

LOCAL SPENDING, TRANSFERS, AND COSTLY TAX COLLECTION

Fernando M. Aragon

This paper studies the effect of relatively costly local taxation on the fiscal response of local governments to intergovernmental transfers. Using a panel dataset of Peruvian municipalities, I find robust evidence that the central government's grants have a greater stimulatory effect in municipalities facing higher local tax collection costs. The results are consistent with the hypothesis that relatively costly local taxation may partially explain the flypaper effect.

Keywords: flypaper effect, intergovernmental transfers, fiscal decentralization

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I. INTRODUCTION

One of the most documented empirical regularities in the fiscal federalism literature is the so-called flypaper effect (Hines and Thaler, 1995; Gamkhar and Shah, 2007). This effect refers to the non-equivalence of different sources of local revenue. In particular, local public spending is more responsive to increments in grants from the central government than to increments in the local tax base.¹ In the traditional grants-in-aid theoretical framework, however, these findings are puzzling (Oates, 1999). If money is fungible and the local government represents the interests of the citizens, then both sources of revenue should be equivalent (Bradford and Oates, 1971).

The most accepted explanations of this phenomenon focus on failure of local politicians to reflect voters' interests, or on empirical flaws in the estimation of the effect of grants on spending.² A complementary argument, first proposed by Hamilton (1986), suggests instead that the flypaper effect may be due to differences in the marginal cost of funds. In Hamilton's model, local taxes are costlier than grants due to distortionary costs. The argument extends naturally to other factors increasing the relative cost of local taxes such as tax collection costs.³ There is, however, scant empirical evidence evaluating this hypothesis.

In this paper, I explore empirically whether relatively costly local taxation affects the responsiveness of local spending to grants. I focus on tax collection costs. These costs are different than the excess burden of taxation, but can also be used to motivate relatively costly local taxation. In order to guide the empirical exercise, I first develop a simple model of local

¹ A similar phenomenon is reported in the aid literature as discussed in Van de Walle and Mu (2007).

² The discrepancy between voters and local politicians may be due to imperfect information (Courant et al., 1979; Oates, 1979), uncertainty (Turnbull, 1998) or the action of agenda setting budget-maximizing bureaucrats (Filimon et al., 1982). More recently, Singhal (2008) finds evidence linking the flypaper effect to the influence of interest groups. Some of the empirical flaws mentioned in the literature are functional miss-specification (Becker, 1996), omitted variables (Hamilton, 1983), reverse causality (Knight, 2002) and measurement error (Moffitt, 1984). A more detailed survey of the literature is discussed in Hines and Thaler (1995), and Gamkhar and Shah (2007).

³ For example, Dahlby (2011) develops a model where differences in the marginal cost of public funds between the central and local governments generate the flypaper effect.

public spending with costly local tax collection, similar in spirit to Hamilton's (1986) model. The model predicts that the responsiveness of local spending to grants *increases* with tax collection costs. I then test this prediction using a panel dataset of Peruvian district municipalities over the period 1999 to 2001. Municipalities are the lowest tier of autonomous sub-national government. They finance their budget mostly from two sources: local revenue (such as property taxes, fees, fines and contributions) and transfers from the central government

I focus on the Municipal Compensation Fund or Foncomun, a large nationwide equalization grant managed by the central government. This grant is funded with a share of the national value added tax and allocated to municipalities using a formula. The empirical strategy exploits across-municipality variation in the Foncomun grant. As a proxy for higher tax collection costs, I use an indicator of advanced tax administration tools, such as an updated cadaster or automated property tax collection systems. The rationale of using these variables is the importance of property taxes as the primary own source of revenue for Peruvian local governments.

I find evidence that municipalities facing higher tax collection costs are more responsive to additional grants. The estimated propensity to spend out of grants for a low cost municipality ranges from 0.515 to 0.752, depending on the model specification. In contrast, the propensity to spend for high cost municipalities ranges from 0.786 to one. Under the assumption that the propensity to spend out of local income is 0.10, these results can be interpreted as evidence that costly taxation explains around 20 percent of the flypaper effect.

The results are robust to identification concerns such as time-invariant omitted variables and confounding factors associated with the measure of tax collection costs. This evidence is consistent with the argument that grants and local tax base are non-equivalent, at least in part, because of costly taxation.

The rest of the paper proceeds as follows. Section II develops the analytical framework. Section III describes the institutional background about Peruvian local governments. Section IV discusses the data and identification strategy. Section V presents the main results and robustness checks. Section VI concludes.

II. A MODEL OF LOCAL SPENDING

In this section I develop a simple model of local public spending with costly tax collection. The model is based on the standard political economy model of public finance used by Persson and Tabellini (2000) in their analysis of redistributive politics. I extend this basic framework by including costly tax collection and lump-sum grants.

The model emphasizes the role of costly taxation as a factor that explains the non-equivalence of revenue sources. This mechanism is similar to the one proposed by Hamilton (1986).⁴ There are, however, two differences that make the model more suitable for empirical testing.

First, the model motivates costly taxation by replacing distortionary costs with tax collection costs, such as compliance or administrative costs.⁵ This is a natural extension of Hamilton's model that facilitates the empirical analysis, since it is easier to obtain proxies for collection costs than for distortionary costs. Moreover, in the context of local public finances tax collections costs might be as relevant as the distortionary costs of taxation (Slemrod, 1990).⁶ Second, the model provides a simple expression linking the grant elasticity of

⁴ In Hamilton's model, the local public good is financed by a combination of local income taxes and grants from the central government. Local taxation is distortionary and creates a deadweight loss that reduces citizens' net income. This feature makes the propensity to spend out of grants greater than out of local income, because grants allow the local government to reduce distortionary taxation and increase citizens' consumption.

⁵ This approach does not deny the distortionary effects of local taxes. These distortions can be important. Several studies have highlighted the efficiency, and distributional, losses associated to property taxes as discussed in Mieszkowski and Zodrow (1986, 1989) and Zodrow (2001, 2008).

⁶ For example, estimates of the compliance and administrative costs of the U.S. federal and state income tax are between 5-10 percent of total tax revenue (Slemrod and Sorum, 1984; Blumenthal and Slemrod, 1992;

spending to tax collection costs, tax rates, and the ratio of grant to non-grant revenue. These features motivate the use of alternative variables to evaluate the role of costly taxation in explaining the fiscal responsiveness to grants.

There are two tiers of government: central and local. Both provide public goods, collect taxes and have their representatives elected in general elections. In addition, the central government provides financial support to local governments in the form of lump-sum grants. I focus on the policy decisions of the local government and take the central government's policies as given.⁷ This assumption implies that the local politician does not take into account the costs incurred by the central government in funding the grant scheme.

