Resource fungibility and the Fly Paper Effect. The case of Public School education funding in Chile.

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We build upon a model by Zampelli (1986) to explore the impact of categorical grants to funding education spending in Chilean municipalities. Our main finding suggests that educational grants given to municipal governments are partially fungible and do not support the Fly Paper Effect hypothesis. Relatively rich municipal governments are clearly able to return to residents some of the money they receive from grants. The elasticity of municipal educational expenditure with respect to educational grants ranges from 0.50 for relatively poor municipalities, to 0.37 for the wealthier ones. Since a reform is being implemented thereby public schools will be moved away from the municipal control, and made them dependent on future specialized Local Educational Services, we hypothesize that said new administration model will give the central government a tighter control of the whole public expenditure on public schools.

JEL classification: H; H4; H7
Keywords: Public Economics, Publicly Provided Goods, State and Local Governments; Education.

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I. Introduction.

This research is intended to explore the extent to which grants to funding municipal schools in Chile are fully transferred on education, as they may partially substitute local funds which are already being used for that purpose. Two opposing effects should be considered. On the one hand, the so called *Flypaper Effect* (*FPE*) anticipates that fungible grants will expand local governments' expenditures beyond the preferences of the local median voter (*MV*). On the other, if grants-in-aid are at least partially fungible, a "*Fungibility Effect*" (*FE*) may arise as not necessarily all additional funding will be spent on the intended purpose. Said effect is likely to be more significant if the recipient jurisdiction has a wider range of functional responsibilities that this additional money could be diverted to. First, municipal governments have 6 exclusive functions and 12 nonexclusive ones, of which public school administration is only one of them. Second; over 90% of municipal governments in Chile contribute with their own budget to complement central government grants in aid for education, which they do voluntarily. Third, all municipalities receive one non categorical equalization grant (*Fondo Común Municipal*) plus a number of other categorical grants, all of which are at least partially fungible.

By the beginning of the 80s, Chile underwent a radical reform at both the primary and secondary school education level. Municipal governments were made responsible for running public schools and even partially fund them by matching a central government grant per student, which was designed in the spirit of Friedman's "voucher per student" model. Municipal schools (*MUN* schools) were assumed to be able to compete with each other and also with the newly developed "public supported private schools" in a similar fashion as they exist in Sweden, Spain and The Netherlands. Nonetheless, municipalities in Chile are very heterogeneous in their social, economic and/or political background, so that significant differences in their willingness to match central transfers are likely to exist. Most importantly, municipal response to variations in the value of central government's grants may range from keeping their contribution unchanged to partially withdraw it as a response to a more generous national level funding. This being the case, the effect of marginal variations in the value of grants on the whole expenditure made on education would be less than expected by the national government, as this partially depends on local governments' willingness to continue co-funding local schools as usual, or even withdraw some of this contribution. Currently, Chile is undergoing a profound reform in the way public schools will be administered and funded. Currently, a reform is being implemented thereby existing municipal schools will be handed over to newly created "Local Educational Services", which are going to be specialized deconcentrated jurisdictions from the Ministry of Education (*MINEDUC*). Since our estimations do not support the "Flypaper Effect" (*FPE*) hypothesis, and some of the central funding appears to substitute municipal educational

spending, we predict that a major effect of the new school administration model will be a narrower central government's control on the national school level expenditure. By using a panel from 2011 to 2015, an empirical model to explaining municipal expenditures on education is estimated. This builds upon a previous estimation by Zampelli (1986), who made a similar exercise for the case of grants in aid given to local governments in the USA.

The remaining of this paper is organized as follows. Section 2 addresses the theoretical and empirical debate on both the "*Flypaper Effect*" and the "*Fungibility Effect*". Section 3 describes the Chilean institutional framework. Section 4 presents the empirical model and section 5 examines the econometric results.

The current debate.

2.1 The Flypaper Effect.

The so called "Flypaper Effect" (*FPE*) has been the subject of an extensive theoretical and empirical debate since this anomaly was first identified (Henderson 1968, Gramlich 1969). The benchmark to look at is the fact that in a riskless world, the jurisdiction's source of income is assumed to have no effect on the optimal allocation of resources between private and public goods (Bailey and Connolly 1998). As opposed to that contention, the *FPE* poses the challenge of having to explain why, when a lump sum grant is given to a sub national jurisdiction, this rises local expenditures more than expected had the same money were given directly to the local median voter (*MV*). This may be expressed by saying that unconditional grants "*stick were they hit*" (Hines and Thaler 1995), which is very often an implicit target when it comes to categorical grants.

While various *FPE* explanation typologies have been presented (Hines and Thaler 1995, Bailey and Connolly 1998, Inman 2008), three broad argumentation avenues can be said to cover all cases. One strand of explanations focus on the fact that, from the view point of the grantee government, the source of funding matters. Frist; recipient governments may prefer grants as opposed to potentially distortive taxes (Hamilton 1986). Second; tax changes as a "rational" response to lump sum grants may involve important transaction costs (Quigley and Smolensky 1992). Third; local institutions and tax bases might be too rigid for this change to occur in the short run, so that fiscally constrained jurisdictions are more likely to increase expenditures than non-restricted ones (Karnik 2005, Volden 2007, Brooks and Philips 2008). Fourth; uncertainty on specific revenue sources and/or transfers being perceived as more permanent than those affecting private income, may lead to a larger expenditure response from the recipient government (Choi et. al. 2007, Vèhg and

