for local governments. Much of this literature focuses on the impact of tax competition among government tiers and units, while much less has been said about the effects of fiscal equalization regimes.[4] Extending the already mentioned model of Smart (1998), which would predict subnational governments that receive unconditional grants to tend to overtax, overspend, and overconsume, Dahlby (2002) in his model allowed the recipient government to act strategically to maximize the received transfers. Consideration of this aspect even underlines Smart's concerns as the recipient government will underspend in productivity-enhancing public goods such as education and infrastructure. Both these contributions, however, neglect to analyze the incentive effects in the donor region. Further theoretical studies differentiate between vertical and horizontal transfers, and investigate into the negative externality effects when two government tiers exploit the same tax base, leading to overtaxation and to a non-optimal public goods production (e.g. Boadway, Marchand, & Vigneault, 1998; Dahlby & Wilson, 2003). Even though the adverse effects found in these models will tend to be overall growth reducing, all authors do not elaborate on regional growth effects, apart from not explicitly distinguishing between recipient and donor regions. In the following section, we briefly introduce the model by Baretti, Fenge, Huber, Leibfritz, and Steinherr (2000) and Baretti et al. (2002) that for the first time explicitly distinguished between donor and recipient regions in the analysis of intergovernmental transfers on regional governments' incentives and economic growth.

As a conclusion of the above review, our empirical model needs to control for regional public investment spending, human capital accumulation, and the characteristic of a region as a donor or recipient so that public goods' effects and incentive effects on regional growth are disentangled.

3. Incentive effects of fiscal equalization and stylized characteristics of France's fiscal equalization scheme

3.1 Theory: the incentive effects of equalization

In the following, Figure 1 presents a graphical representation of the incentive effects for regional economic growth based on the model by Baretti et al. (2000, 2002), according to which a regional government can positively influence its regional economic growth through efforts. These efforts are characterized by increasing marginal cost (MC) and decreasing marginal benefits (MB). Hence, there is an optimal regional growth rate Y^*, where the two are equal.

The *volume* of fiscal equalization affects Y^* because it influences the marginal benefit of efforts to raise the regional economic growth rate: if net payments received increase, the region's fiscal capacity rises and it experiences a positive income effect, implying lower MB from efforts to raise growth. In Figure 1, an exogenous positive revenue shock of net recipients through fiscal equalization payments causes the MB line to shift to the left (MB′). Hence, fiscal equalization payments lower the optimal growth rate for net recipients (Y^* shifts to the left), reducing their productive efforts. For net

Figure 1. Incentive effects of fiscal federalism.
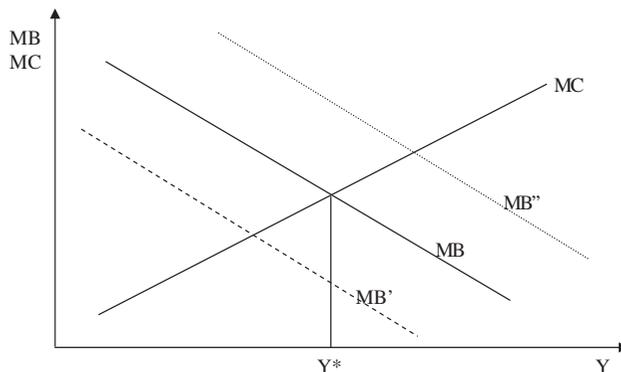
payer regions, however, an increase in fiscal equalization payments to poorer regions implies that they now have to provide more support to poor regions and thus lose own revenue, which, in turn, raises the MB of revenue-generating growth. For net payers, the exogenous revenue shock lets the MB schedule shift to the right—to MB″. Their optimal growth rate is now higher (Y^* shifts to the right): donor regions compensate for the revenue loss through increasing their productive efforts, which generates (higher) revenue-generating growth.