The local government rules over a community populated by a continuum of citizens of mass one. Citizens have identical income $e_i = 1$, but heterogeneous type. Their type is denoted by y_i . The individual type defines the tax she will pay and can be interpreted as the value of her property.⁸ In order to abstract from the effect of individual inequality, I restrict attention to symmetric distributions such that both the average and the median y_i are equal to y .⁹

Citizens derive utility from private consumption c_i and a homogeneous public good g provided by the local government. Preferences are defined by a quasi-linear utility function

$$(1) \quad U_i = c_i + H(g),$$

where the utility from the public good $H(g)$ is an increasing and concave function.

The assumption of a quasi-linear utility is used in several models of political economy and public finance (see for example Grossman and Helpman, 1994; and Persson and

Slemrod and Yitzhaki, 2002). In the case of local governments, Wicks and Killworth (1967) estimate collection costs for real property taxes of around 9.5 percent of the tax revenue. An empirical survey of compliance and administrative costs is discussed in Sandford (1995).

⁷ This is a plausible assumption if local governments are unable to, individually, affect central government's policies.

⁸ In the Peruvian case, the most important local tax is the property tax.

⁹ The results are similar with asymmetric distributions. This extension is available from the author upon request.

Tabellini, 2000). This functional form simplifies the model significantly and allows us to obtain a more tractable expression linking tax collection costs to public spending and grants. This assumption, however, imposes constant marginal utility of income, as well as the same marginal utility of the public good for all citizens, regardless of income. These restrictions limit the ability of the model to study distributional issues, which may be relevant in some applications (Dixit et al., 1997).

This limitation, however, is less of a concern in this paper for two reasons. First, I focus on how differences in marginal cost of public funds affect the level public spending, not on distributional issues. Second, the functional assumption does not drive the results. I obtain, for example, similar results using a less restrictive Cobb-Douglas utility function.¹⁰

The local government funds the provision of the public good from two revenue sources: a local tax on y_i and a grant from the central government. Tax policy is not targeted and hence the local tax rate $\tau \in (0,1)$ is the same for all citizens. The local government sets the tax rate and collects the tax revenue. In contrast, the decisions on grant funding, including the allocation formula, are made by the central government.¹¹

Collecting local taxes is costly. In particular, the local government faces an administrative cost of operating the tax system equal to $\Gamma C(\tau)y$ where Γ is a cost shifter and $C(\cdot)$ is an increasing and convex function. $\Gamma C(\tau) \in (0, \tau)$ to avoid a corner solution with zero taxation. The administrative cost can represent, among others, the cost of processing tax returns, monitoring tax evasion, and enforcement.

¹⁰ These results are in an appendix that is available upon request. Hamilton (1986) does not impose a utility functional form, but assumes instead a quadratic cost function. Similar to this model, he also finds that government spending is more responsive to grants in the presence of costly taxation.

¹¹ In the Peruvian case, local authorities cannot set tax rates, only their level of tax enforcement. This distinction, however, does not affect the model predictions as long as tax enforcement is costly and positively related to tax receipts. Consider, for example, this simple modification of the model: assume a fixed tax rate (normalized to be equal to one) and denote τ as the level of tax enforcement (i.e. share of tax liabilities actually collected). This modification leaves the model basically unchanged though now we are assuming that tax collection costs are proportional to tax enforcement instead of the tax rate.

The assumption of increasing marginal costs $C'' > 0$ guarantees that there is an optimal level of government spending and taxation. This assumption can be justified if the technology to collect taxes, including monitoring and enforcement costs, exhibits decreasing marginal returns.¹²

From (1) and the previous definitions, we can write the indirect utility of citizen i as:

$$(2) \quad V_i = 1 - \tau y_i + H(g),$$

while the local government's budget constraint is

$$(3) \quad g = y[\tau - \Gamma C(\tau)] + a,$$

where y is the local tax base and a is the lump-sum grant per capita. Note that the expression $R \equiv y[\tau - \Gamma C(\tau)]$ represents net tax revenue. I assume that $\Gamma C' < 1$, which guarantees that net tax revenue is an increasing function of the tax rate.

A. Equilibrium policy

Note that the citizen's indirect utility (2) satisfies the single-crossing property which allows us to use the median voter theorem. Thus, with credible commitment and majority rule, the equilibrium policy g^* would be the one that maximizes the median citizen's utility,

$$(4) \quad g^* = \arg \max \quad 1 - \tau y + H(g).$$

Rearranging the budget constraint (3), we can express τ as a function of g

$$(5) \quad F(\tau) \equiv \tau - \Gamma C(\tau) = \frac{g-a}{y},$$

¹² Consider, for example, a tax authority that uses a Cobb-Douglas technology with both administrative tools (A) and auditors' labor (L) to collect a tax revenue of τ (note that this is equal to the tax rate since total income is one). Hence $\tau = A^\alpha L^{(1-\alpha)}$, with $\alpha < 1$. The price of inputs A and L are 1 and w , respectively. It is straightforward to show that, in the short run when A is fixed, the tax collection cost is $C(\tau) = w\tau^{\frac{1}{1-\alpha}} A^{-\frac{\alpha}{1-\alpha}} + A^\alpha$. Note that the marginal cost of collecting taxes is increasing in τ and decreasing in A , the administrative tool. An alternative way to motivate costly tax collection is to include compliance costs. In the rest of the model I will focus on administrative costs because they are more relevant for the empirical case. I also extend the model to allow for compliance costs. This extension is available from the author upon request.

where $F' > 0$, $F'' < 0$ due to the convexity of $C(\tau)$ and the assumption that $\Gamma C' < 1$. Since F is a monotonic function, we can write the tax rate as

$$(6) \quad \tau = f\left(\frac{g-a}{y}\right),$$

where $f(\cdot) = F^{-1}(\cdot)$ and hence $f' > 0$, $f'' > 0$.

Solving (4) and using (6), we obtain the equilibrium policy:

$$(7) \quad g^* = h\left(f'\left(\frac{g^*-a}{y}\right)\right),$$

where $h(\cdot)$ is the inverse function of $H'(\cdot)$. Note that $h' < 0$ because H is concave.

B. Costless tax collection

Consider first, as a benchmark, the case of costless tax collection. In this scenario, (7) simplifies to $g^* = h(1)$ and it is easy to see that the effects of lump-sum grants and local tax base on g^* are both identical and equal to zero.¹³

When tax collection is costless, the model predicts that grants from the central government do not affect spending but instead are fully translated to citizens as tax rebates. Moreover, the mechanism used to transfer resources becomes irrelevant because both grants and the local tax base are equivalent in terms of their effect on local government spending and taxation.