Vuletin 2015, Besfamille 2015). Another strand of explanations is based on the *MV's* perception of grants. On the one hand, transfers may induce some degree of "fiscal illusion" by making local public goods look cheaper, and accordingly more demanded (e.i Oates 1979). On the other, the so called "Leviathan Model" predicts that significant differences may arise between the *MV* preferences and local authorities' (Le Maux 2009). This may occur – among other factors, because of lobby being made by pressure groups (Dougan and Kenyon 1988), the bureaucrats' budget maximizing effort (Niskanen 1991) and other forms of "government's failures" as multidimensional voters' options or singled picked preferences. Finally, potential econometric problems are in order. One is the confusion between matching grants - which have a price effect on the targeted local public good, and lump-sum grants having only an income effect (Gramlich and Rubinfeld 1989, Oates 1979). Estimated regressions may also omit some important variables that correlate with *MV*'s income and/or grants themselves (Hamilton 1983, Hamilton 1986), or endogeneity problems stemming from grants being assigned as a function of sub national expenditures (e.i. Gordon 2004).

Most evidence for the USA predicts that - in line with the *FPE*, education grants have a significant inter jurisdiction income redistribution effect, albeit not a significant allocation effect to education (Goertz and Natriello 1999). However valid, this prediction appears to be subject to some time lag to occur as shown by Gordon (2004). A grant specific analysis of this question is provided by Fisher and Papke (2000), who observes that expectedly, the *FPE* differs across types of grants, being stronger for unrestricted grants without minimum tax rate, significant but lower in the case of categorical grants, and even lower when they are accompanied by tax rate expenditure requirements.

The Fungibility Effect.

A well-known weakness of fiscal decentralization refers to the potential effect of inter jurisdiction externalities, which may lead local governments' decisions to deviate from the social optimum. It has been stated that this is likely to be a more severe problem in the case of the so called "redistributive function" of the State (Oates 1972), in which potential beneficiaries are likely to migrate across jurisdictions in search of the best option to settle down. Nonetheless, a relevant justification to delegate said functions onto local governments hinges upon the information benefits on local residents' demands that lower tiers of governments may have. This delegation is usually twofold. On the one hand, local jurisdictions can be made responsible for the administration of the service in question, leaving its funding in the hands of the national level. Alternatively, local jurisdictions can be made responsible for both the administration and funding of the function at stake, in which case usually -albeit not always, decentralization of services is accompanied by some type of

conditional grant. This grant conditionality is based on a principal-agent relationship between the donor and the recipient government, as it assumes that all the money being granted will be spent on a specific budget item. Interestingly, said prediction collides with the view that the recipient jurisdiction itself is autonomous to decide on how much it wishes to spend on the delegated function. The extent to which the principal's preferences on local expenditures are to be enforced highly depends on whether the recipient government has some control on the whole spending being made. If the funding of the function in question is a shared responsibility between the donor and the recipient government, increases in the value of the grant might be subject to the so called "*fungibility effect*" (eg Shah 2007), thereby the recipient jurisdiction lowers the self-funded share of the granted function to align the whole expenditure to its specific preferences. Generally, we may expect that the more leeway to substitute the granted expenditure by another closely related expenditure, the more likely it is that the transfer at stake does not lead to an equal increase on the expenditure being granted. Said substitution may take either the form of lower public expenditures and/or more private ones if grants induce the recipient government to give away some of its tax revenues.

Despite most of the empirical literature on the matter hinges upon the expenditure effect of the international aid given to developing country (Morrissey 2015), an equally intense debate exists on the extent to which similar grants given to sub national governments do have an impact on the specific expenditure being promoted. Evidence shows that fungible grants in aid might be diverted to uses other than intended ones, this being clearly the case of education. While the expenditure effect is likely to depend on the degree of grants conditionality (Gramlich 1977, Das et. al. 2005), the type of aid recipient (Oberg 1997) and/or the degree of goal conflict between the donor and recipient governments (Chubb (1985, Nicholson-Crotty 2004), empirical results generally support the fungibility hypotheses, this being particularly relevant in the case of educational grants (eg Garret 2001, Erekson et. al. 2002, Evans and Zhang 2007).

The Chilean case.

As opposed to most unitary countries, Chile is very centralized from both the fiscal as well as the political point of view (Galilea and Letelier 2011), which expresses in a myriad of fiscal and institutional factors. The country is divided into 15 "regions" (intermedium level of government) and 345 municipalities (local level). Albeit the regional level has a government of its own since 1993, this is not entirely representative of its constituency, as it is headed by a centrally appointed governor (intendente). Concerning the municipal level, this stands for about 12% of the general government expenditures. Municipalities get their "permanent" funding through local taxes and service fee charges, to which must

be added the net value of the so called Common Municipal Fund (*FCM*), which operates as a "Robin Wood" revenue redistributing mechanism across municipalities (Ahmad et. al 2015). Categorical grants and a number of applicable capital grants are also available for municipal and regional governments to improve basic infrastructure.

By the early 80s, municipalities were made responsible for running school level education and primary health centers. Originally, they were allowed to choose between direct administration of these services or delegating them to nonprofit private organizations called "corporations". Only 53 of them were established before the Constitutional Court decided in 1981 that above mentioned delegated functions to municipalities could not be performed by private entities. Since above reforms took place, the main current school funding is based on a voucher per student, which is given to municipalities upon pupil's attendance to classes (e.g. Aedo and Sapelli 2001, Epple 2017). Although a referential value of this voucher exists, this is timed by a factor equals to or above one depending on the rural-urban status of the school, and the type of education being provided. Complementary, the Ministry of Education differentiates among "autonomous", "emerging" and "in recovery" schools by giving them case specific vouchers. Since 2008, a "Preferential Subsidy Law" was passed, thereby schools that concentrate a large number of economically (and socially) deprived pupils are eligible to be given a supplement to the original voucher. A parallel model of publicly funded education exists in the form of private subsidized schools (*PSP* schools). Although they are voucher eligible in a similar way as *MUN* schools do, these private providers are allowed to partially charge for each student in return of a reduced voucher value. A third track of school suppliers is the one represented by fully paid private schools.

