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# *Capital Infrastructure and Equity Objectives in Decentralized Systems\**

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## **I. Introduction: Issues and motivation**

Equity concerns about decentralization are particularly acute in the case of capital infrastructure services. This is because the share of subnational governments in total capital expenditures of a country is typically twice their share in total recurrent expenditures (Martinez-Vazquez and Timofeev, 2012). This is true for developing and developed countries. While on average the subnational share of capital expenditures is 60 percent, the share of subnational governments in recurrent expenditures is 30 percent (Figure 1). In addition to the potential disparities in the quantity and quality of public services offered to residents, to the extent that the availability of public infrastructure determines the attractiveness of a locality for doing business, unless properly addressed, fiscal disparities in the stock of infrastructure can feed back through different levels of private investments into economic disparities, creating a vicious circle for less endowed subnational jurisdictions. For that reason central governments might desire to implement even higher degrees of equalization for productive economic infrastructure than for social infrastructure.<sup>1</sup>

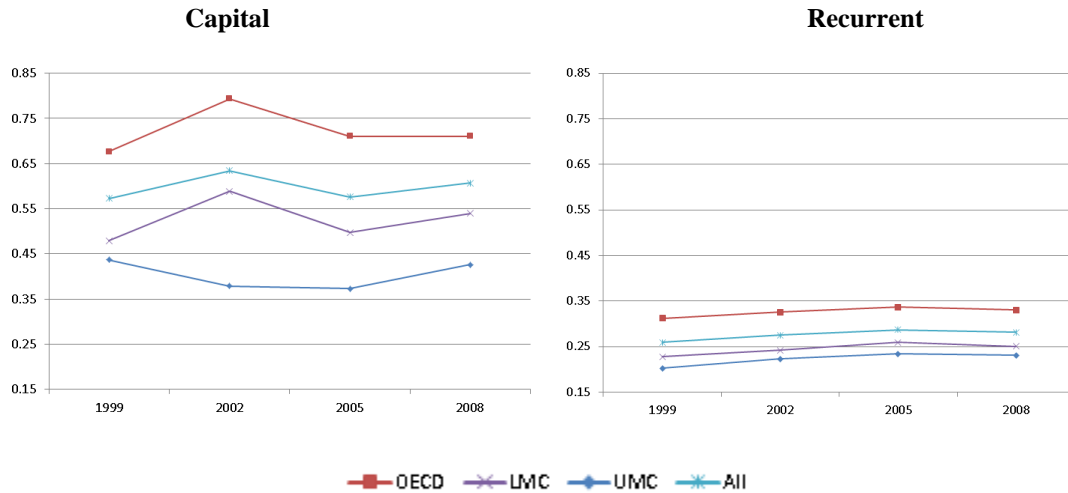
To the extent that the main objective of intergovernmental grants, and more in particular equalization transfers, is to ensure the “adequate” financing of decentralized functions, it is easy to argue convincingly that this adequacy should be assessed in terms of the entire expenditure needs, including capital infrastructure. Generally, in most decentralized systems the need to provide equal financing abilities, taking into account the different fiscal capacities of subnational units, to provide a standard basket of public services is not questioned. However, this broad consensus in the theory and practice of fiscal federalism has been focused on the recurrent expenditures needed to finance those public services. Nevertheless, it is pretty immediate that most of these services cannot be adequately provided without the existence of the

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<sup>1</sup> As we explain further in our paper, the appropriate treatment of infrastructure disparities depends on the exact objectives of intergovernmental policies. In particular, one has to distinguish the fiscal equity objective from that of balanced economic development. While the former objective aims at achieving equitable service provision in the presence of fiscal disparities, the latter objective attempts to narrow the economic disparities that are likely behind the fiscal disparities. Thus, by its nature, the first objective plays more of a short-term, mitigating role, while the second objective pursues long-term outcomes often with little immediate impact. However, given that education account for the bulk of local government expenditures in many countries, immediate mitigation of fiscal disparities is likely to translate into more equitable development patterns. Further the association between school facilities and student achievements, frequently reported by education scholars, seems to represent causality as suggested by more rigorous economic studies using sophisticated controls for covariates (e.g. Cellini et al 2010).

complementary infrastructure inputs (e.g., recurrent expenditures for teacher salaries, textbooks, etc. need to be complemented by school buildings to deliver education services.).