The RET is defined as the fraction of one additional unit of tax revenue collected by a region that it may retain for her own spending. In the theoretical model of Baretti et al. (2000, 2002), RET is the RET at the end of all stages of fiscal equalization. The impact of RET on regional growth is difficult to predict, because like any implicit tax on revenue-generating "effort," it causes both substitution and income effects. First, in both donor and recipient regions, a higher RET increases the benefits from additional growth, thus raising the optimal growth rate. Second, there is also an income effect: assume, for instance, an increase in the RET, i.e. a higher total amount of funds available for redistribution: relatively wealthy regions will pay more and lose revenue, while relatively poor regions receive these additional resources, increasing their fiscal capacity. In the recipient regions this effect reinforces the substitution effect as increased income diminishes further incentives to raise output. But in donor regions, the loss of income means higher incentives to raise output, which works in the opposite direction than the substitution effect.

Based on these considerations, we expect

- in both donor and recipient regions, the receipt of fiscal transfers to reduce regional per capita growth, while a loss in own tax revenue generates higher growth,
- for recipient regions, a positive influence of the marginal retention ratio on per capita growth, and
- for donor regions, the sign is indeterminate.

We test these propositions by examining the signs of RET coefficient in recipient and donor regions.

3.2. Stylized facts on the fiscal equalization system of France

France's fiscal equalization system consists, in principle, only of two stages: in stage one, the regions (the consolidated subnational governments, i.e. communes, departments, and regions) pay a part of the tax revenue collected on their territory (by a central government tax agency) to the central government.[5] France employs a system of shared tax bases (see Prud'homme, 2006, for a detailed description of the various transfer schemes in France).[6] In stage two, the central government and the rules of the fiscal equalization scheme determine the amount of transfers paid to each consolidated subnational government. In our database, we consider all transfers irrespective of their sources—they are largely driven by formulas. Note that the total volume of such annual transfers in France has been in our sample on average about 2% of GDP, i.e. a relatively moderate figure.

We define as "retention rate" the share of consolidated subnational government tax revenues that remains in the region, after the central government has received its share in stage one and after transfers have been paid to the regions in stage two. Specifically, this share can be considered to be a *RET*, defined as the fraction of one additional unit of tax revenue collected by a region that is kept by the region for its own government spending, as there is, in principle, no "tax free" amount and no progressive tax rate schedule.[7]

For our analysis, we calculate for each of the six years the "retention rate" that each of the 22 regions faced between 2002 and 2008. Since intergovernmental transfers to the 22 regions are in each case smaller than the central government's share of tax revenues collected at the region's territory, we can calculate a net outflow of revenues from each region. Admittedly, these net outflows

are "simple" in the sense that they do not make adjustments for any incidence: hence, it is not analyzed whether tax revenues collected by a region have their economic origin in this region and were not shifted. In addition, it is assumed that transfers to a certain region have their main economic effects in the particular receiving region. Note that the average RET in our sample is 35%. Specifically for recipient regions, it is 40% and for donors it is 29%, which may appear to be still in a moderate range.

This net outflow of revenues is the basis for our definition of donor and recipient regions in the system of fiscal equalization (see also Section 3.1). Since there is no generally accepted method of identifying these two types of regions in France, we employ this net outflow to make the separation. We identify groups of donors and recipients in different ways to see whether they all yield consistent results: first, we used the median, and second we used both the lower and upper 25 percentile of the net loss distribution. The latter produced conservative measures of true donors and recipients. An alternative definition based on a large number of budgetary elements per region by Prud'homme (1997) identified only three donor regions: Alsace, Île de France, and Rhônes-Alpes, a measure which we employ for performing a robustness test (see also Davezies, Nicot, & Prud'homme, 1998).

4. Data description and empirical model

4.1. Measures of fiscal equalization
This study employs various indicators of fiscal equalization across the 22 French regions constructed on the basis of local and departmental ("subfederal") government budget statistics (DGCL, INSEE, and *budgets locaux in chiffres*). First, we employ a simple measure of the financial transfers (horizontal and vertical) received by the region, expressed as share in regional GDP. Second, we approximate (expected) transfer volume by one specific region by the averaged own tax revenue (as a per cent of GDP) in all 21 remaining regions, where "own tax revenue" is the tax revenue net of transfer payments to other regions.