When it comes to funding municipal schools' current expenditures, two caveats are in order. First; students voucher stand as a conditional grant. Nevertheless, a rational response to transfers may lead grantee jurisdiction to budget reallocations of partially fungible funds (McGuire 1978, Zampelli 1986). A second feature to consider is that, according to the Chilean municipal Law, central government's grants to funding education are assumed to match a municipal budget contribution, which involves a "price effect" along with the income effect (Inman 2008). Thus, an increase in the central government's grant per head does not necessarily lead to an equivalent expansion on education expenditures. On the one hand, municipal governments can vary the locally funded share of the whole expenditure, which might partially neutralize variations in the value of categorical grants they receive. In our case, more than 94% of municipal governments

contribute to education[3]. On the other, municipalities can give away a share of their regular tax revenues as a response to more generous grants being received (Letelier and Ormeño 2017). Nevertheless, the extent to which these adjustment channels are indeed feasible in practice, very much depends on the particular municipal government we look upon.

In 2015, a profound reform proposal of this school administration model was made into a bill. This is based on two pillars. First, *MUN* schools will be removed from the municipal administration and made dependent on 68 newly created Local Education Districts. While they are going to be autonomous in various respects, they will depend on the Ministry of Education, which stands as a more centralized administrative arrangement. Second, *PSP* schools were obliged to get organized as non-for-profit private organizations. Only the second pillar is now under full operation, as a progressive implementation is expected to take place on the first one. From the view point of this research, a major feature of the existing model is the above mentioned contribution to education made by municipalities themselves as it raises the question of whether the combination of *FPE* and *FE* referred to above, may generate a significant loss of central government's control on the actual amount of resources spent on education. Some evidence on the *FCM* suggests that increases on said transfer leads to a proportionally lower decrease in local revenues (Bravo 2010), this being evidence of a partial *FPE*. A similar differentiation can be made as far as the *FPE* is concerned. Despite local tax rules are the same for all jurisdictions, the composition of tax bases differs significantly across municipalities and so does their leeway to reduce fiscal effort as a response to grants.

Following Morrissey (2015), we may hypothesize that municipal governments whose median voter's preferences are closer to the donor government are less likely to reduce its contribution as a reaction to more generous central level grants. In this regard, a relevant differentiation hinges upon the chance that poor municipalities are more likely to have a "corner solution" as far as educational expenditure is concerned. They usually have a low – and often null- tax base, have a limited capacity to make contributions to education and face a severe budget restriction to fulfill all municipal functions. In this scenario, an increase in the value of a non-conditional grant to funding schools is more likely to lead to similar increases in educational expenditures. At the other end, wealthy municipal

[3] Average municipal contribution in 2015 equals 9.7%, this being generally higher for rich municipalities. Nevertheless, this contribution is more than 40% of the budget for only 3.2% of cases, and above 20% of the budget for 12.5% of cases. Contributions above cero and below 20% accounts for 82% of municipal governments. Interestingly, this last component is entirely decided by local authorities as it depends on residents' priorities and municipality's resource availability.

governments are usually net contributors to educational expenditures, which makes them likely to spend the amount being wished by the local *MV*.

The empirical model.

We build upon Zampelly (1986), whose empirical model has three features worth mntioning. First; it is a highly nonlinear, which is known to be an advantage as it circumvents the bias of linear models in the estimated grantee government's income effect (Becker 1996). Second; in contrast to most empirical studies in the USA, results reported by Zampelly do not formally support the *FPE* hypothesis, this being evidence of Zampelly's model being a stronger testing of this effect. Third; it contains a built in parameter that measures the degree of grant fungibility, which is a relevant issue in our case.

Formally, the model in question states that local government voluntary contributions to education are equal to total spending (T_i) minus the non-fungible component of educational categorical grants ($(1-\emptyset_i)G_i$) (Eq. 1). This total is explained by the (municipal) income effect (first parenthesis), a price effect (second parenthesis), a population based scale factor and a random error ($e^{POP_i+\mu_i}$). Under the assumption that municipal governments have some leeway to decide on the share of potential revenues they have access to, municipal income is made up of all sources of revenue that the municipal government wishes to retain for its own purposes. This includes the potential fungible resources from local sources (*OWN*), the fungible share of all categorical grants ($\sum_j \emptyset_j G_j$) and the unconditioned grants being received (RS). The retained share of these sources is accounted for by π. We may expect that a "perfect *FPE*" leads to $\pi = 1$. Parameter α stands for the municipal income elasticity of education. As for the "price" of municipal education, this will be higher as the degree of grant fungibility ($\emptyset_i$) approaches to 1. Intuitively, this implies that a fully fungible grant ($\emptyset_i = 1$) can be used in any alternative purpose other than the one being targeted, which raises the opportunity cost of educational spending. Parameter β stands for the municipal price elasticity (see formal derivation in APPENDIX I).