**Figure 1. Decentralization of recurrent and capital expenditures, 1997-2008**

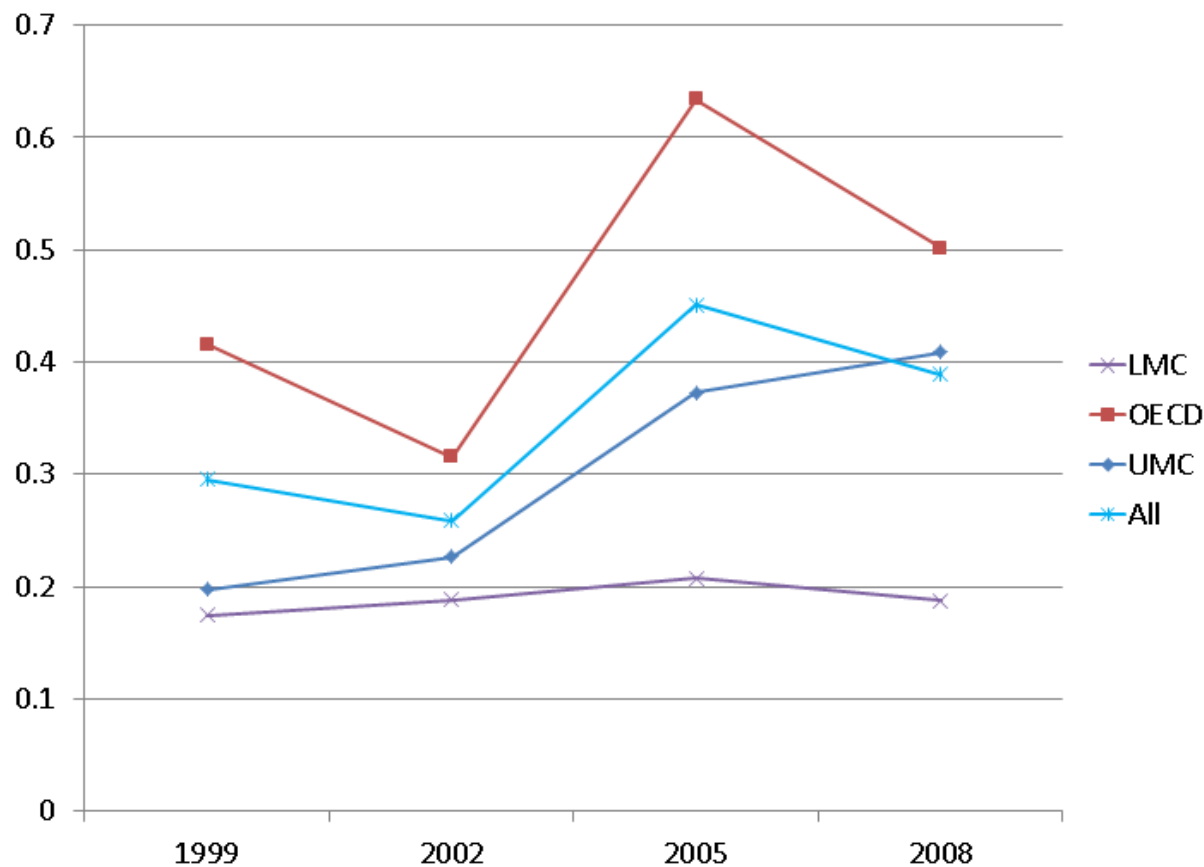


Source: Martinez-Vazquez and Timofeev, 2012

Notes: The sample includes 39 countries, out of which 6 lower middle income, 10 upper middle income, 2 non-OECD high income, and 21 OECD countries.

While the system of grants should balance available resources with the entirety of capital and non-capital costs in the provision of subnational services, it is a separate and unresolved question in the intergovernmental grants literature whether capital financing needs should be arranged separately in an earmarked manner. On average, explicit capital grants account for only about one third of net subnational investments and this share ranges from less than one-fifth in lower-middle counties to over a half in OECD countries (Figure 2). In particular, in the transitional countries capital grants have played a smaller role in the financing of local infrastructure than own current and capital revenues of local governments (the latter often from the sale of assets), and borrowing; in particular, borrowing has been more prevalent in Central Europe (Swianiewicz, 2004).



**Figure 2. Capital grants as a share of subnational capital investments 1997-2008**

Source: Martinez-Vazquez and Timofeev, 2012

Notes: The sample includes 33 countries, out of which 1 low income, 7 lower middle income, 7 upper middle income, 2 non-OECD high income, and 16 OECD countries.

Conceptually, there are potential efficiency losses associated with the different treatment of operating and capital cost needs of subnational governments; for example, it can lead to deferred maintenance. The practice of budget unity and integrity allows for establishing the optimal level of activities needed to maintain or replace public infrastructure assets according to their originally contemplated serviceability. In particular, proper maintenance can avoid the capital costs of replacement for the optimal period of time. On the other hand, under separation of capital budgets and funding, local managers might try to save on operating costs by not performing (or deferring) maintenance at the proper time without perceiving, or trying to shift to

another level of government, the incurred capital costs of this strategy. Furthermore, depending on the practices of upper-level governments, in some countries, proper maintenance of capital infrastructure may reduce the chances of receiving funds for capital rehabilitation, as the practice of allocation of grants may be based on the physical shape of assets.<sup>2</sup>

When higher-level governments build local infrastructure rather than providing capital grants to local government, this can aggravate rather than help the fiscal conditions of the “lucky” recipient. The separation of decisions among different levels of government for building infrastructure and for operating it has been traditionally interpreted as a main cause of the poor physical shape of assets in the Soviet Union (Wallich, 1994). For a more recent example, in Germany, the states (*Länder*) prescribe hospital capacity levels and finance investment expenditures but do not assume the operating costs or cover any potential hospital losses. As a result, the state politicians have an incentive to overbuild hospital capacity and claim political credit for employment creation while settling local governments with the bill for operating costs, which over the years can be a multifold of the construction costs (Wurzel, 1999). Thus, the central government intervention does not only create the agency problem but also removes the life-time costing of facilities from making investment decisions. There are of course many cases of centrally driven—or foreign donor driven—infrastructure investments in developing countries that have been abandoned because of subnational governments’ inability to operate and maintain them on a sustainable basis.

On the other hand, political economy considerations might require going beyond accounting for capital expenditure needs in determining the total amount of equalization transfers by also specifically earmarking some part of these transfers for capital investment purposes. As underinvestment is essentially a form of dissaving, the same moral hazards can be present here as in the case of subnational borrowing.<sup>3</sup> That is the capital costs can be shifted to the successive governments or even next generations of local residents, which violates the so-called “Golden Rule.” Thus, Ahmad and Searle (2006, p. 389) argue that in many low- and middle-income

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<sup>2</sup> For example, New York’s Building Aid program does not fund routine maintenance while major renovations are eligible for state grants, covering on average half of the project costs. Curiously, 93 percent of projects approved in 1984-2002 were renovations of existing school buildings (Wang 2011).