We employ further the annual *net loss* per capita—for both donor and recipient regions separately—constructed as the interacted variables of the net loss with a dichotomous measure of "recipient" or "donor". The net loss per capita is defined as the difference between the transfers given to other regions and the transfers received from other regions, expressed as per capita values; transfers given are calculated as total tax revenue minus the amount of tax revenue kept for region's own spending. Theoretically, positive values suggest that the region is (most likely) a net donor, while negative values indicate that the region is a net recipient. However, both variables, transfer received and transfer kept, constitute only approximations, and most regions report positive values.

For distinguishing donor from recipient regions, we split the sample according to the cross-regional distribution of net loss per capita, for each year separately. In one version, we construct two groups of donors and recipients by those lying to the right and to the left of the *median*, respectively. In another version, we view the regions in the first quartile as recipients, while those in the fourth quartile are defined as donors. The regions lying in the middle constitute then a group of undecided cases that could be either donors or recipients. In our empirical analysis, we employ indicators of "donor" and "recipient" regions which we interact with the continuous net loss measure expressed in per capita terms. As a result, we obtain a continuous variable for the regions belonging to the specific category which takes on the value "zero" for those regions not belonging to that category.

Finally, to account better for incentive effects exerted by transfers across regions, we employ the retention rate, which measures how much (expressed as share) of the regional tax revenue can be kept and spend by the regional governments. It is constructed as the subfederal tax revenues for own use divided by total subfederal tax revenue. For the sources and definitions of these variables, see Table 1.

Table 1. Variable definition	
Definition	**Source**
Real regional GDP per capita: GDP deflated to the base year 2000, divided by the resident population	INSEE[a]
Growth of real GDP per capita: $((GDPpc_t - GDPpc_{t-1})/GDPpc_t)$	INSEE
Growth rate in residential population: $((POP_t - POP_{t-1})/POP_t)$	INSEE
Aggregated subfederal government investments as share of the GDP: INV/nominal GDP	DGCL[b], Budgets locaux en chiffres
Share of population in any education	EUROSTAT[c]
Gini coefficient of personal income	Statistiques locales[d], "revenus fiscaux localisés des ménages" (RFLM)
Number of patent applications at the EPO, divided by resident population	EUROSTAT
Marginal retention rate: subfederal tax revenues for own use/total subfederal tax revenue (recipients and donors)	DGCL, Budgets locaux en chiffres
Received transfers, share of GDP, subfederal received transfers/GDP	DGCL, Budgets locaux en chiffres, INSEE
Net loss (of tax revenue) per capita: (total subfederal tax revenue—subfederal tax revenues kept—subfederal transfers received from other regions)/POP_i	DGCL, Budgets locaux en chiffres, INSEE
Donor dummy: equals one if net loss per capita is greater than the median of annual net loss pc distribution	Own calculations
Recipient dummy: equals one if net loss per capita is less than the median of annual net loss per capita distribution	Own calculations
"Poor" 25% quartile dummy: equals one if net loss per capita is less than or equal to the first quartile of annual net loss per capita distribution	Own calculations
"Rich" 25% Quartile Dummy (=75% Quartile Dummy): Equals one if net loss per capita is greater than the forth quartile of annual net loss per capita distribution	Own calculations
Average own tax revenue, other regions, for the ith region: $\left(\sum_{j \neq i} \text{Own\_Taxes}_j / GDP_j \right) / (J)$	DGCL, Budgets locaux en chiffres, INSEE
Average real growth in neighboring regions, for the ith region with k neighbors: $\left(\sum_{k \neq i} \text{GDP growth}_k \right) / (K)$	INSEE

Notes: "Regions" refer to territories of French regions; "subfederal" spending refers to combined spending by local and departmental governments.

[a]INSEE: Institut national de la statistique et des études économiques, www.insee.fr.

[b]DGCL: Direction générale des collectivités locales, http://www.dgcl.interieur.gouv.fr/.