This result replicates the veil hypothesis which has provided the theoretical basis for the flypaper paradox (Oates, 1999). According to this hypothesis, when the local authority represents the wishes of the median voter, both lump-sum grants and the local tax base have similar effects on local spending. Thus, the local government acts only as an intermediary (the veil hypothesis) and does not distort the final allocation of resources.

¹³ This result is extreme due to the quasi-linearity assumption which eliminates the income effect.

C. Costly tax collection

Now relax the assumption of costless taxation. Taking total derivatives from (7) we can calculate the propensities to spend out of the local tax base (y) and grants:

$$(8) \quad \frac{dg^*}{dy} = -\frac{h'f''}{y-h'f''} \frac{g^*-a}{y},$$

$$(9) \quad \frac{dg^*}{da} = -\frac{h'f''}{y-h'f''}.$$

Since $h' < 0$, and $f'' > 0$, these propensities to spend are positive. Thus, in contrast to the benchmark case, local spending increases both with increases in the local tax base and grants from the central government. The reason is that grants reduce the tax rate required to fund a given level of spending. In turn, this lowers tax collection costs, reduces the marginal cost of the public good, and thus results in additional spending.

Expressions (8) and (9) allow us to compare both marginal propensities to spend and evaluate the magnitude of the flypaper effect. Using both results and definition (5), we obtain:

$$(10) \quad \frac{dg^*}{da} = \frac{dg^*}{dy} \frac{1}{\tau^* - \Gamma C(\tau^*)}$$

where τ^* is the equilibrium tax rate and $\Gamma C(\tau^*)$ is the administrative cost as a proportion of the tax base.

Since $\Gamma C(\tau^*) \in (0, \tau^*)$ and $\tau^* < 1$, the marginal propensity to spend out of grants is *greater* than the marginal propensity to spend out of the local tax base.¹⁴ Hence, the model predicts that grants and the local tax base are not fungible. This prediction is consistent with the observed flypaper effect and, contrary to the veil hypothesis, suggests that these two sources of local revenue are not equivalent.

Similar to Hamilton (1986), the non-equivalence result is driven by the differences in the cost of funds faced by the local government. In particular, a local government finds it

¹⁴ Moreover, finding similar marginal propensities would be rare since it requires very high tax rates and negligible collection costs.

more costly to collect local taxes than to use grants from the central government. In the model, this cost difference arises from the inability of the local government to internalize the cost of funding the intergovernmental transfers. This result points out a potential source of inefficiency: local governments may overspend if they do not take into account the tax collection costs incurred by the central government.

D. Testable Predictions

In the empirical section, I follow Becker (1996) and use a double logarithmic specification. This specification provides estimates of elasticities instead of propensities to spend. In order to link the model to the empirical exercise, we can rewrite equation (10) in terms of elasticities:

$$(11) \quad \varepsilon_a = \varepsilon_y \frac{a}{y} \frac{1}{\tau^* - \Gamma C(\tau^*)},$$

$$(12) \quad \varepsilon_a = \varepsilon_y \frac{a}{g-a},$$

where $\varepsilon_a \equiv \frac{da}{dg} (a/g)$ and $\varepsilon_y \equiv \frac{dg}{dy} (y/g)$ are the elasticities to spend out of grants and out of the local tax base, respectively, and $a/(g - a)$ is the ratio of grant to non-grant revenue.

From (11) and (12) it is straightforward to obtain the following testable predictions:

1. The elasticity to spend out of grants increases with tax collection costs, $\frac{d\varepsilon_a}{d\Gamma} > 0$.
2. The elasticity to spend out of grants decreases with the tax rate, $\frac{d\varepsilon_a}{d\tau} < 0$.
3. The elasticity to spend out of grants increases with the ratio of grant to non-grant revenue, $\frac{d\varepsilon_a}{d(a/(g-a))} = \varepsilon_y \geq 0$.

Note that predictions 2 and 3 provide alternative ways to explore the importance of costly taxation using tax rates and the ratio of grant to non-grant revenue instead of measures of tax collection costs. This is possible because with costly taxation, tax rates are inversely

related to tax collection costs. In Section 5, I test empirically these predictions in the context of Peruvian district municipalities.

III. INSTITUTIONAL BACKGROUND

Peru is divided into three tiers of sub-national administrative units: departments, provinces and districts. In the period of analysis, there were 24 departments, 194 provinces and around 1650 districts. District municipalities are responsible for the provision of local services —such as waste collection, local police and civil registry— and development and maintenance of local infrastructure. They do not, however, participate in the provision of education or health services, and cannot redistribute cash directly to citizens.

Municipalities finance their budget mostly from two sources: local revenue (such as local taxes, fees, fines and contributions) and transfers from the central government (Table 1). In the period 1999 to 2001, these two sources represented around 83 percent of the total budget. The remaining budget corresponds mostly to debt, sales of assets and the budget surpluses from previous years.¹⁵

A. Local revenue, and tax collection costs

The most important source of local revenue is the property tax. In 2001, this tax amounted to 80 percent of total local tax revenue.¹⁶ The property tax is levied on the estimated value of the real estate property. Local governments, however, have little control over the tax rate and tax base. The tax rate is defined by national law while the property value is calculated using criteria defined by a national surveyor agency such as property size,

¹⁵ Municipalities can roll forward any amount of local revenues or transfers not spent in a fiscal year.

¹⁶ Other sources of local revenue include taxes to property sales, gambling and entertainment, fees for waste management, parking, registry services or business licenses, as well as contributions to public works and fines.

quality and economic use. The amount actually collected, however, depends on the municipality's monitoring and enforcement effort. District municipalities keep all the receipts from local taxes in their jurisdiction.

A common form of tax evasion is the failure of owners to report improvements to existing properties (which could increase the taxable base). To address this problem, local tax authorities usually maintain a register of properties or cadaster, with details about location, size and ownership of properties.

In the empirical analysis, I use as an indicator of tax collection costs, whether the government has an updated cadaster (see Section IV for further details on variables and data sources). The rationale for using this proxy is twofold. First, the cadaster is recognized as an effective tool in implementing and operating property tax systems (United Nations, 2005; International Federation of Surveyors, 2005). To the extent that this tool complements other inputs used in tax collection, such as labor, having a cadaster would reduce marginal cost.¹⁷ Second, an updated cadaster seems to capture an important dimension of tax collection costs. For example, the local revenue per capita among municipalities with an updated cadaster is 34 Nuevos Soles. In contrast, this figure among municipalities without it is less than half, 15 Nuevos Soles.

In addition, I also use as a measure of tax collection costs whether the local government has an automated tax system. In practice, this means having tax information -such as the registry of tax payers and payment records- in electronic format, or access to tax management software. In the sample, 23 percent of municipalities report having an updated cadaster, while 7 percent report having an automated tax system.

¹⁷ See footnote 10 for a formal derivation.