Our estimated model innovates in adding a dummy that captures the likely difference in the magnitude of the *FPE* across municipal tax revenues quartiles (D_q). Expectedly, municipalities with a larger tax base –usually the wealthier ones – will have more leeway to vary their tax revenue collection if they so decide. On the contrary, narrow tax base municipalities (first quartile) will have little if no margin to actually adjust their tax revenues in response to grants being received. Thus, δ_q is expected to be negative for rich municipalities (fourth quartile) and positive (or no significant) for the poor ones.

$$T_i + (\emptyset_i - 1)G_i = \left(OWN + \pi\left[1 + \delta_q D_q\right]\left\{\sum_j \emptyset_j G_j + RS\right\}\right)^{\alpha} \left(\frac{T_i + (\emptyset_i - 1)G_i}{T_i}\right)^{\beta+1} e^{POP_i + \mu_i} \qquad [Ec.1]$$

Based upon Ec.9.1 we need to know how effective an increase in G_i may *be* in raising local expenditure on education ($T_i + (\emptyset_i - 1)G_i$). This is summarized by the "grant-expenditure" elasticity, which may be derived from the estimated parameters above (see APPENDIX).

In the case under analysis, one more dollar of G_i may not lead to an equivalent increase on educational expenditures due to at least two reasons. First, the existing Law on Municipal Rents gives municipalities some autonomy on the rates being charged on business licenses and other service related charges. While this leeway is likely to be enforceable in jurisdictions with a larger tax base and wealthier residents (Volden 2007, Letelier and Ormeño 2017), a significant share of municipalities strongly depend on the *FCM*[4] (see section 3), which is exogenous in the short run. Nonetheless, for those cases in which this margin of maneuver can be taken advantage of –usually wealthier municipalities- , we may expect that recipient local governments would lower their fiscal effort as G_i raises. Second, as more than 90% of municipalities do contribute to funding education (see above), there is the chance that an increase in G_i will lead them to partially reduce this contribution. In short, actual expenditure effectiveness of central level decisions on G_i rests on, i) the non-existence of a perfect *FPE*, and ii) the existence of some degree of fungibility of educational categorical grants.

Model estimation.

Our sample consists of a yearly panel between 2011 to 2015, which includes 345 municipalities. Formally, the joint municipal budget in Chile is divided into three separate accounting records (OCDE 2017), which are education, health and municipal budgets. While they are closely interconnected, we will differentiate grants given to each of them. Thus, our empirical exercise requires the following information; i) total municipal educational spending (T), ii) current categorical grants transferred to education (G^E), health (G^H) and municipal budgets (G^M), iii) capital grants on account of the same categories $(GC^E,\ GC^H,\ GC^M)$, iv) unconditional transfers given to municipalities (RS) and v) self-generated municipal revenues (OWN). A data description of per capita values of variables is provided in table A (APPENDIX II), and a data summary is shown in table 1. Issues worth mentioning are the following. First, a small number of municipalities have no categorical transfers (minimum value equals zero), which corresponds to cases in which the

[4] 25% of municipalities get more than 60% of their revenues from the FCM. This same figure reaches 49% for those municipalities in which the FCM is above 50% of all revenues.

service in question does not exists or the municipality gets no transfers for this concept[5]. Second, the coefficient of variation is clearly higher for capital grants relative to current grants, which partially reflects the fact that capital grants are mainly given upon request, and formally evaluated before they are assigned. Third, local tax revenues as well as non-categorical grants also exhibit a high variation, this being the result of major differences in local tax bases and socio demographic indicators. Finally, a much lower CV is observed in the case of current grants, which are assigned on the basis of enrolled students and residents being potentially attended (section 3).

$[Table\ 1]$

Estimation of *Ec. 1* was made by using nonlinear least squares (*NLLS*). For a large sample and normal errors, it may be shown that *NLLS* provide consistent estimators of parameters. Dummies were added to control for specific regions and years. We make two sets of estimations. The first one only considers current transfers to education (table 2). The second one includes current and capital grants altogether (table 3). Within every set, four different values of Ø (fungibility coefficient) were considered. The choice of model is made upon the Akaike Information (AIC) and Bayesian information Criteria (BIC). Relevant coefficients to look at are the marginal propensity to "tax" resources from different sources ($\pi_L,\ \pi_G,\ \pi_R$), the income elasticity (α) and the price elasticity of municipal educational spending (β). In order to measure the extent to which π may differ across jurisdictions, four municipal income quartiles were defined, whose effect is caught by three dummies (D_{Q2} , D_{Q3} , D_{Q4}). A set of regional dummies were added (regions names in the tables). While the model presented in the appendix assigns a different propensity to tax for each type of revenue source, we will assume that π is the same for all cases. This is consistent with the fact that, once all municipal revenue sources have been filtered by the fungibility coefficient (Ø), they become "equally fungible" from the view point of the municipal government. For the sake of simplicity, a similar assumption will be made about Ø itself, so that a unique value is assumed for all categorical grants. It may be observed from tables 2 and 3, that model 1 (Ø=0.2) is chosen in both cases (min value of *AIC* and *BIC*). This result

[5] Over the whole sample period, 2011-2015, 8.32% of municipalities have no health services (they get no current transfers on this account) and 0.88% of them do not get current transfers to the so called "municipal sector". Regarding capital transfers, in 0.59% of cases the municipal sector exhibits zero transfers. This same figure rises to 81.2% and 95.49% for the cases of the educational and health services respectively.

leads us to conclude that at least 20% of categorical grants on municipal education are fungible. An F test on π is conducted for all estimated models under the null π=0 and π=1 respectively (table 4). Since both nulls are rejected, no evidence of perfect *FPE* exists.