<sup>3</sup> In countries where subnational governments are required to finance investments with past savings instead of borrowing against future revenues (e.g. Denmark), a capital grant could be interpreted to represent essentially a bailout to a municipality that has failed to save in the past.

countries" scarcity of financial resources and popular pressure to use them for immediate current spending may leave little for capital formation." Similarly, according to Boothe (2007, p. 192), "one of the key reasons for advocating a move to accrual accounting has been the view that during periods of deficit reduction, governments using cash accounting simply replace fiscal deficits with infrastructure deficits by ignoring the depreciation of public capital." In addition, Moak and Hillhouse (1975) among many others suggest that, when under fiscal strain, local governments tend to postpone capital projects rather than expenditures for operating agencies. Similar evidence from surveys of coping strategies of U.S. cities was reported by Pagano (1993). Earmarking of some part of intergovernmental grants for capital investments can mitigate these risks.

There may also be other significant practical matters that may require a separate treatment of capital infrastructure needs. For example, as we discuss in more length in the next section, addressing disparities in capital infrastructure can require considering differences in access to borrowing sources and the costs of borrowing; these considerations bring intertemporal issues that can be hard to address explicitly and correctly in the context of general equalization grants (traditionally focused on recurrent expenditure needs.)

All in all, in this paper we argue that disparities in the availability of and need for capital infrastructure matters for fiscal equity. However, we believe that a proper discussion of this topic should be framed in terms of the incidence of outputs and outcomes of public services produced with this infrastructure. Infrastructure alone cannot be assigned any policy priority independent of programs and services that utilize these capital assets. Once we place this discussion in the framework of access to and quality of public services, we then move to the question of the best form of policy intervention, which can be specific to capital inputs. Thus, we consider both pros and cons of addressing infrastructure disparities in an earmarked fashion—in the line of conditional capital grants still used in many countries— as opposed to incorporating capital infrastructure disparities into a general-purpose equalization grant—which is not explicitly done in many countries. The rest of this paper is organized as following. In the next section we make a normative case for addressing infrastructure needs in intergovernmental arrangements. Then, we examine how and to what extent those capital disparities are addressed in practice using three country cases (Peru, Russia, and Spain). Next, we discuss some policy implications. We conclude with a summary of the issues and final comments.

## II. The normative case for addressing disparities in capital infrastructure needs

The general case for addressing disparities in capital infrastructure needs can be built around three different dimensions having to do respectively with:

- (i) disparities in infrastructure costs;
- (ii) disparities in borrowing costs;
- (iii) (historical) disparities in capital endowments;

Furthermore, the treatment of these disparities in infrastructure costs and endowments will also vary depending on the balance of competing government objectives, including economic efficiency (efficient taxation and geographic mobility and location of factors of production) , internalization of externality spillovers, national solidarity, and merit goods.

In this section, we apply these policy objectives (efficiency, internalizing externalities, etc.) to the discussion of separate aspects of infrastructure disparities (disparities in endowments, construction costs, and borrowing costs).

To facilitate the extraction of policy implications of the normative discussions in this section, we will conclude this paper by introducing a two-dimensional matrix summarizing the main points along policy objectives in columns and the aspects of infrastructure disparities in rows.

However, in order to make the discussions easier to follow and lay the foundation for the policy implications, immediately below we start by providing more details on the reasoning and justification behind each of the aforementioned policy objectives.

### Understanding the implications of policy objectives for capital infrastructure

#### *Pursuing efficiency: Trends in tax assignment and revenue sharing*

Even in the most decentralized countries, local jurisdictions cannot operate like sovereign states because they are constrained by national legislation, which among other things, limits taxing and borrowing powers of local governments. As economic development has made economic activities increasingly footless, there has been a trend toward centralizing the taxation of businesses activities at the national level in order to reduce (tax) distortions to the decision of business location. Even in the taxation of consumption, the trend over the last decades has been the substitution of the national VAT for local sales taxes. As a result, throughout the world the bulk of revenue-raising powers has been concentrated at the national level. To accommodate the

mismatch between revenue sources and spending obligations, central governments have been providing grants to subnational governments. The sharing of revenue from national taxes with subnational governments thus has become a common remedy for vertical imbalances, where revenue sources available to subnational governments as a group do not correspond to their expenditure responsibilities. Furthermore, after some countries have experienced episodes of macroeconomic instability following unsustainable subnational borrowing, as was the case in Latin America in the 80s and 90s, many countries have also concentrated borrowing powers at the national level.

*Pursuing efficiency: Fiscal equalization to address horizontal imbalances.* Horizontal imbalances occur when the spatial distribution of local revenue sources and fiscal capacity do not match the spatial distribution of local government expenditures and expenditure needs. National governments generally attempt to mitigate these horizontal imbalances both on the grounds of social solidarity, such as equal access to some basic services independently of the place of residence, and economic efficiency, such as preventing fiscally-induced migration and misallocation of economic resources. In relation to expenditure needs, economic efficiency concerns emerge in the situation where benefits from local services vary across different population strata rather than being uniform for all local residents. In this case, it has been suggested, for example, that an efficiency-inducing grant formula should take into account the differences in the proportion of entitled population (e.g. school-age children) in various localities.