These two measures are not without their problems.¹⁸ A first concern is that they may fail to capture differences in actual tax collection costs. This measurement error would create an attenuation bias. Second, they may just reflect other municipality characteristics that also affect spending decisions. In that case, they would confound the empirical analysis and lead to inconsistent estimates. I discuss these concerns in more detail in Section V.

[TABLE 1]

B. The Foncomun grant

In addition to their own local revenue, district municipalities receive several transfers from the central government (Table 1). The most important is the Foncomun, an equalization grant that represents around 30 percent of municipalities' revenue and around 70 percent of total transfers.¹⁹ Other transfers include the Glass of Milk (*Vaso de Leche*), a conditional grant earmarked to a food support program, and sharing schemes for national taxes such as the income tax imposed on extractive industries and custom duties.²⁰ I focus on the Foncomun because it is the largest and most widespread transfer.

The Foncomun is an equalization grant allocated to all district municipalities. It is the most important source of revenue for local governments. The Foncomun is funded with a fixed proportion of the national value added tax. This tax is managed and collected by the central government without any intervention by local governments. The central government defines the size of the total Foncomun budget, based on tax revenue estimates.

During the period of analysis, use of the Foncomun was subject to some restrictions. In particular, municipalities were required to spend at least 80 percent of the Foncomun on capital expenditures. Capital expenditures are broadly defined and include expenditure on

¹⁸ Ideally, I would like to use better estimates of tax collection costs such as spending in tax administration or revenue offices. This information, however, is not available.

¹⁹ Foncomun stands for *Fondo de Compensación Municipal* or Municipal Compensation Fund.

²⁰ These transfers are assigned only municipalities in areas with natural resources or custom offices.

durable assets, investment projects and related expenses such as feasibility studies and consultancies. The Foncomun, however, is not earmarked to any project. These features make the Foncomun a specific lump-sum grant.²¹

In practice, compliance with these restrictions was far from complete. In aggregate, the proportion of the Foncomun actually spent on capital expenditures decreased from 67 percent in 1998 to 54 percent in 2001. In 2003, the spending conditionality was removed. This suggests that the Foncomun may have been de facto treated as an unconditional grant. For that reason, in the rest of the analysis, I treat the Foncomun as a general lump-sum grant.

The amount of Foncomun received in a given year does not depend on spending in the previous years. Similarly, there are no features that would have made the Foncomun a matching-grant, i.e., a grant that requires a minimum amount of funds from the beneficiary.²² Instead, the Foncomun is allocated to all district municipalities using an allocation formula defined in national legislation.

In the period of analysis, the Foncomun allocation formula was proportional to population size and certain indicators of needs. The allocation was done in two steps. First, the Foncomun was distributed among provinces based on population weighted by child mortality rates collected in 1981.²³ Second, the amount assigned to each province was shared among district municipalities based on a weighted measure of population size, with double weight for rural population. This last step used data on urbanization rates from the 1993 Population Census.²⁴

²¹ The literature in intergovernmental transfers considers both general and specific lump-sum grants as having similar effects on public spending i.e. increasing community income. This effect contrasts to matching grants that change the relative price of public goods (Bailey and Connolly, 1998).

²² With matching grants, the flypaper effect would just reflect the differences in prices of the public good.

²³ A province is the administrative unit immediately above a district.

²⁴ There have been several changes to the allocation formula in 2002 and 2010. The current allocation formula uses a richer, and updated, set of indicators of needs, poverty, and population. It also includes indicators of local government's performance such as relative size of capital expenditure and the ratio of local taxes to total revenue.

This allocation generates variation across municipalities and spatial correlation within a province. In particular, the Foncomun per capita a municipality receives depends on the province's child mortality rate, and on the municipality's urbanization rate relative to the rest of municipalities in the same province.

The allocation formula reflects both the rationale of the Foncomun grant and the data limitations in 1993, the year it was created. According to law, the Foncomun should be distributed considering equalization and compensation criteria such as poverty, demographics, and territory characteristics. In practice, however, there were no estimates of local poverty in Peru in 1993.²⁵ This data limitation may explain the use of child mortality and urbanization in the allocation formula, instead of direct measures of poverty.

There are two additional observations. First, changes in the allocation formula require amendments to the national legislation. Hence, municipalities cannot, individually, affect the allocation formula or weights. Second, in the period of analysis, the allocation weights were not updated to reflect new information on child mortality, only updated estimates of population size. These features reduce concerns of possible bargaining between municipalities and the central government, or changes in Foncomun due to manipulation of reported data, both possible sources of endogenous transfers.

C. The additional transfer

In 2000 and 2001, the central government created a transitory fund, called *asignación adicional* or additional transfer, to increase the Foncomun.²⁶

²⁵ There were some estimates of poverty done in 1999 by Foncodes, a central government's office, using measures of infrastructure needs at district level. Only since 2003 there are annually-updated estimates of poverty at the regional level. This data became available with the sample expansion of the Households Living Standards Survey (ENAHU).

²⁶ This policy was a response to the decline in value added tax revenues, the main source of Foncomun's funding.

The fund was financed with national funds and redistributed to municipalities receiving a monthly Foncomun smaller than 25000 Nuevos Soles (around US\$7300). The extra amount transferred to a municipality was defined by law and was inversely proportional to the calculated Foncomun grant (Table 2). Note that the additional transfer was a lump-sum not a grant per capita. For accounting and budgetary purposes, the additional transfer was considered as part of the Foncomun grant.

[TABLE 2]

The additional transfer was in place from August 2000 to December 2001 and was assigned to around 60 percent of district municipalities. In practice, the additional transfer benefited municipalities with small populations. These municipalities were supposed to receive a smaller total Foncomun but ended up receiving a larger amount. This implies that their Foncomun per capita was greater than a comparable municipality with larger population.

Table 3 compares the socio-demographic characteristics of municipalities that received the additional transfer to those in municipalities that did not. The variables are measured in 1999, a year before the implementation of the additional transfer.²⁷ Note that the main differences between the two groups are population size, urbanization, density, and access to piped water, but there are not significant differences in poverty rates.

The additional transfer created across-municipality variation in the Foncomun, in addition to the variation among municipalities due to the allocation formula. In particular, municipalities that received the additional transfer experienced a faster growth of the Foncomun. For example, in the period 1999 to 2001, the Foncomun per capita of municipalities that received the additional transfer grew, on average, by 17.7 percent per year. In contrast, the Foncomun of municipalities not entitled to the additional transfer grew, on average, by 5 percent per year.

²⁷ I describe in more detail the data sources in Section IV.

In the empirical section, I exploit this source of variation to estimate the elasticity of spending out of grants and explore how it changes with measures of tax collection costs.