Concerning π, our point estimation is in the range of 0.722 (current and capital transfers) to 0.752 (current transfers only) for model 1 (Ø=0.20). The 95% interval for these estimations ranges between 0.65 and 0.8 (table 5), and 0.662 and 0.843, respectively. This implies that at least 15% of additional fungible resources are returned to local residents. The same estimated coefficient ranges between 0.17 and 0.05 in Zampelli (1986) for different sets of restrictions on Ø. This is consistent with the more rigid structure of local taxes in the Chilean case as compared with the USA one, and the fact that municipal governments in Chile have very limited access to credit, which forces them to spend all additional resources (Letelier 2011). Nonetheless, a value of π well below 1 demands an explanation of how municipalities in Chile "return" some of the grants they receive to local residents. The answer probably lays in the fact that part of local taxes and fees being collected depend on the will of the municipality in question. Despite the Law is quite uniform and centralized in terms of tax bases and tax rates, some leeway is given to municipalities to decide on business licenses and some other charges (Letelier & Ormeño 2017). Expectedly, this effect is clearly higher for relatively wealthy municipalities (negative and significant D_{Q4}), which is in line with the hypothesis that a larger tax base gives municipal governments more leeway to vary tax effort in response to grants being received.

As for the income elasticity, this is in the range of 0.598 (current transfers only) to 0.734 (current and capital transfers), suggesting that educational spending tends to grow less than proportionally relative to growth in municipal income. Similar estimated coefficients for the USA report values close to 0.2 (McCarty 2008). Our price elasticity estimation exhibits point values of -0.179 and -0.321 respectively, leading to correspondingly large intervals. While these values are generally higher than Zampelly´s (-0.64 to -0.32), both sets of results are not strictly comparable given the range of services being included in each case. For the purpose of our study, a relevant parameter is the "educational grant-elasticity" of municipal educational spending, that we will call σ_g^{Exp} (*Eq. A9.1* and *A9.2* in APPENDIX III). Table 6 shows said estimation for our four municipal quartiles and the two definitions of grants leading to tables 2 and 3. In each case, the average share of MINEDUC's contribution to funding education is reported (% MINEDUC). We see that our estimated elasticity ranges between 0.37 and 0.50, which is below the expected effect of a 1% increase in the value of educational grants had the municipal contribution to education were to stay the same.

$$[Table\ 2, 3, 4, 5, 6]$$

From the view point of the national educational policy, above results entail a dilemma, as the way in which school education has been funded so far assumes a perfect FPE ($\pi=1$), and a value of σ_g^{Exp} compatible with the share of MINEDUC contribution to municipal education. That is to say, all increases in the value of grants are expected to be spent on education. The reason why this does not occur is twofold. On the one hand, municipal governments do contribute to funding schools, which they do on a voluntary basis. As they receive more money from the national level, they may also decide to reduce or adjust this contribution in line with the *MV* preferences. On the other, categorical grants are partially fungible, which allows municipalities to partially use them on items other than education. A reform to the existing funding and administrative model is in progress. Since schools will be reallocated to monofunctional educational districts that have no taxes of their own, the two channels responsible for the leak being mentioned will be closed. From the central government view point, one advantage of having spatialized districts lies on the "higher control" on educational spending.

However clear this conclusion might be, it should not be interpreted as an argument to move back from a locally decentralized administration and return all schools to some kind of centrally controlled public entity. There is the chance that some municipalities have enough resources and management capacity to be in charge of schools, so that an "all across the board" reform will leave some educational districts worse off. A relevant trade-off exists between the national government's need to control the expenditures being made, and the need to have a sound management capacity at the local level. It might be the case that a set of selected municipalities do have this capacity (Letelier & Ormeño 2017), albeit they may partially offset national educational grants through a combination of *FPE* and *FE*.

Conclusions.

We provide evidence showing that ; i) categorical grants given to funding municipal Schools in Chile are partially fungible, ii) the so called *FPE* appears not to be statistically relevant, and that iii) increases in the value of these grants do not lead to a proportional increase on the whole local educational spending being made. This result suggests that municipal governments withdraw some of their own contribution to education and/or return to local residents some of the grants being received as a response to an increase in the value of said grants.

Since municipal schools in Chile are going to be made dependent on special educational districts (*LED*), a question then arises as to how such a reform will affect the funding of public schools. Regardless of the formula to be used in the distribution of educational grants to these new districts, the fact of them being specialized jurisdictions with no taxes of their own, will rule out the chance of this money being spent on things other than local public education. Our results show that this tighter control will become more apparent on the case of wealthier municipalities, as they are the ones with the lower elasticity of Educational Expenditures with respect to grants. Nonetheless, a relevant trade-off exists between the national government's need to control the expenditures being made, and the need to have a sound management capacity at the local level. It might be the case that municipalities with lower expenditure-grant elasticity – usually the wealthier ones, are also the ones with the best local educational services, which poses a dilemma on the national plan to withdraw schools from the municipal level.

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APPENDIX I
(Empirical Model)

Following Zampelli (1986):

Our demand for local public goods may be writes as; $Q_i = B^{\alpha} p_i^{\beta}$ $[Eq.A1]$, where Q_i is the quantity of public good "i", B is the amount of fungible resources available for the public sector, p_i is the "effective price" of Q_i and α and β stand for the corresponding income and price elasticities. Since Q_i is not observable, Ec.1 may be expressed as; $p_i Q_i = B^{\alpha} p_i^{\beta+1} [Eq.A2]$, in which $p_i Q_i$ is the effective expenditure on Q_i.