[c]EUROSTAT: www.epp.eurostat.ec.europa.eu/.

[d]Statistiques locales: www.statistiques-locales.insee.fr.

4.2. Growth determinants

To analyze the growth effects of fiscal equalization in French regions, we use as the dependent variable the regional real per capita economic growth rate. The GDP measures are obtained from INSEE.[8]

The variables that form the vector of controls are selected based on theoretical models of economic growth (e.g. Aghion & Howitt, 2009). In order to account for convergence effects, we employ (lagged) real GDP per capita. According to modern and classical growth theory, both population growth and investments in human and physical capital play a significant role. We therefore use regional population growth rate, (defined in analogy to GDP growth), the combined local and departmental government spending on investments in infrastructure as share in GDP, and the share in the regional population currently undergoing some educational training (obtained from INSEE, GGCL, and RFLM, respectively). Technological progress is accounted for by the annual number of patent applications from the region to the European Patent Office (EPO). Finally, we employ a measure of regional income inequality to account for its effects on growth represented by the Gini coefficient.[9] Our robustness check employs a measure of spatial growth-spillovers across French regions: we construct such spill-over as the averaged growth rate in those regions geographically neighboring the region under analysis.

4.3. Summary statistics

Table 2 provides summary statistics of the variables employed in our empirical analysis. In our sample of 22 French regions from 2002 to 2008, French regions experienced both positive and negative

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Table 2. Summary statistics, 2002–2008					
Variable names	**Notation**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
Real GDP per capita (in 10,000 €)	**gdpr_pc**	2.237	0.398	1.786	4.052
Growth of real GDP per capita	**gdpr_pc_g**	0.008	0.014	−0.030	0.082
Received transfers by recipients (share in GDP)	**trangdp_rec**	0.023	0.028	0.000	0.124
Received transfers by donors (share in GDP)	**trangdp_pay**	0.016	0.016	0.000	0.041
Marginal retention rate (recipient)	**ret2_rec**	0.399	0.428	0.000	1.572
Marginal retention rate (donor)	**ret2_pay**	0.293	0.314	0.000	0.747
Average own tax revenue in other regions (recipient) (share in GDP)	**torec**	0.023	0.023	0.000	0.049
Average own tax revenue in other regions (donors) (share in GDP)	**topay**	0.023	0.023	0.000	0.049
Average own tax revenue in 25% poorest regions (recipient) (share in GDP)	**torec25**	0.012	0.020	0.000	0.049
Average own tax revenue in 25% richest regions (donors) (share in GDP)	**topay25**	0.012	0.020	0.000	0.049
Gini coefficient	**gini**	0.371	0.024	0.339	0.445
Population growth	**pop_g**	0.006	0.005	−0.001	0.018
Number of patents (in 1,000)	**patents**	0.077	0.063	0.000	0.293
Share of population in educational training	**educ2**	0.227	0.018	0.175	0.268
Investment (share in GDP)	**inv_gdp**	0.035	0.009	0.018	0.084
Average real growth in neighboring regions	**spa_rgpc**	0.008	0.011	−0.017	0.041

growth rates, ranging between −0.03 and 0.08. The difference in GDP per capita across French regions is substantial, as the standard deviation of 3,956 € indicates; the maximum income level is double as much as the minimum income (17,850 €). Not unexpectedly, the RET is higher for recipients than for donors. Similarly, the maximum of received transfers in the recipient region is much higher than that in the donor regions, with variance larger among the recipients. Most importantly, we should note that both donors and recipients receive positive transfers from other regions and the central government.

Even though we split the regions into "donors" and "recipients," the summary statistics for the average own tax revenue in all other 21 regions is quite similar for both types of regions—this is because for either type only one region is excluded from building the average from the total sample of 22 regions. Substantial cross-sectional variation is also observable for population growth, investment (ranging from 2 to 8%), the share of population undergoing education (from 18 to 27%), the number of patents (from 2.3 to 292.93), and economic growth in neighboring regions (from −2 to 4%). In France, regional income inequality ranges from 0.34 to 0.44, the latter indicating a strongly skewed income distribution. Given the sufficiently large number of regions and the relatively large variation in the data, this relatively short time period of seven years is sufficient to allow meaningful statistical analyses.