[TABLE 3]

IV. EMPIRICAL STRATEGY

A. Data

I use a panel data set of 1558 Peruvian district municipalities with information on annual budgets, administrative resources and socio-demographic characteristics.²⁸ The budgetary information covers three years (1999 to 2001) and comes from annual reports prepared by the local governments. These official reports are used for national accounting and auditing by different government agencies.²⁹ They include detailed information on municipalities' revenues and expenditures, including the amount received from different transfers.³⁰ I express the revenue and expenditure variables in per capita terms using population estimates for 1999.

I also collect data on the municipality's administrative resources such as having an updated cadaster -a register with details about location, size and ownership of properties- or automated administrative systems. The data come from surveys conducted in 1999 by the National Statistics Institute to assess the resources and capabilities of district municipalities.³¹ The results of the survey were not intended to affect the transfers' allocation or the implementation of other governmental programs. Participation in the survey was compulsory

²⁸ The sample size is smaller than the universe of 1650 municipalities due to lack of budgetary information for some small municipalities.

²⁹ The budget reports I use correspond to the copy sent to the Ministry of Economy.

³⁰ I compared the amount of transfers registered in the budget reports with the records from the Ministry of Economy —the office in charge of distributing the transfers— and I found similar values.

³¹ The survey is called *Registro Nacional de Municipalidades* or the National Municipality Register. The survey collects information about human resources, equipment, municipality services, local infrastructure and current investment projects.

for all district municipalities and the questionnaire was completed by the local authority or a representative.

I complement the dataset with socio-demographic variables from several sources. I obtain measures of population density and percentage of urban population from the 1993 Population Census, as well as population estimates for 1999 from the National Statistics Office. Poverty headcount and access to utilities are estimates for 1999 from Foncodes - a central government's office in charge of several anti poverty programs- and used for the prioritization of public works and development projects.

I use the value of expenditure and Foncomun per capita as measures of local spending (g) and grants (a), respectively. I also calculate the additional transfer per capita. As I describe below, I use this variable as an instrument for Foncomun per capita.

As proxies for tax collection costs, I use indicators of the municipality having tax administration tools, such as an updated cadaster and automated tax systems.³²

As discussed in Section III, the choice of these proxies responds to the importance of the cadaster to manage property tax systems, and the data limitations. I aggregate the information of both measures of tax collection costs by constructing a dummy called *HIGHCOST* equal to one if a municipality has neither an updated cadaster nor an automated tax system, and 0 otherwise.³³ This definition assumes that a municipality faces lower tax collection costs if it has *either* of these two administrative tools. In terms of the model, *HIGHCOST*=1 represents a higher value of Γ , the shifter of the tax collection cost. In the sample, around 75 percent of municipalities are classified as high cost.³⁴

³² Note that the category of municipalities without an updated cadaster includes municipalities with an outdated cadaster and without any cadaster.

³³ As a robustness check, I also report the results using the components of the dummy (having an automated tax system or an updated cadaster) separately (Table 8).

³⁴ 76.5 percent of municipalities do not have an updated cadaster, while 92.5 percent lack an automated tax system.

The model also predicts the differences in the grant elasticity of spending by the tax rate (τ) and by the grant to non-grant ratio ($\frac{a}{g-a}$) (predictions 2 and 3). These predictions allow us to indirectly assess the importance of costly taxation, without directly observing tax collection costs. As empirical counterparts of τ , I use the average local revenue per capita in 1998 which includes local taxes, fees, contributions and fines collected directly by the municipality.³⁵ As a proxy for $\frac{a}{g-a}$, I use the ratio of Foncomun to non-Foncomun revenue in 1998.

Table 4 presents summary statistics of the main variables and the p-values of a mean comparison between low cost and high cost municipalities. There are three important observations. First, municipalities classified as low cost have a higher value of own revenue per capita, and a lower ratio of Foncomun to non-Foncomun revenue. This is consistent with these municipalities actually facing lower tax collection costs, and hence being able to collect more local taxes.

Second, while having similar levels of expenditure per capita, high cost municipalities receive a higher Foncomun per capita, and hence have a larger ratio of Foncomun to expenditure (proxy of a/g). This raises concerns that differences in grant elasticities may be driven mechanically by differences in the relative contribution of Foncomun to total expenditure.³⁶ In the empirical section, I address this concern by using the different ratios for high and low cost municipalities to transform the grant elasticities into propensities to spend, and by estimating these propensities directly using a linear model.

Finally, there are systematic differences between both types of municipalities. High cost municipalities have smaller populations, they are less urban, less dense and poorer. These

³⁵ I also use alternative proxies such as the local tax per capita in 1998 and the property tax per capita in year 2001, the only year available. The results, not reported, are similar.

³⁶ Note that $\epsilon_a = \frac{dg}{da}(a/g)$

systematic differences between low and high cost municipalities raise relevant concerns that I discuss in Section V.

[TABLE 4]

B. Econometric specification

The purpose of the empirical analysis is to estimate the grant elasticity of spending (ε_a) and evaluate how it varies with tax collection costs. To do so, I estimate the following baseline regression:

$$(13) \quad \ln g_{it} = \beta_0 \ln a_{it} + \beta_1 (\ln a_{it} \times HIGHCOST_i) + \eta_i + \varepsilon_{it},$$

where g_{it} is the expenditure per capita of municipality i in year t , a_{it} is the amount of Foncomun per capita, and $HIGHCOST_i$ is the indicator for having high collection costs.

Following Becker (1996), I use a double logarithmic specification. This functional form reduces concern of mis-specification and produces estimates of elasticities instead of propensities to spend. I also check the robustness of the main results using a linear specification. In addition, I cluster the standard errors by province. This clustering accounts for the possible correlation within provinces due to the Foncomun allocation procedure, as well as for the serial correlation of municipal spending.

The interaction term $(\ln a_{it} \times HIGHCOST_i)$ captures differences in the grant elasticity of spending by tax collection costs. Note that in this specification β_0 and $\beta_0 + \beta_1$ are the estimated grant elasticity of spending for municipalities with low and high collection costs, respectively. The model predicts that ε_a is increasing in tax collection costs, which implies $\beta_1 > 0$.

A main concern when estimating equation (13) is the presence of omitted variables correlated both with Foncomun and expenditure per capita. This may arise, for example, if

municipalities with unobservable greater propensities to spend also receive a larger Foncomun per capita.³⁷

The identification strategy addresses this concern in two ways. First, the baseline regression includes municipality fixed effects η_i . This procedure exploits within municipality variation driven by the growth over time of the Foncomun budget, and the additional transfer distributed in late 2000 and 2001. Moreover, it controls for time-invariant heterogeneity that may bias the regression estimates such as the observed demographic differences in Table 3, or unobserved differences such as the long-run level of income, size of tax base or nature of administrative tools.