Local government budget (B) is the sum of fully fungible resources plus the fungible share of grants given to the local government in question. It follows that $B = \pi_L R_L + \pi_G \sum_j \emptyset_j G_j + \pi_R RS$ $[Eq.A3]$, where i) R_L= potential fungible resources from local sources, ii) π_L = marginal propensity to tax R_L, iii) $\emptyset_j G_j$ = fungible share $(\emptyset_j)$ of grants to funding local public good"j" (G_j).

If we do not impose restrictions on the use of grants, total expenditure on "i" would be $p_i Q_i = L_i^* + \lambda \pi_G \emptyset_i G_i + \psi_i \pi_R RS + \sum_{j \neq i} (1 - \lambda_j) \pi_G \emptyset_j G_j$ $[Eq.A4]$, where i) $L_i^* =$ local government's fungible resources that would have been spent on Q_i in case restrictions did not exist, ii) λ= fraction of $\pi_G \emptyset_i G_i$ spent on "i", iii) $(1 - \lambda_j)$ = fraction of $\pi_G \emptyset_j G_j$ spent on "i, and iv) ψ_i= fraction of $\pi_R RS$ spent on "i".

Since categorical grants are expected to be fully spent on the particular public good being funded, recipient government will adjust L_i^* to respect that restriction. Thus, expenditure on "i" out of own resources may be written as: $L_i = L_i^* - (1 - \lambda) \pi_G \emptyset_i G_i - (1 - \pi_G) \emptyset_i G_i - (1 - \pi_R) \psi_i RS + \sum_{j \neq i} (1 - \lambda_j) \pi_G \emptyset_j G_j$ $[Eq.A5]$.

A simplified version of $[Eq.5]$ may be written as; $L_i + \emptyset_i G_i + \psi_i RS = L_i^* + \lambda \pi_G \emptyset_i G_i + \psi_i \pi_R RS + \sum_{j \neq i} (1 - \lambda_j) \pi_G \emptyset_j G_j = p_i Q_i$ $[Eq.A6]$, whose left hand side corresponds to the amount of fungibles resources spent on "i". Since the cost being paid is $L_i + G_i + \psi_i RS$, the price of "i" (p) is the ratio between the opportunity cost of resources and the direct cost being mentioned $(p_i = [L_i + \emptyset_i G_i + \psi_i RS] / [L_i + G_i + \psi_i RS])$. The more fungible G_i is, the higher the opportunity costs of resources devoted to "i" (numerator) and the higher the value of p_i. By replacing $Eq.6$ into$Eq.2$, we get; $p_i Q_i = L_i + \emptyset_i G_i + \psi_i RS = (\pi_L R_L + \pi_G \sum_j \emptyset_j G_j + \pi_R RS)^{\alpha} p_i^{\beta+1}$ $[Eq.7]$.

Since ψ_i cannot be either observed nor estimated, we remove it from the left hand side in $Eq.A6$. To do this we express the cost of "i" as; $T_i = L_i + G_i + \psi_i RS$. Rearranging terms we get; $T_i + (\emptyset_i - 1) G_i = L_i + \emptyset_i G_i + \psi_i RS = p_i Q_i$. By replacing this result and expression of p_i into $[Eq.A7]$, we get an expression that may be estimated:

$$T_i + (\emptyset_i - 1) G_i = \left(\pi_L R_L + \pi_G \sum\nolimits_j \emptyset_j G_j + \pi_R RS \right)^{\alpha} \left(\frac{T_i + (\emptyset_i - 1) G_i}{T_i} \right)^{\beta+1} [Ec.A8]$$

Nevertheless, Zampelli (1986) reduces the number of parameters to estimate in $[Ec.A8]$ by doing the following; i) $\pi_L R_L$ is replaced by *OWN* and ii) parameters π_G and π_R are assumed to be equal, which leads to $[Ec.A9]$.

$$T_i + (\emptyset_i - 1) G_i = \left(OWN + \pi \left\{ \sum\nolimits_j \emptyset_j G_j + RS \right\} \right)^{\alpha} \left(\frac{T_i + (\emptyset_i - 1) G_i}{T_i} \right)^{\beta+1} [Ec.A9]$$

T_i : Out of Municipal Budget spending on education

G_i : Categorical Grants from the central government.

RS : Fungible transfers received.

APPENDIX II
(Data Description)

$$[Table\ A]$$

APPENDIX III
(Educational Grant-Elasticity of Municipal Spending on Education: σ_g^{Exp})

$$\sigma_g^{Exp} = \frac{\partial T_i}{\partial G_i^E}\frac{G_i^E}{T_i} \qquad Ec.A9.1$$

where:

$$\frac{\partial T_i}{\partial G_i^E} = \frac{(\beta+1)\left(\frac{G_i^E(\emptyset_i-1)}{T_i}+1\right)^{\beta}(\emptyset_i-1)e^{\varepsilon POP}(OWN+\pi[\emptyset_i\{G_i^E+G_i^H+G_i^M\}+RS])^{\alpha}}{T_i}$$
$$+\alpha\left(\frac{G_i^E(\emptyset_i-1)}{T_i}+1\right)^{\beta+1}\emptyset_i\pi e^{\varepsilon POP}(\pi[\emptyset_i\{G_i^E+G_i^H+G_i^M\}+RS])^{\alpha-1}-\emptyset_i+1 \qquad Ec.A9.2$$

Table A. Data Description.
All variables in per capita terms. Thousands of pesos of 2016.