4.4. Model and estimation

The basic model (Model 1), relating the dependent variable with the vector of explanatory variables, is given in Equation 1:

$$\text{GROWTH}_{it} = \nu_i + \beta' \mathbf{X}_{it-1} + \varepsilon_{it} \tag{1}$$

where the dependent variable is the real per capita growth rate of a region i in a given period t (**gdpr_pc_g**). The vector of explanatory variables $\mathbf{X}_{it-1}$ includes regional GDP per capita (**gdpr_pc**), population growth (**pop_g**), human capital (**educ2**), real capital investment (**inv_gdp**), income inequality measure (**gini**), and innovation (**patent**).[10] The term ν_i denotes the region-specific fixed effects and ε_{it} represents the error term. More detailed information on the variable definitions and their sources is provided in Tables 1 and 2.

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In order to estimate the effects of fiscal equalization on regional economic growth, the basic Model 1 is augmented with the retention rate (**ret2_rec** and **ret2_pay**) and each of the three following measures of fiscal equalization volume (**torec and topay**, **torec25 and topay25**, **trangdp_rec and trangdp_pay**). As a result, we have the following three extended model specifications:

$$\text{GROWTH}_{it} = \nu_i + \beta' \mathbf{X}_{it-1} + \gamma^1 \times \mathbf{ret2\_rec}_{it-1} + \gamma^2 \times \mathbf{ret2\_pay}_{it-1} + \delta^1 \times \mathbf{torec}_{it-1}$$
$$+ \delta^2 \times \mathbf{topay}_{it-1} + \varepsilon_{it} \tag{2}$$

$$\text{GROWTH}_{it} = \nu_i + \beta' \mathbf{X}_{it-1} + \gamma^1 \times \mathbf{ret2\_rec}_{it-1} + \gamma^2 \times \mathbf{ret2\_pay}_{it-1} + \delta^1 \times \mathbf{torec25}_{it-1} \tag{3}$$
$$+ \delta^2 \times \mathbf{topay25}_{it-1} + \varepsilon_{it}$$

$$\text{GROWTH}_{it} = \nu_i + \beta' \mathbf{X}_{it-1} + \gamma^1 \times \mathbf{ret2\_rec}_{it-1} + \gamma^2 \times \mathbf{ret2\_pay}_{it-1} + \delta^1 \times \mathbf{trangdp\_rec}_{it-1} \tag{4}$$
$$+ \delta^2 \times \mathbf{trangdp\_pay}_{it-1} + \varepsilon_{it}$$

We subsequently refer to these three additional model specifications as Model 2, Model 3, and Model 4, respectively.

The robustness of our estimation results was verified by augmenting Model 3 and Model 4 with additional variables capturing spatial dependence in regional economic growth (**spa_rgpc**).[11] We refer to these models as Model 3A and Model 4A (including a lagged value of **spa_rgpc**); Model 3B and Model 4B (including a contemporaneous value of **spa_rgpc**); and Model 3C and Model 4C (including both contemporaneous and lagged values of **spa_rgpc**).

The models reported in Equations 1–4 are then applied to a data panel on the 22 French regions. The panel is balances and covers the period from 2002 to 2008. We apply the generalized least squares (GLS) method in order to estimate each model in question. Observe that we allow for the region-specific fixed effects (ν_i) and use the heteroscedasticity-robust standard errors for statistical inference.

5. Results

5.1. The effects of fiscal equalization on economic growth

The findings of the empirical analysis are presented in Table 3.[12] Model 1 (column 1) contains estimation results of a baseline model that excludes fiscal equalization measures, while we add the RET and diverse measures of transfer payments to Models 2–4. The importance of the fiscal equalization measures is underscored by the increase in the model goodness of fit (within R^2) observed in Models 2–4, compared to that of Model 1.