Second, I use the additional transfer per capita (*ADDTRANSFER*) as an instrument for the Foncomun per capita. As an instrument for the interaction term $(\ln a_{it} \times \text{HIGHCOST}_i)$ I use $(\ln \text{ADDTRANSFER}_{it} \times \text{HIGHCOST}_i)$. I estimate this regression using panel data with fixed effects and instrumental variables.

Recall that the additional transfer was inversely proportional to the *total* Foncomun transfer and benefited mainly municipalities with small populations. For that reason, municipalities that received this transfer are systematically different, potentially in an unobservable way. This would be a concern if estimating a cross section since it would violate the instrument's exclusion restriction. To minimize this issue, I include district fixed effects. These fixed effects effectively control for all time-invariant heterogeneity between municipalities. In this specification, the identification assumption is that the *changes* in the additional transfer are related to *changes* in expenditure only through changes in the Foncomun i.e. that the evolution of expenditure in municipalities with and without additional transfer would have been similar in absence of the policy change.

³⁷ Similar concern would rise if the measure of tax collection costs fails to capture the real nature of administrative tools in a locality such as scope or quality. To the extent that the measurement error is correlated to spending, it would lead to inconsistent estimates.

V. MAIN RESULTS

Table 5 presents the main results. Column 1 estimates the baseline regression (13) including municipality fixed effects. Column 2 estimates the two stage least squares (2SLS) model using *ADDTRANSFER* as an instrument for Foncomun per capita.³⁸ Using both methods, the parameter associated with the interaction term (β_1) is positive and significant. This suggests that the grant elasticity of spending (ϵ_a) is significantly larger for municipalities with high tax collection costs.

I obtain similar results using a linear model (columns 3 and 4). This specification might lead to overestimation of the flypaper effect (Becker, 1996), but produces direct estimates of the propensity to spend out of grants (dg/da).³⁹ Note that in both cases, the estimated dg/da is significantly larger for high cost municipalities.⁴⁰ For example, in column 3 the estimated dg/da for a low cost municipality is 0.752 while for a high cost is around one, a value almost 30 percent larger. These results are consistent with the model predictions that grants have a greater stimulatory effect in localities with costlier taxation (prediction 1).

As a reference, the middle rows of Table 5 display the implied dg/da and their 95 percent confidence interval. For columns 3 and 4, these figures are obtained directly from the linear model. In contrast, for columns 1 and 2, the estimated elasticities must be converted to propensities. I do so by dividing them by the average ratio of Foncomun to total expenditure. Note that the implied propensities to spend are large, with values ranging from 0.52 to 1.17.

³⁸ There are two instruments: one for the variable in levels and the other for the interaction term. The system is just identified, which reduces concern of weak instrument bias. The first stage, not reported, confirms that the excluded instruments are significantly, and positively, correlated to the endogenous variables. The multivariate F statistics of excluded instruments, suggested by harmless in the case of multiple instruments, are 23.9 and 93.7, respectively.

³⁹ If the real relation between two variables, y and X , is non-linear $y = g(X) + \epsilon$, then the error term of estimating a linear model $y = \beta X + \mu$ is $g(X) - \beta X + \epsilon$. In this case, the error term μ would be, by construction, correlated to the regressor. This may lead to inconsistent estimation.

⁴⁰ The results are similar including other transfers as control variables. These results are available from the author upon request.

These estimates, however, are within the ranges reported in the literature (Hines and Thaler, 1995).

The previous results only suggest that, consistent with Hamilton's (1986) model, costly taxation increases the responsiveness of local spending to grants. In general, however, they do not provide information about the magnitude of the flypaper effect or the contribution of costly taxation to explain this phenomenon. To do so, requires an estimate of the propensity to spend out of income, dg/dy , which I cannot estimate due to lack of information on income, or tax base, at municipal level.

We can make some progress, however, by assuming a similar value of dg/dy for high and low cost municipalities. Under that assumption, the previous results can be interpreted as evidence that costly taxation partially explains the flypaper effect. A back of the envelope calculation, taking the most conservative estimate of dg/da and assuming $\frac{dg}{dy} = 0.10$, suggests that the observed differences in tax collection costs account for around 20 percent of the flypaper effect.⁴¹

[TABLE 5]

A. Additional model predictions

A concern with the previous results is that the measure of tax collection costs may fail to capture actual cost differences. To address this issue, I exploit the model's additional predictions.

Recall that, in the presence of costly taxation, the model predicts that: (1) elasticity of spending out of grants (ε_a) decreases with the tax rate, and (2) ε_a increases with the ratio of

⁴¹ 0.10 corresponds to the upper bound of estimated $\frac{dg}{dy}$ in the literature (Hines and Thaler, 1995). I use the ratio $\frac{dg/da}{dg/dy}$, proposed by Becker (1996), as a measure of the magnitude of the flypaper effect.

grant to non-grant revenue, $a/(g - a)$.⁴² These predictions suggest alternative ways to explore the role of costly taxation without directly measuring tax collection costs.

To do so, I estimate the baseline regression replacing *HIGHCOST* by measures of the tax rate and $a/(g - a)$. Table 6 shows the results. Column 1 and 2 replace *HIGHCOST* by the log of the own revenue per capita in 1998, a proxy for the tax rate and estimate the model using OLS and 2SLS. The estimated parameter associated to the interaction term is negative and significant. Columns 3 and 4 instead use the ratio of Foncomun to non-Foncomun revenue in 1998, a proxy for $a/(g - a)$. In this case, the estimated β_1 is positive. These findings are consistent with the ancillary model predictions. Moreover, they provide additional support to the claim that tax collection costs are relevant to explain differences in the response of local spending to grants.

[TABLE 6]

B. Additional checks

As previously mentioned, there are systematic differences between municipalities with low and high tax collection cost. High cost municipalities tend to have smaller, less dense and more rural populations. Similarly, the nature of administrative tools may vary across municipalities in ways not fully captured by the measure of tax collection costs. To the extent that these variables only affect the level of spending, their effect is controlled by including municipality fixed effects.

A primary remaining concern, however, is that the measure of tax collection costs may just reflect these systematic differences. In that case, the estimated β_1 might capture differences in grant elasticities attributed to these other factors, not to tax collection costs.

⁴² Intuitively, we can use tax rates and $a/(g - a)$ because, in equilibrium, high cost municipalities would have lower tax rates, and higher dependence on grants.

I address this concern in two ways. First, I include full interactions of $\ln(\text{Foncomun per capita})$ with observables such as population size, density, poverty headcount and access to piped water. This procedure effectively accounts for differences in grant elasticities related to these observable factors. If the variable high cost is just picking up these municipality features, the estimates of β_1 should become insignificant when including these interaction terms.