Variable	Definición
T	Total Expenditure on Education.
G^E	Transfers to Education, from the Ministry of Education.
G^H	Transfers to Health, from the Ministry of Health.
G^M	Transfers to Municipal Sector, from different institutions.
GC^E	Capital transfers to Education.
GC^H	Capital transfers to Health.
GC^M	Capital transfers to the Municipal Sector.
OWN	Tax revenues.
RS	Net Municipal Common Fund.
Population	Municipal population.

Source: All variables extracted from National System of Municipal Information (SINIM), Ministry of Internal Affairs, 2011-2015. Except Net Municipal Common Fund, which is self elaborated over the base of SINIM 2011-2015.

Table 1. Summary Statistics (average values 2011-2016, US$ dollars 2016)

Variables	Obs.	Mean	Std. Dev.	CV	Min	Max
T	1,707	349.98	224.62	0.642	18.44	1904.28
G^E	1,707	216.94	145.66	0.671	4.11	1231.95
G^H	1,707	70.75	43.55	0.616	0.00	417.55
G^M	1,707	35.98	109.15	3.034	0.00	3457.74
GC^E	1,707	2.31	12.65	5.474	0.00	215.97
GC^H	1,707	0.13	1.19	9.092	0.00	29.45
GC^M	1,707	88.44	194.35	2.198	0.00	3,054.55
R_L	1,707	74.58	137.60	1.845	2.43	1,910.95
RS	1,707	183.25	503.14	2.746	-1,366.21	6,532.50
pob_{1000}	1,707	76.70	128.87	1.680	0.20	1395.51

Table 2. Non Linear Least Squares. *Current Transfers.*

VARIABLES	(1)	(2)	(3)	(4)
	ϕ=0.2	ϕ=0.4	ϕ=0.6	ϕ=0.8
π	0.752***	0.698***	0.685***	0.680***
	(0.0462)	(0.0318)	(0.0300)	(0.0295)
D_{Q2}	0.0430	0.0443	0.0466	0.0489
	(0.0555)	(0.0369)	(0.0325)	(0.0297)
D_{Q3}	-0.0486	-0.0366	-0.0278	-0.0231
	(0.0567)	(0.0382)	(0.0336)	(0.0306)
D_{Q4}	-0.282***	-0.217***	-0.173***	-0.140***
	(0.0433)	(0.0328)	(0.0305)	(0.0289)
α	0.598***	0.781***	0.798***	0.803***
	(0.0161)	(0.0103)	(0.00918)	(0.00858)
β	-0.179***	-0.455***	-0.667***	-1.254***
	(0.0482)	(0.0659)	(0.106)	(0.227)
ξ	-0.00217***	-0.000846**	-0.000852**	-0.000915***
	(0.000386)	(0.000298)	(0.000275)	(0.000259)
Aysén	2.309***	0.983***	0.845***	0.778***
	(0.115)	(0.0696)	(0.0602)	(0.0544)
Antofagasta	1.893***	0.477***	0.369***	0.342***
	(0.124)	(0.0762)	(0.0669)	(0.0614)
Araucanía	2.256***	1.143***	0.981***	0.881***
	(0.0994)	(0.0634)	(0.0557)	(0.0510)
Arica y P.	2.253***	0.866***	0.713***	0.638***
	(0.129)	(0.0816)	(0.0704)	(0.0634)
Atacama	2.461***	1.266***	1.078***	0.963***
	(0.108)	(0.0732)	(0.0653)	(0.0604)
BioBío	2.443***	1.268***	1.091***	0.984***
	(0.0985)	(0.0601)	(0.0524)	(0.0477)
Coquimbo	2.503***	1.315***	1.125***	1.008***
	(0.103)	(0.0669)	(0.0593)	(0.0545)
L. B. O'Higgins	2.312***	1.182***	1.013***	0.909***
	(0.0968)	(0.0618)	(0.0546)	(0.0503)
Los Lagos	2.469***	1.253***	1.072***	0.962***
	(0.103)	(0.0633)	(0.0550)	(0.0500)
Los Ríos	2.222***	1.052***	0.867***	0.754***
	(0.116)	(0.0832)	(0.0739)	(0.0677)
Magallanes y la A.	2.113***	0.705***	0.550***	0.480***
	(0.115)	(0.0714)	(0.0629)	(0.0578)
Maule	2.435***	1.277***	1.086***	0.966***
	(0.0970)	(0.0619)	(0.0549)	(0.0506)
Metropolitana	2.180***	1.065***	0.913***	0.819***
	(0.102)	(0.0695)	(0.0626)	(0.0584)
Tarapacá	2.423***	1.129***	0.983***	0.908***
	(0.113)	(0.0694)	(0.0604)	(0.0549)
dummy2012	0.108***	0.111***	0.0858**	0.0677**
	(0.0324)	(0.0293)	(0.0266)	(0.0247)
dummy2013	0.128***	0.129***	0.107***	0.0916***
	(0.0314)	(0.0286)	(0.0260)	(0.0241)
dummy2014	0.171***	0.141***	0.118***	0.102***
	(0.0303)	(0.0282)	(0.0258)	(0.0240)
dummy2015	0.192***	0.205***	0.182***	0.165***
Observations	1,707	1,707	1,707	1,707
Adj. R-squared	0.968	0.961	0.952	0.943
AIC	18180.5	18552.1	18882.7	19186.6
BIC	18316.6	18688.2	19018.7	19322.6

Fuente: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 3. Non Linear Least Squares. *Current Transfers plus Capital Expenditure Transfers.*