The baseline model estimates presented in column 1 of the table show that there is convergence of per capita GDP across French regions, indicated by the negative and significant value of the coefficient for the lagged GDP variable. The GDP growth is enhanced by factors such as the share of total investment in GDP, the innovation intensity measured by the past number of newly registered patents, and lagged income inequality measured by the Gini coefficient on income. Despite the theoretical discussion on whether the income inequality exerts an impeding or enhancing effects on the economic growth, our empirical findings are consistent with the results reported in several studies that a positive relationship between these two variables is particularly common for developed, richer countries (e.g. Aghion, Caroli, & García-Peñalosa, 1999; Barro, 2000; Persson & Tabellini, 1994). The influence of the current population growth (with a negative sign, as theoretically expected) in the lagged human capital investment was found statistically insignificant. These estimation result do also hold in the augmented Models 2–4.

Table 3. Fiscal equalization and economic growth in France, 2003–2008				
	Model			
	1	**2**	**3**	**4**
gdpr_pc(−1)	−0.216***	−0.289***	−0.251***	−0.276***
	0.042	*0.047*	*0.045*	*0.045*
pop_g	−1.217	−1.034	−0.753	−2.523*
	1.368	*1.341*	*1.385*	*1.445*
inv_gdp(−1)	2.169***	2.459***	2.284***	1.528**
	0.617	*0.602*	*0.618*	*0.671*
educ2(−1)	−0.734	1.030	−0.529	0.172
	0.680	*0.903*	*0.706*	*0.739*
gini(−1)	3.174***	2.265***	3.375***	3.071***
	0.707	*0.838*	*0.723*	*0.747*
patents(−1)	0.171**	0.150**	0.121	0.063
	0.073	*0.074*	*0.075*	*0.078*
ret2_rec(−1)		0.018	−0.057**	−0.065**
		0.041	*0.028*	*0.029*
ret2_pay(−1)		0.015	−0.052*	−0.060*
		0.045	*0.028*	*0.035*
torec(−1)		6.473**		
		2.518		
topay(−1)		6.596**		
		2.559		
torec25(−1)			−0.150	
			0.164	
topay25(−1)			0.147	
			0.176	
trangdp_rec(−1)				2.281**
				0.916
trangdp_pay(−1)				2.304**
				1.059
R^2	0.35	0.42	0.39	0.41

Notes: Dependent variable is the per capita regional GDP growth rate. All models include region-specific fixed effects. Tables report GLS estimates with heteroscedasticity-robust standard errors reported in italics.

*Significance at 10% level.

**Significance at 5% level.

***Significance at 1% level.

The influence of the retention rate on the economic growth is found to be negative in Models 3 and 4 (which use better proxies of actual transfer payments than Model 2), indicating that a higher marginal tax on own fiscal revenue positively influences regional growth. This result holds for both types of regions identified as net recipients and net payers in the system of fiscal equalization.

According to the economic theory (see Section 3.1), a retention rate works like an income tax that exerts both income and substitution effects. The negative relation between the retention rate and economic growth is consistent with the hypothesis that the income effect dominates the substitution effect: the more the central government withholds from the regional tax revenue, the more efforts regions exercise in order to compensate for their lost income. On the contrary, if the regional governments are allowed to keep too much of their tax revenue, then this seems to create a

disincentive effect undermining their economic growth. All in all, our main finding is that for both groups of regions, donors and recipients, redistribution by the central government does not appear to impede regional economic growth.

In Models 2, 3, and 4, we address also the influence of the second component of the fiscal equalization system: the volume effect approximated by three different transfer payments measures. The estimation results of Model 2 indicate that past average own tax revenue of all other 21 regions affects regional economic growth positively, for both donor and recipient regions (defined by the net loss in tax revenue per capita and split at the median of the regional distribution). In Model 3, we use a more conservative definition of "donor" and "recipient" regions, focusing on the extreme quartiles of the per capita tax revenue net loss distribution. We find, however, that the associated estimates are not significantly different from zero. In Model 4, we introduce an additional measure of fiscal equalization volume, actual transfers received by the region as a share of regional GDP. For both recipients and donors, we find that the transfers have a positive growth effect on the regional growth.