Columns 1 and 2 in Table 7 display the results using the panel data with fixed effects and the instrumental variable approach. In both cases, the findings are similar to the baseline regressions: the grant elasticity of spending is increasing in tax collection costs. Interestingly, the estimates also suggest that municipalities with smaller populations are more responsive to grants. This may reflect a larger marginal benefit of public spending.

Second, I perform a falsification test using the Glass of Milk transfer. In contrast to the Foncomun, the Glass of Milk transfer is fully earmarked to a food assistance program. This food program is supported by the central government but managed locally. Since local governments cannot use this revenue to fund other expenditures, we should not expect any differential spending response by tax collection costs. A significant difference would be indicative that the measure of collection costs is picking up another municipality's characteristic which affects public spending.⁴³

Columns 3 and 4 in Table 7 show the results of this falsification test. In both cases, I add the log of Glass of Milk per capita and its interaction with the measure of tax collection costs. Note that the grant elasticity of spending of the Foncomun is still increasing in tax collection costs. In contrast, the elasticity of spending of the Glass of Milk is not different between low and high cost municipalities.

[TABLE 7]

⁴³ For example, unobserved technical capability or citizen's preference for public spending.

Finally, I check the robustness of the results to alternative ways of constructing the measure of tax collection costs. Recall that, in the baseline regression, I classify a municipality as high cost if it lacks both an updated cadaster and an automated tax system.

First, I estimate the baseline regression (13) using both measures of administrative tools separately. Columns 1 to 4 in Table 8 display the results. Columns 1 and 2 replace the dummy *HIGHCOST* by *NOCADASTER*. This variable indicates lack of an updated cadaster only. Columns 3 and 4 use an indicator of lack of an automated tax system (*NOAUTOMATED*). Note that the results using *NOCADASTER* are similar to the baseline results. In contrast, the results become insignificant when using *NOAUTOMATED*. This suggests that combining both measures, as in the baseline regression, may produce more conservative results.⁴⁴

Second, I move towards a more continuous measure of tax collection costs. To do so, I use the number of tax administration tools the municipality lacks (*HIGHNUMBER*). This is a discrete variable that ranges from zero to two. Columns 5 and 6 in Table 8 show the results using this variable instead of the dummy *HIGHCOST*. Note that the results are similar to the baseline regression.

[TABLE 8]

VI. CONCLUSION

This paper explores empirically the effect of costly local taxation on the responsiveness of local governments to grants from the central government. Using the case of

⁴⁴ The insignificant result in columns 3 and 4 may be due to the lack of variation in the variable *NOAUTOMATED*. In the sample, 92.5 percent of municipalities lack an automated tax system. This lack of variation may make the estimates less stable and noisier. To evaluate this, I replicate Table 5 using a more parsimonious specification. In particular, I replace municipality fixed effects by department fixed effects. The results, which are available from the author, are similar to the ones obtained using the baseline specification.

Peruvian district municipalities, I find robust evidence that grants have a greater stimulatory effect on the spending of local governments with higher tax collection costs.

For instance, a conservative estimate of the propensity to spend out of grants is around 0.75 for municipalities facing lower collection costs and close to one for municipalities facing higher costs. The results are robust to alternative measures of tax collection costs and relevant confounding factors such as local poverty and demographic characteristics.

These results provide empirical support for the hypothesis that costly taxation partially explains the flypaper effect. In this view, grant recipients may be more responsive to increases in transfers because they are perceived as marginally cheaper than other revenue sources. This argument may also be relevant in explaining the lack of fungibility of grants and local revenue in other contexts, such as development aid.

These findings raise several policy issues. The first relates to the design of equalization grants. Equalization grants are usually allocated on the basis of indicators of needs, such as population and poverty, or size of tax base. Less attention is paid, however, to the differences in the relative cost of tax collection. This is important because costlier taxation may reduce the ability of a locality to fund local spending and hence increase the need for larger transfers. A direct implication is that developing fiscal capacity would reduce dependency on intergovernmental transfers and increase local spending.

Second, it raises concerns about the long term effect of intergovernmental grants. Note that the model suggests that grants have greater stimulatory effect because they are cheaper than costly local taxation. By reducing the cost of local spending, lump-sum grants may create disincentives for investment in local technical capacities and contribute to the persistence of differentials in tax collection efforts across jurisdictions.

Finally, the model also points out to a potential source of inefficiency associated to fiscal decentralization. In particular, local governments may consider grants as cheaper

sources of revenue, because they bear the cost of local taxation but fail to internalize the cost of funding the transfer scheme. In this case, local spending would be higher than optimal and the flypaper effect would be a symptom of overspending at local level. This inefficiency could be offset, however, by the choice of the level of grants and the nature of matching grants by the central government.

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Table 1

Aggregate Municipal Budget 1999-2001

(in million of US\$)

Source	Annual Budget	% Total budget
A. Transfers	308.0	44.6
Foncomun grant	207.8	30.1
Glass of Milk	66.0	9.5
Other transfers	34.2	5.0
B. Local Revenue	267.3	38.7
Taxes	104.4	15.1
Service fees	143.4	20.7
Fines and contributions	19.5	2.8
C. Other Revenue	94.8	13.7
D. Previous year balance	21.1	3.1
Total revenue	691.3	

Note: Other transfers include *Canon* and *Renta de Aduanas*.
Other Revenue includes credit and capital income.
Source: Ministry of Economy of Peru.

Table 2

Allocation of additional transfer

(in Nuevos Soles)

Calculated monthly Foncomun	Monthly additional transfer
11000 to 17000	4000
17001 to 20000	3000
20001 to 23000	2000
23001 to 25000	Variable ^a

a/ Difference between 25000 and calculated monthly Foncomun.

Table 3

Socio-demographic characteristics in 1999

Variable name	Received additional transfer		Mean comparison
	No (1)	Yes (2)	p-value (3)
Population	23909 (55461)	2446 (1728)	0.000
Population density	836 (3290)	43 (329)	0.000
% urban population	38.3 (33.6)	43.3 (27.3)	0.003
Poverty headcount	46.2 (15.7)	46.6 (13.1)	0.576
% access piped water	58.8 (31)	65.8 (33.8)	0.000
Nr. Municipalities	651	910	

Notes: Standard deviations in parenthesis. Column (3) reports the p-value of the test that the conditional mean of municipalities that received and not the additional transfer is equal. Mean comparison is conditional on province fixed effects.