*Compensation for the presence of spillovers or “externalities” between jurisdictions.* When local governments are left to make their own decisions, they may under-spend on certain services which may report substantial additional benefits to third parties, such as neighboring local governments. For example, sewage treatment by an upstream municipality benefits residents of downstream municipalities sharing the same river basin. Economic theory suggests that local governments should receive a unit (Pigovian) subsidy equal to the marginal value of the inter-jurisdictional spillovers created in the provision of one unit of local public services. Based on this rationale one would expect such subsidies to increase with the magnitude of external benefits but not with the local costs required to produce these benefits. On the contrary, under reciprocal externalities per unit subsidies should be inversely related to the unit costs in the

recipient locality so that the national government could induce maximum externalities per unit of national grants.

*Funding national priorities or “merit goods”.* The concept of merit (or demerit) good is mostly related to the situation when societal values override personal choice even though no spillover of benefits occurs. In particular, this includes paternalism in distribution, when society cares more about the distribution of certain goods, such as basic necessities of life, health, and citizenship rights than about income distribution in general. Similar to the case of externalities, economic theory suggests that conditional grants could stimulate local spending on such goods or services. For merit goods involving equal access or an assured universal minimum, such conditional grants should take into account differences in the local costs and might also require determining the adequate level of funding in order to secure this assured minimum.

The relative importance of these competing policy objectives defines the nature of a particular grant scheme. Therefore, the actual practice of intergovernmental transfers, further explored at the end of this paper, might show various degrees of mitigation of infrastructure disparities when some of these other objectives override government action.

*A simple theoretical framework for the optimal level of capital inputs:* In order to be able to superimpose inter-jurisdictional disparities in infrastructure over the aforementioned set of policy objectives, let us assume for a moment that the balance of these policy objectives implies a certain level  $S$  of public service outcome in a given jurisdiction. Then, under standard cost-minimization, this fixed level of service outcome will translate into different optimal levels of capital inputs, depending on local service load factors (level of service output required to achieve a given level of outcome), and the relative costs of capital and non-capital inputs in a jurisdiction. Thus for a Cobb-Douglas technology, Wang et al., (2011) derive the following functional form for the optimal level of capital inputs:

$$K^* = \left( \frac{\beta P_O}{1-\beta P_K} \right)^{1-\beta} a^{\frac{1}{\tau}} (bSN^{\alpha}Z^{\varphi})^{\frac{1}{\tau}} \quad (1)$$

where

a and b are constant parameters;

$\tau$  captures returns to scale in production (increasing when  $\tau > 1$ )

$\beta$  represents the cost share of capital;

$P_K$  is the cost of capital inputs;

$P_O$  is the cost of non-capital (operational) inputs;

$\gamma$  is the elasticity capturing differences between technical economies of scale and economies of quality scale;

$\alpha$  and  $\varphi$  are elasticities measuring the impact of population size  $N$  and service load factors  $Z$  (e.g. proportion of disadvantage students) on the service outcome.

From equation 1 it is obvious that the optimal level of capital inputs is inversely related to the cost of capital  $P_K$  but positively related to the cost of non-capital inputs  $P_O$ . As expected, the optimal level of capital inputs is increasing with the targeted service outcome level  $S$ , population size  $N$  and service load factors  $Z$ . It can be shown that these relationships are not specific to the Cobb-Douglas technology but also hold for a more general Constant Elasticity of Substitution (CES) production function.

#### Making the case for addressing disparities in capital infrastructure

*Disparities in infrastructure costs:* Overall, the theory of fiscal equalization presents a rather limited case for compensating subnational governments through grants for the presence of higher costs of producing subnational public services, as opposed to making the case of compensating for differences in service needs. However, this theoretical position contrasts markedly with the actual practice of intergovernmental grants, where adjustments for cost differences are very common outside North America.<sup>4</sup> But, such gaps between theory and practice are not unprecedented in public finance, as illustrated by decades of neglecting the VAT in the theory of public finance until long after it had been introduced in practice. In the case of intergovernmental grants, this gap is partially explained by the fact that the discussion in the economic theory of equalization has focused on the efficiency objective while in the practice of grant design cost disparities would appear to be addressed for reasons having to do with the objectives of social solidarity and merit goods.

Thus, if for example the merit goods objective were to require a uniform service outcome in all localities, then according to optimal production theory in equation (1), this would translate into lower levels of infrastructure in jurisdictions with higher costs of infrastructure. However,

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<sup>4</sup> While most of the 38 U.S. states that have aid grants for education facilities make adjustments for fiscal capacity of local jurisdictions, only a few states make adjustments for differences in needs and costs using such factors as enrollment growth, special need students, local costs, etc. (Wang et al. 2011)

even this lower level of infrastructure might require higher levels of capital outlays if the elasticity of substitution of non-capital inputs for capital inputs is not high enough to offset a higher unit cost of capital. For example, for a Cobb-Douglas technology, which has a unitary elasticity of factor substitution, Wang et al., (2011) derive the following functional form for the optimal level of capital expenditures:

$$KE^* = P_K^\beta \left( \frac{\beta}{1-\beta} P_O \right)^{1-\beta} a^{\frac{1}{\tau}} (bSN^\alpha Z^\varphi)^{\frac{1}{\tau}}. \quad (2)$$

From this equation it is clear that, with a unitary elasticity of factor substitution, the optimal capital outlays increase with the costs of capital despite using less capital inputs. Thus, in order to assure a targeted outcome level of services under the Cobb-Douglas technology, intergovernmental grants have to accommodate higher capital outlays in localities with higher costs of capital. However, this is not necessarily the case for other technologies. In particular, for a more general CES production function, capital outlays can be decreasing in capital costs when the elasticity of substitution as well as the relative price and share of capital are sufficiently high:  $P_K / P_O > (1-\beta)$ .