Summarizing our estimation results, the empirical evidence presented in Table 3 indicates that the current scheme of fiscal equalization in France does not impede growth, but rather enhances it, though exerting a stronger effect for the donor rather than the recipient regions.

5.2. Robustness test: regional growth spillovers

In this subsection, we verify the robustness of our results by including measures capturing regional growth spill-overs. As the observe economic growth in a particular region may be result of growth spill-over effects from its richer, fast-growing neighbors rather than an outcome of fiscal equalization measures.

In Table 4, we report the results of testing the hypothesis whether poorer, slower growing regions benefit from the richer, fast-growing regions by including measures of regional growth spill-overs in addition to fiscal equalization measures defined above. We formulate a regional growth spill-over variable by computing for each regions the average past and contemporaneous growth of its neighboring regions. We add lagged, contemporaneous and both lagged and contemporaneous regional growth spill-over measures in Models 3A and 4A; Models 3B and 4B; and Models 3C and 4C, respectively. Judging from the increase in the model goodness of fit (R^2), regional spill-overs seems to be an important factor in promoting local economic growth. We observe that controlling for the past and present economic growth in neighboring regions leave our previous results, reported in Table 3, largely intact, i.e. we still find that boosting fiscal equalization efforts by increasing transfer volumes and raising retention rates exerts a positive influence on the regional growth rate.

6. Conclusions

This paper provides an empirical analysis on the question whether equalization payments across regions and transfers from the central government stimulate regional growth or impede it. Using a panel of 22 French regions from 2002 to 2008, we find that regional economic growth is positively affected by the fiscal equalization system. We employ two indicators of this system, the transfer volume measure (approximated by either tax revenues in other regions or transfers to regions) and the RET. Using either measure, the transfer volume effect is positive for growth in both donor and recipient regions: we do not find any evidence that regional governments allocate transfers inefficiently. This is, however, not true for the poorest recipients, for which we observe no significant volume effects.

The effect caused by the retention rate is negative, indicating that if wealthier regions would be asked to make greater contributions to the system (the retention rate would hence decline), their regional economic growth would, on average, not suffer but even increase. Thus, the income effect dominates the substitution effect: especially wealthier regions do want to "make up" for the revenues lost due to fiscal equalization. Likewise, if recipient regions would receive less support, their regional growth would also be promoted, on average, rather than dampened.

Table 4. Accounting for growth-spillover effects						
	Model					
	3A	**4A**	**3B**	**4B**	**3C**	**4C**
gdpr_pc(−1)	−0.235***	−0.244***	−0.210***	−0.239***	−0.242***	−0.254***
	0.049	*0.047*	*0.038*	*0.037*	*0.039*	*0.039*
pop_g	−0.342	−2.018	−0.303	−1.721	−1.166	−1.930
	1.457	*1.437*	*1.138*	*1.184*	*1.175*	*1.190*
inv_gdp(−1)	2.297***	1.316*	1.685***	1.052*	1.561***	1.123**
	0.618	*0.665*	*0.514*	*0.551*	*0.506*	*0.552*
educ2(−1)	−0.528	0.405	−0.822	−0.295	−0.869	−0.490
	0.707	*0.733*	*0.581*	*0.607*	*0.569*	*0.621*
gini(−1)	3.319***	2.862***	2.418***	2.104***	2.393***	2.116***
	0.726	*0.739*	*0.608*	*0.624*	*0.596*	*0.622*
patents(−1)	0.125*	0.049	−0.024	−0.082	−0.056	−0.090
	0.075	*0.077*	*0.065*	*0.067*	*0.065*	*0.067*
ret2_rec(−1)	−0.050*	−0.053*	−0.052**	−0.055**	−0.065***	−0.061**
	0.029	*0.029*	*0.023*	*0.024*	*0.023*	*0.024*
ret2_pay(−1)	−0.046	−0.045	−0.046*	−0.066**	−0.059**	−0.076**
	0.029	*0.035*	*0.023*	*0.028*	*0.024*	*0.029*
torec25(−1)	−0.130		−0.020		−0.045	
	0.165		*0.136*		*0.133*	
topay25(−1)	0.160		0.188		0.165	
	0.177		*0.144*		*0.142*	
trangdp_rec(−1)		3.146***		1.931**		1.371
		0.981		*0.749*		*0.853*
trangdp_pay(−1)		3.119***		2.310***		1.822*
		1.103		*0.864*		*0.933*
spa_rgpc			0.678***	0.667***	0.786***	0.746***
			0.096	*0.093*	*0.105*	*0.109*
spa_rgpc(−1)	−0.116	−0.290**			0.265**	0.174
	0.128	*0.132*			*0.115*	*0.129*
R²	0.392	0.442	0.591	0.614	0.612	0.621