Table 4

Summary statistics and mean comparison

Variable name	Total	Tax collection cost		Mean comparison p-value
		Low cost	High cost	
<u>Model counterparts</u>				
Expenditure per capita (<i>g</i>)	165.3 (124.9)	171.6 (128.3)	163.2 (123.7)	0.062
Foncomun per capita (<i>a</i>)	100.2 (86.5)	87.0 (78.9)	104.5 (88.4)	0.000
Foncomun/Expenditure (<i>a/g</i>)	0.623 (0.206)	0.545 (0.239)	0.649 (0.187)	0.000
Own revenue per capita in 1998 (τ)	23.3 (79.9)	44.9 (132.8)	15.5 (46.1)	0.000
Foncomun/Non Foncomun revenue in 1998 <i>a/(g-a)</i>	2.1 (2.2)	1.5 (1.5)	2.3 (2.4)	0.000
<u>Tax collection costs</u>				
No cadaster	76.5 (42.4)	16.9 (37.5)	100.0 (0)	0.000
No automated tax system	92.5 (26.4)	69.9 (45.9)	100.0 (0)	0.000
<u>District characteristics</u>				
% received additional transfer	57.0 (49.5)	44.7 (49.8)	61.1 (48.8)	0.000
Population	11711.4 (37967.7)	23874.3 (63512.5)	7641.1 (22605.8)	0.000
Population density	383.9 (2205.1)	1125.1 (3914.2)	134.2 (1049.8)	0.000
% urban population	41.2 (30.3)	50.5 (34)	38.0 (28.2)	0.000
Poverty headcount	46.4 (14.3)	41.6 (15.9)	48.1 (13.3)	0.000
% access piped water	62.8 (32.8)	60.8 (32.4)	63.5 (32.9)	0.190
Nr observations	4144	1021	3123	
Nr. Municipalities	1558	376	1182	

Notes: Table reports unconditional means. Standard deviations are in parentheses. Column (4) reports the p-value of the test that means of high and low cost municipalities are equal.

Table 5

Main results

	<u>Ln(expenditure per capita)</u>		<u>Expenditure per capita</u>	
	(1)	(2)	(3)	(4)
Ln(Foncomun per capita)	0.321*** (0.077)	0.593*** (0.087)		
Ln(Foncomun per capita) <i>x HIGHCOST</i>	0.169** (0.073)	0.139* (0.079)		
Foncomun per capita			0.752*** (0.151)	0.943*** (0.198)
Foncomun per capita <i>x HIGHCOST</i>			0.255* (0.149)	0.238 (0.181)
<u>Implied dg/da</u>	-	-	-	-
<i>dg/da</i> low cost	0.515 [0.272–0.758]	0.951 [0.677–1.227]	0.752 [0.562–0.942]	0.943 [0.555–1.33]
<i>dg/da</i> high cost	0.786 [0.646–0.925]	1.174 [0.975–1.376]	1.007 [0.863–1.151]	1.181 [0.988–1.372]
Estimation method	OLS	2SLS	OLS	2SLS
Observations	1445	1445	1445	1445
Nr municipalities	4025	4025	4025	4025
R-squared	0.276	0.256	0.309	0.303

Notes: Robust errors in parentheses. Standard errors are clustered by province. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. All regressions include municipality and year fixed effects. Column 2 uses *ADDTRANSFER* as instrument for Foncomun per capita. Implied *dg/da* calculated using the average ratio Foncomun/Expenditure for low and high cost municipalities.

Table 6

Testing additional model predictions

	Ln(expenditure per capita)			
	(1)	(2)	(3)	(4)
Ln(Foncomun per capita)	0.521*** (0.049)	0.728*** (0.071)	0.363*** (0.064)	0.576*** (0.078)
Ln(Foncomun per capita) \times Ln(own revenue per capita 1998)	-0.046* (0.024)	-0.042* (0.023)		
Ln(Foncomun per capita) \times Foncomun/Non-Foncomun 1998			0.037*** (0.013)	0.033** (0.013)
Estimation method	OLS	2SLS	OLS	2SLS
Observations	3300	3300	3368	3368
Nr municipalities	1173	1173	1197	1197
R-squared	0.255	0.241	0.256	0.243

Notes: Robust errors in parentheses. Standard errors are clustered by province and year. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. All columns include municipality fixed effects and a time trend. Columns 2 and 4 use *ADDTRANSFER* as instrument for Foncomun per capita.

Table 7

Additional checks

	Ln(expenditure per capita)			
	(1)	(2)	(3)	(4)
Ln(Foncomun per capita)	1.328*** (0.287)	1.356*** (0.333)	0.288*** (0.075)	0.556*** (0.095)
Ln(Foncomun per capita) <i>x HIGHCOST</i>	0.126* (0.073)	0.120 (0.084)	0.170** (0.074)	0.141 (0.089)
Ln(Glass of Milk per capita)			0.129*** (0.029)	0.099*** (0.035)
Ln(Glass of Milk per capita) <i>x HIGHCOST</i>			0.012 (0.037)	0.016 (0.043)
Ln(Foncomun per capita) <i>x ln(population)</i>	-0.132*** (0.032)	-0.135*** (0.039)		
Ln(Foncomun per capita) <i>x poverty headcount</i>	0.087 (0.247)	0.265 (0.281)		
Ln(Foncomun per capita) <i>x population density</i>	0.034** (0.016)	-0.062 (0.062)		
Ln(Foncomun per capita) <i>x % urban population</i>	-0.038 (0.099)	-0.063 (0.102)		
Ln(Foncomun per capita) <i>x % piped water</i>	0.051 (0.067)	0.043 (0.077)		
Estimation method	OLS	2SLS	OLS	2SLS
Observations	3963	3963	4025	4025
Nr. municipalities	1421	1421	1445	1445
R-squared	0.288	0.279	0.288	0.269

Notes: Robust errors in parentheses. Standard errors are clustered by province and year. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. All columns include municipality fixed effects and a time trend. Columns 2 and 4 use *ADDTRANSFER* as instrument for Foncomun per capita.

Table 8

Alternative measures of tax collection costs

	Ln(expenditure per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Foncomun per capita)	0.280*** (0.086)	0.583*** (0.099)	0.456*** (0.097)	0.628*** (0.133)	0.201* (0.118)	0.485*** (0.141)
Ln(Foncomun per capita) <i>x NOCADASTER</i>	0.217*** (0.081)	0.166* (0.087)				
Ln(Foncomun per capita) <i>x NOAUTOMATED</i>			-0.001 (0.096)	0.083 (0.132)		
Ln(Foncomun per capita) <i>x HIGHNUMBER</i>					0.144** (0.060)	0.123* (0.072)
Estimation method	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	3509	3509	4016	4016	4025	4025
Nr. Municipalities	1259	1259	1442	1442	1445	1445
R-squared	0.273	0.251	0.275	0.255	0.276	0.257

Notes: Robust errors in parentheses. Standard errors are clustered by province and year. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. All regressions include municipality fixed effects and a time trend. Column 2, 4 and 6 use *ADDTRANSFER* as instrument for Foncomun per capita. See main text for definition of *NOCADASTER*, *NOAUTOMATED* and *HIGHNUMBER*.