One has to note that for any CES technology, optimal capital outlays have to increase with the service need parameters ( $Z$ ) if we want to achieve a given outcome target of  $S$ . Furthermore, for this given outcome target  $S$ , capital outlays have to increase with the overall level of input costs (as opposed to the relative cost of capital). However, if the objective of intergovernmental policies is the efficient location of mobile resources, then the service target  $S$  might be set lower in jurisdictions with high costs, including higher costs of infrastructure. In this sense, Boadway (2004, p. 238) points out that, for a benevolent social planner, addressing cost differences across decentralized jurisdictions should be approached the same way as inter-local cost differences in a unitary country:

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“To the extent that some regions have higher costs of provision than others, difficult problems arise for equalization. In a unitary state, if different regions have different costs, different levels of public services will generally be provided. The equity advantages of more equal provision will have to be set against the efficiency costs. Thus, the level of public services is typically lower in remote and scarcely populated areas than in urban areas, but how much lower involves a policy judgment.”

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While this argument appears reasonable, to our knowledge no formal model has been developed to feature such a tradeoff between economic efficiency and fiscal equity. One would



expect that analytically it should be no less feasible than modeling the trade-off between equity and efficiency in taxation.

The limited case for cost equalization ever developed in fiscal equalization models is entirely based on the existence of inter-jurisdictional externalities (Albouy, 2012). Concerning the externalities induced from the mobility of population, equalization grants should compensate for the loss of economies of scale from a marginal out-migrant only to the extent that such economies of scale are present in the production of local government services (that is, based on the ‘publicness’ of local government services). This is because private benefits from local services are already fully internalized in the individual’s migration decision. However, most empirical estimates of the congestion (or crowding) parameter for local government services imply the majority of these services are highly congestible and therefore they are more like private goods than pure public good (Albouy, 2012). Therefore, given the empirical findings related to the ‘privateness’ of most local government services, there is little need from that perspective for intergovernmental grants to take into account differences in local costs.

Only very recently, Albouy (2012) has formally modeled differences in the unit costs of a public service provision in addition to differences in the levels of its congestion. In his model, Albouy (2012) allows the unit cost of the public good provision to vary among regions due to differences in their productivity. Thus, per capita costs of the public service provision are equal to  $pG/N$ , where  $p$  is the marginal rate of transformation of the private good (a numeraire) into a public good. At the same time per capita benefit  $S$  from the public good output  $G$  is a function of population size  $N$ :  $S=G/N^\alpha$ , where  $\alpha$  is the extent of congestion as in the previous literature. The derived difference in the equalization grant due to the differences in expenditure needs looks like  $(1-\alpha)*(p_1G_1/N_1 - p_2G_2/N_2)$ . Thus, it appears that efficiency-enhancing grants should take into account differences in the local costs of producing the public good.

However, this compensation term disappears in the case of complete congestability (lack of publicness) of the public service with  $\alpha=1$ . Furthermore, the derived equalization grant takes into account per capita costs of the local public goods provided at the levels which are *optimal* from the social planner's perspective. As Boadway (2004) conjectures that it would be optimal to have a lower level of public service provision in a high-cost region, then assessed expenditure needs  $p_i G_i / N_i$  can be higher or lower in a high-cost region depending on the interplay of  $p_i$  and  $G_i$ . Albouy (2012, p. 827) makes the following general interpretation of the formula for efficiency-inducing grants derived from his model:

“The transfer formula implies that it is inefficient to subsidize a household's location based on the cost of private or public goods. Neither [of these prices appear in the grant formula] independently of total expenditures  $p_i G_i$  which matters only for the public-good externality. Thus variation in these prices due either to factor costs or production efficiency are to be ignored. When prices are set efficiently, they represent the opportunity cost of scarce factors for producing tradable output. Subsidizing households to live in areas where providing local services costs more ignores these opportunity costs and leads to inefficient use of scarce factors.”

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Apart from economies of scale, the only theoretically conjectured case for efficiency-inducing equalization grants to be positively related to local infrastructure needs is due to differences in the composition of population in terms of entitlement to various capital-intensive services. However, this conjecture articulated by Boadway (2004) has not been formally derived in the theoretical literature. In this sense, it needs to be pointed out that taking into account the different segments of the population eligible for government services has been one of the key features in the design of intergovernmental grants throughout the world, mainly in the pursuit of social solidarity and merit goods, as we mentioned before.

All in all, even with a uniform standard of service, economic efficiency appears to generally require lower level of infrastructure in localities with higher costs of capital. However, even with this lower level of infrastructure, high-cost localities are likely to have higher capital expenditure needs unless the elasticity of substitution of non-capital for capital inputs is sufficiently high. For services where a uniform outcome standard is not an absolute government

objective, efficiency considerations might require lower levels of service in high cost localities in addition to producing those services with less capital.

*Disparities in borrowing costs:* Up to this point, in our discussion we have assumed that once a local government has determined the optimal level of capital inputs required to produce a given service standard with least costs, it can procure (i.e. lease) those assets (e.g. classrooms) from the market at a rate  $P_K$ . As discussed in paper 6 of this collection, in some sectors this is becoming increasingly feasible through various forms of private-public partnership. However, as of today, we can generally say that for most countries and most sectors, the bulk of capital infrastructure cannot be leased from the private sector. This is due to the usual risks associated with dealing with a single buyer and the high specificity of capital assets that have little alternative use. Therefore, the government typically has to assume all the risks and costs of creating these capital assets. Sometimes, these assets are built by one government agency, such as a government building authority, and leased to another government agency, such as the department of education. However, even these arrangements do not change the overall situation with the risks and costs, other than pooling the risks and spreading the fixed costs of managing the associated portfolios of capital assets and liabilities to entire government as opposed to a single agency unit.<sup>5</sup>

While public finance experts agree that government spending on recurrent (local) goods and services should be met by revenues from taxes and other recurrent revenue sources, the “golden rule” for (local) government borrowing states that it is proper for (local) governments to borrow for capital projects.<sup>6</sup> As discussed in Box 1, the ability of local governments to borrow as part of an efficient system of intergovernmental fiscal relations is important on normative grounds.