VARIABLES	(1)	(2)	(3)	(3)
	ϕ=0.2	ϕ=0.4	ϕ=0.6	ϕ=0.8
π	0.722***	0.698***	0.688***	0.682***
	(0.0366)	(0.0310)	(0.0297)	(0.0277)
D_{Q2}	0.0510	0.0478	0.0461	0.0445
	(0.0447)	(0.0358)	(0.0318)	(0.0293)
D_{Q3}	-0.0474	-0.0343	-0.0299	-0.0296
	(0.0457)	(0.0370)	(0.0328)	(0.0302)
D_{Q4}	-0.261***	-0.203***	-0.162***	-0.136***
	(0.0364)	(0.0319)	(0.0297)	(0.0280)
α	0.734***	0.785***	0.794***	0.795***
	(0.0124)	(0.00975)	(0.00882)	(0.00824)
β	-0.321***	-0.477***	-0.739***	-1.510***
	(0.0461)	(0.0642)	(0.103)	(0.222)
ξ	-0.000929**	-0.000627*	-0.000600*	-0.000634*
	(0.000331)	(0.000285)	(0.000264)	(0.000251)
Aysén	1.279***	0.863***	0.736***	0.672***
	(0.0871)	(0.0664)	(0.0583)	(0.0533)
Antofagasta	0.787***	0.384***	0.304***	0.289***
	(0.0937)	(0.0724)	(0.0645)	(0.0598)
Araucanía	1.437***	1.047***	0.891***	0.793***
	(0.0773)	(0.0608)	(0.0542)	(0.0501)
Arica y P.	1.158***	0.685***	0.523***	0.437***
	(0.102)	(0.0786)	(0.0688)	(0.0626)
Atacama	1.582***	1.134***	0.945***	0.827***
	(0.0868)	(0.0706)	(0.0639)	(0.0596)
BioBío	1.601***	1.191***	1.027***	0.926***
	0.0743)	(0.0572)	(0.0506)	(0.0466)
Coquimbo	1.645***	1.211***	1.030***	0.918***
	(0.0803)	(0.0641)	(0.0575)	(0.0533)
L. B. O'Higgins	1.484***	1.080***	0.915***	0.811***
	(0.0749)	(0.0593)	(0.0532)	(0.0495)
Los Lagos	1.580***	1.151***	0.981***	0.877***
	(0.0787)	(0.0605)	(0.0533)	(0.0490)
Los Ríos	1.390***	0.966***	0.795***	0.690***
	(0.0980)	(0.0805)	(0.0720)	(0.0666)
Magallanes y la A.	1.055***	0.606***	0.472***	0.411***
	(0.0878)	(0.0683)	(0.0612)	(0.0570)
Maule	1.612***	1.186***	1.006***	0.893***
	(0.0746)	(0.0592)	(0.0532)	(0.0494)
Metropolitana	1.359***	0.999***	0.861***	0.772***
	(0.0815)	(0.0665)	(0.0607)	(0.0573)
Tarapacá	1.407***	0.967***	0.813***	0.727***
	(0.0867)	(0.0667)	(0.0591)	(0.0546)
dummy2012	0.129***	0.0897**	0.0600*	0.0401
	(0.0324)	(0.0287)	(0.0262)	(0.0245)
dummy2013	0.153***	0.125***	0.104***	0.0894***
	(0.0315)	(0.0279)	(0.0255)	(0.0238)
dummy2014	0.164***	0.129***	0.106***	0.0906***
	(0.0308)	(0.0276)	(0.0253)	(0.0237)
dummy2015	0.233***	0.214***	0.197***	0.186***
	(0.0303)	(0.0271)	(0.0250)	(0.0235)
Observations	1,707	1,707	1,707	1,707
Adj. R-squared	0.969	0.962	0.954	0.944
AIC	18130.6	18480.4	18820.3	19146.9
BIC	18266.6	18616.5	18956.3	19283.0

Fuente: Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 4. F test on π

	Current Transfers (CT)		Current and Capital Transfers (CCT)	
Model	$H_0: \pi = 0$	$H_0: \pi = 1$	$H_0: \pi = 0$	$H_0: \pi = 1$
1	265.73 (0.000)	28.81 (0.000)	389.10 (0.000)	57.59 (0.000)
2	482.65 (0.000)	90.25 (0.000)	505.29 (0.000)	94.89 (0.000)
3	523.62 (0.000)	110.29 (0.000)	537.69 (0.000)	110.18 (0.000)
4	532.98 (0.000)	118.06 (0.000)	606.98 (0.000)	131.51 (0.000)

P values in parenthesis.

Table 5. 95% Conf. Interval, ϕ=0.2.

	CT		CCT	
Parámetro	Lower limit	Upper limit	Lower limit	Upper limit
π	0.662	0.843	0.650	0.794
α	0.566	0.629	0.709	0.758
β	-0.273	-0.084	-0.411	-0.230
ξ	-0.003	-0.001	-0.002	-0.0002
DT/dg	0.759	0.740	0.726	0.668
σ_g^{Exp}	0.459	0.470	0.414	0.450

Table 6. Expenditure – Grant elasticity; σ_g^{Exp}

	Current Transfers		Current and Capital Transfers	
Quartile	% MINEDUC	σ_g^{Exp}	% MINEDUC	σ_g^{Exp}
Q1	0.6840	0.4956	0.6840	0.4657
Q2	0.6672	0.4827	0.6672	0.4545
Q3	0.6532	0.4755	0.6532	0.4473
Q4	0.5603	0.4044	0.5603	0.3724