Notes: Dependent variable is the per capita regional GDP growth rate. All models include region-specific fixed effects. Tables report GLS estimates with heteroscedasticity-robust standard errors reported in italics.

*Significance at 10% level.

**Significance at 5% level.

***Significance at 1% level.

Do our results imply that transfers across regional governments are enhancing economic growth, overall? For this country and this time period, yes. However, any change of the retention rate and/or of the volume of equalization outside the range considered in this sample ("out-of-sample prediction") may result in the system showing different effects from the ones reported here. Thus, for instance, if the retention rate is lowered further and the redistributed volume is heavily increased, then the willingness to contribute and to use transfers effectively may well suffer. Indeed, Baretti et al. (2002) show for the German states strong adverse incentive effects on regional growth of both the retention rate and the transfer volume. And given the described theory this is plausible when comparing the RETs of both countries, which have been in Germany on average 86% (see Baretti et al., 2002; Table 3) and in France on average 35%, see our table "Summary statistics" above).

Our results may also bear implications for the discussion of introducing a transfer scheme between richer and poorer countries in the European Union, with the aim to stabilize the Euro currency. Based on this study, transfers across EU members should rather exert overall growth enhancing effects—at least they should not dampen growth in the richer member states. However, this would be true only for a moderate volume of redistribution.

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Notes
1. Similarly, Eggert, von Ehrlich, Fenge, and König (2007) report that regional transfers provided by the EU structural funds have negative effects on long-term real economic growth in Germany.
2. For studies on the deficiencies of the old system, see Zhuravskaya (2000), Alexeev and Kurlyandskaya (2003), Desai, Freinkman, and Goldberg (2005), Thiessen (2006), and Freinkman and Plekhanov (2009).
3. For a literature review, see Barro and Sala-I-Martin (1992).
4. For a literature review, see Brülhart and Jametti (2006).
5. The official statistics show 36,782 communes, 100 departments, and 22 regions plus 4 overseas regions. The latter are excluded from our analysis.
6. The subnational governments can determine the tax rates largely themselves within some boundaries set by the central government, but they have been relatively stable.
7. Note that the inverse of this retention rate is the amount of an additional unit of tax revenue raised that flows out of the region, working like a "marginal tax rate on tax revenues" (see Baretti et al., 2002). This latter expression is sometimes used in the literature instead of the retention rate, but they both mean the same.
8. It is the availability of the GDP per capita measure from 2000 on that serves as a constraint to the time dimension of our data.
9. The Gini coefficient on personal income takes on the value zero for equally distributed incomes and the value of one for the most unequal distribution where one household received all income in the economy. In industrialized countries, we observe Gini coefficients of around 0.3.

10. Observe that all but one variables (population growth, **pop_g**) that enter the vector of control variables $\mathbf{X}_{it}$ are lagged one period in Equations 1–4.
11. For the sake of brevity, we concentrate only on Model 3 and Model 4 as these use better proxies of actual transfer payments than Model 2.
12. Observe that even though the original data in levels span the period 2002–2008, the effective estimation sample covers the period 2003 until 2008. One year is lost as a result of taking the log-difference transformation of the real GDP.

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