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<sup>5</sup> An inter-agency building authority can be instrumental in dealing with lumpiness of capital outlays by annuitizing capital costs through inter-departmental (accrued) amortization charges. This is because in any given year only a fraction of many capital assets in various sectors undergo capital rehabilitation, which can be covered by pooling amortization charges from all sectors. However, when local jurisdictions are so small that the lumpiness of capital outlays makes investments unfeasible without central government assistance, this suggests a problem with the jurisdiction size in general not just in relation to capital projects. If a municipality has only one school, it is hard to justify the operational costs of the additional layer of local bureaucracy (school inspectors, etc) running a single school.

<sup>6</sup> Musgrave, Richard Abel. 1939. "The Nature of Budgetary Balance and the Case for the Capital Budget." *The American Economic Review*, 29(2), pp. 260.

**Box 1****The efficiency gains from borrowing for local capital infrastructure**

To a large extent, the efficiency of decentralized government finance rests on the benefit principle, which requires that the costs of public services be covered with taxes paid by those who benefit from these services. However, if current tax receipts were spent toward some capital project that brings fruits for many years ahead, such as a new road or a water treatment plant, the benefit principle would be violated in an inter-temporal sense across time periods. Unless corrected, this “inter-temporal spillover” of benefits would lead to the under-provision of local public capital goods. This is because current residents might not be willing to pay the full cost of the project while receiving only a fraction of its benefits.

Debt financing has the potential to rectify this situation by spreading the costs of building a facility over the entire period during which the benefits from this investment are received, and with future taxes being used to repay the loan taken in the earlier period

Borrowing can also help address other issues such as the lumpiness of investments. For instance, while funding a piped water scheme from recurrent local resources may prove prohibitive, borrowing could help put in place a sustainable, fee-based public water scheme.

It is important to realize that within any country, with its own peculiar financing institutions, the ability to borrow is likely to differ markedly across sub-national governments. Local government borrowing from competitive capital markets –either through private financial institutions or directly from the bond markets- requires the local authority to be creditworthy by demonstrating its financial ability to repay its loan over time and technical capacity to manage its debt. As such, the very nature of capital markets assures that local government borrowing is likely to exacerbate horizontal imbalances: credit markets provide larger and wealthier regional and local governments with access to capital funding, while smaller and poorer local governments are typically excluded altogether from access to capital.

However, the issue of inadequate fiscal capacity of poorer jurisdictions is not specific to debt financing. Without being addressed with effective remedies, insufficient fiscal capacity affects the ability of local governments to finance their operating costs just the same way it does affects their ability to borrow and repay their debt. In fact, debt financing is only a tool for managing the flow of income and expenditures across time periods. If the flow of income is overall inadequate to finance the flow of expenditures rather than there being a mismatch of these two flows across time, then debt financing by itself cannot improve this situation. However, when a decentralized fiscal system is able to effectively address fiscal disparities by equalizing fiscal capacity and expenditure needs, including infrastructure needs, this equalization

should allow local governments to generate the necessary surpluses to cover amortization and interest on their debt in addition to maintenance of the associated capital assets. Stable and predictable intergovernmental equalization and other grants contribute significantly to building the creditworthiness of local governments, if not just the same way as stable revenues from their own sources. Other arrangements can facilitate the access to credit by poorer jurisdictions. An example may be the creation of financial intermediary that borrows at lower costs in the markets and on-lends to smaller jurisdictions. Another example is provided by the practice of intercepting sub-national government sources of revenues; the ability to intercept intergovernmental transfers can be seen by creditors as the most secure collateral.<sup>7</sup>

According to the theory of fiscal equalization, efficiency-inducing grants should take into account disparities in source-based taxes and local rents. Concerning disparities in residence-based taxes, the disparities that should be equalized are only those determined by the differences in the composition of residents in those jurisdictions in terms of their income-earning abilities, but not those based on their actual income, as for example determined by local income-generating opportunities. These normative prescriptions for fiscal equalization have been derived using a single-period model. Conceptually these arguments could be extended to a multi-period setting so that a migration decision by a local resident is determined by the present value of future revenues and costs. However, this introduces one additional aspect of disparities, namely the costs of inter-temporal smoothing or borrowing costs (Herrero-Alcalde et al., 2010). Thus, for two jurisdictions with identical streams of future revenues, the one with higher borrowing costs will have a lower present value of its revenues.

Alternatively, one can look at disparities in borrowing capacities from the cost side. The normative framework above assumes that the use of infrastructure brings on the local government a cost of  $P_K$  for each unit of capital inputs. This cost is either explicit in the case of leasing this infrastructure from a private supplier or implicit if it is built and maintained by the local government itself. Regardless of the arrangements, the cost of infrastructure  $P_K$  is essentially made of the same elements: cost of financing (or opportunity cost)  $i$ , depreciation of the asset (equal to the amortization of the loan principal)  $d$ , and maintenance required to preserve

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<sup>7</sup> At the same time the right to intercept intergovernmental transfers can discourage lenders' effort to monitor local government finances, and in some cases could be interpreted by these lenders as a promise of central government bailout. For example, Mexico has recently abandoned the practice of the intercept for these same reasons.

existing assets in the serviceable form  $m$ . Depreciation and maintenance cost ( $d+m$ ) can vary with local conditions but should not depend on who supplies these capital assets.<sup>8</sup> By contrast, for a given provider, the cost of financing should not vary across different localities within the same capital market but can vary among suppliers, in particular among local governments. Therefore, depreciation and maintenance ( $d+m$ ) should be treated by equalization policies the same way as other costs of public services. However, the financing/opportunity costs of capital are special in a sense that the cost and availability of financing can be different for the central government than for a local government. Standard tools of bridging such misalignments include earmarked subsidies and on-lending with adjusted interest rates.<sup>9</sup>

Even when being able to generate revenue surpluses from their own sources and stable intergovernmental transfers, smaller jurisdictions might not be served by private markets because of the small size of their financial needs and relatively higher associated transactions costs. This suggests that policy makers need to consider alternative means of funding capital infrastructure in local authorities that lack access to capital markets. However, capital grants are only one of several alternatives to private sector borrowing for financing local capital development in smaller jurisdictions, as we discuss immediately below.

As already advanced above, intermediary financial institutions specializing in local governments can help break the vicious circle in which smaller less-developed localities are restricted in funding infrastructure investments because of lack in capacity to manage borrowing at reasonable costs. Although international practices vary substantially between countries, an intermediary institution can borrow in its own name at lower costs, sometimes with the backing of the central government, and use the proceeds to purchase debt instruments of local governments; this type of intermediary is known as a bond bank. Alternatively, financial intermediaries that serve local governments might assemble and repackage municipal debt instruments and make them available to the market (e.g., create local bond pools). Such intermediaries can provide access to capital markets for smaller governments that otherwise would not get credit or allow them to obtain credit at lower costs. In particular, financial

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<sup>8</sup> Depreciation and maintenance should be considered in isolation from each other as a chosen schedule of maintenance determines the useful life and hence amortization of the asset.

<sup>9</sup> While compensating for higher borrowing costs unrelated to local government actions, the central government would not want to undo the disciplining effect of a higher risk premium charged by capital markets as the volume of outstanding debt becomes too large relative to the expected future revenue stream (Capeci 1994).

intermediation brings savings on the fixed costs of debt issuance thanks to standardized borrowing procedures and documentation, and technical assistance to local governments with capital planning, cash flow projections, and pre-structuring of loan packages (Freire and Petersen, 2004). While this intermediation is provided for a fee, the costs associated with such intermediation for small-scale projects are generally less than the costs of bond issuance.<sup>10</sup>

In practice, financial intermediation, especially when run by the national government, can have its own problems. Besides creating moral hazards, if the “soft” financial assistance from the center is institutionalized, it can also create a culture of long-term dependency and impede capital market development. Therefore, as a practical compromise, complementing borrowing with equalizing capital grants would allow the grants component to be means tested, thus representing an upfront payment of future gaps between debt service costs and revenue collections at some reasonable rates. Such upfront grants can be superior to subsidized interest rates and operating subsidies as they bring transparency and eliminate the need for future surveillance and administration (Varley, 2001). The allocation of grants can be based on affordability analyses, targeting those projects that would become affordable only if subsidized with a partial grant.

Petchey and MacDonald (2007) argue that capital grants can be used as a “short-term option” in transition and developing countries until subnational governments get access to capital markets, tax handles or predictable intergovernmental revenue. Furthermore, they argue that under the aforementioned constraints, capital grants can be used as a short-cut for ensuring equal access to public services that have capital as the main input (e.g., transport). While this might be a valid point in some specific settings, it is not uncommon in developing countries to see local governments not having cash to provide access to education even at a “school under a tree” at the backdrop of aborted government construction sites and idle pieces of infrastructure, which were found to be of little use upon completion. For a broad range of public services, allowing some degree of substitution between capital and non-capital inputs, the flexibility of, for example a sectoral block grant, could significantly enhance the chances of local governments to provide a larger access to these services than conditional grants earmarked to capital use or specific infrastructure projects. Indeed, regardless of central government objectives for financing

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<sup>10</sup> For example, in the United States bond banks have been quite successful in leveraging “economies of scale on behalf of the small borrowers” since 1960s (Government Finance Group 1997, p. 29).

subnational infrastructure, these objectives should apply to both construction and maintenance of such assets. This point was eloquently made by Hulten and Schwab (1997, p. 150):

“We can increase that flow [of services from the stock of public capital] by either adding to the stock through investment or by improving the stock through maintenance. If the federal government is interested in providing the proper incentives to lower levels of government, it is hard to see why it should encourage state and local governments to invest in new capital but not encourage them to maintain that capital once it has been put in place”.

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*Disparities in capital endowments:* Up to this point, we have assumed that local governments start with a clean slate when determining the optimal level of capital inputs and then lease or build this optimal infrastructure required to achieve a given service outcome level. In practice, localities already own some stock of infrastructure, which can be above or below the optimally required level. One of the open conceptual questions in the design of grant mechanisms is whether intergovernmental policies should address disparities in the accumulated stock of physical capital (sometimes referred to as “capital backlog” or “capital infrastructure gap”) relative to some target level.

If the existing local infrastructure throughout the national territory is considered a true local good that has been built under optimal arrangements (so that those who currently enjoy the benefits also contribute to paying off the accumulated debt), there is no need to address this disparity with intergovernmental grants. Indeed, fiscally-induced migration—a well-accepted justification for the introduction of equalization grants to avoid this type of migration— will not arise here because the incentives to migrate into infrastructure-rich jurisdictions will be offset by the disincentives of higher taxation necessary to pay off the associated debt incurred onto in the past to finance the infrastructure.

However, if the disparity in infrastructure resulted from some exogenous decision, e.g., discriminatory policies of the Apartheid regime in South Africa, this type of disparity is not equitable and indeed can cause fiscally-driven migration and therefore the misallocation of population across the national territory. In the case of income-generating assets,<sup>11</sup> this would lead

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<sup>11</sup> Here we should consider net capital income defined as revenues from sales less outlays for operation, maintenance and depreciation of assets (equal to amortization of the loan principal). Obviously, if the central government built a museum with negligible admission receipts but tremendous operation and maintenance costs, it



to disparities among localities in capital revenues accruing to different jurisdictions, which will need to be addressed with equalization grants according to the existing principles of fiscal equalization theory (Boadway, 2004). In the case of assets that do not generate income, under accrual accounting, the income from these assets would have to be imputed and accounted as part of own-source revenues.<sup>12</sup> Thus, at least conceptually, this form of disparity could be addressed by taking into account these imputed revenues and expenditures in the assessment of revenue capacity and expenditure needs as part of a conventional fiscal equalization grant. Of course, from a practical angle, there would remain questions of timing; for example, should all the pasts imputed revenues and expenditures be dealt with in a simple period or multiple periods and how should be delays in the intervention be compensated for over time? Again the answer to this question is likely to be different depending of the policy objectives. Past inequities are likely to be irrelevant for efficient location of mobile resources but quite relevant for social solidarity.

When the infrastructure under consideration contributes to a redistributive government function (such as basic education or primary health care), then central government intervention might also be warranted. Thus, the decades of litigation on equity and adequacy of education finance in the U.S. have included inequalities in school facilities in more than two thirds of the states (Duncombe and Wang 2009). Furthermore, in at least six states, suites have been brought solely on the grounds of school infrastructure inequality, starting with the Arizona case of *Roosevelt Elementary School District v. Bishop* (1994). According to Duncombe and Wang (2009, p. 327), the “Wyoming court saw no reason to separate facilities from other financing programs, regarding school infrastructure as a part of the total educational package.”

However, the exact form of this intervention is not necessarily clear. Thus, when state-level litigation in the USA found school financing systems not meeting the “thorough and efficient” or “general and uniform” education clauses of states’ constitutions, the improvements mandated by the trial courts sometimes included specific requirements in terms of physical facilities for each area of the curriculum. Thus, the 1979 West Virginia case (*Pauley vs. Kelly*)

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would not increase local revenue capacity. Furthermore, the estimates of user fee revenues should take into account reduced tariffs mandated by the national governments for certain categories of local residents.

<sup>12</sup> We have to acknowledge that our conceptual framework mostly applies to public service infrastructure. As to economic infrastructure (public inputs to the private economy), our framework suggests that we should not equalize higher wages and capital returns stemming from better infrastructure but only the differences capitalized as the rent on local immobile factors.

resulted in a mandated master plan for educational improvements, among other things requiring an art room for each 350-500 pupils with at least 50 square feet per student (Crampton and Thompson, 2004). In *DeRolph v. State* (2000), the Ohio court included “sound buildings that are in compliance with state building and fire codes” in its definition of the meaning of an efficient system of schools.

Some scholars suggest that, when regional disparities are exogenously given, as in the case of the Apartheid regime in South Africa, the central government can also externally determine a fair or equitable distribution of physical infrastructure and introduce a series of earmarked grants to bring about the desired allocation of capital stock after a certain number of years (e.g., Levtchenkova and Petchey, 2007). However, this approach is not without problems, especially if the target level is not adjusted for differences in service needs or service costs according to the cost-minimization optimum captured by equation 1. For example, if some locality has redundant infrastructure, this doesn’t mean we should replicate this redundancy everywhere else. The main rationale for decentralization is allowing local players to make efficient decisions based on their better knowledge of local conditions. The right mix of capital and non-capital inputs to the production of public services is one of the most important economic decisions that decentralized systems entrust to subnational officials. Even for the uniform standard of service outcome, the right level of capital inputs will vary with local costs, as was shown earlier in this paper. Therefore, externally imposing the level of capital infrastructure has the potential of leading to inefficient modes of service production and delivery.

In general, the acquisition of assets through separate budgeting procedures can lead agencies to treat assets – once won in the struggle for a share of the government’s capital budget – as a free good. This can lead to inefficient utilization of the assets due to the disregarding of the opportunity costs represented by the assets and also due to inefficiency in evaluating programs that utilize these facilities without accounting for the cost of capital. If one decides to address historical bias in the distribution of physical infrastructure, an alternative approach could be accounting for the impact of infrastructure availability on the recurrent costs of service provision when equalizing expenditure needs with unconditional grants. Thus, under accrual budgeting, as for example implemented in the New Zealand model of “new public management,” a capital charge is levied on the net worth (as shown on its balance sheet) of each department to internalize the amortization of public assets in the production of public services (Laking, 1999).

Applying this approach to the allocation of grants would impute potential capital income as part of the fiscal capacity of the asset-rich jurisdictions or alternatively assess the costs of leasing missing infrastructure as part of expenditure needs of those less fortunate.<sup>13</sup> This may not still deal in an appropriate way with the lumpiness of capital infrastructure; as we have argued earlier, having the necessary funds for leasing the infrastructure does not mean that such infrastructure will be available for leasing. However, this issue is not specific to unequal capital endowments and can be addressed with an array of instruments including credit enhancement and borrowing intermediaries as discussed earlier.

While it is an open question whether separate capital grants are required to address infrastructure gaps, when used for this or other reasons, capital grants do affect disparities in capital endowments.<sup>14</sup> As was demonstrated earlier with equation (1), even under the most egalitarian objective of a merit good with a uniform outcome standard, it would be optimal to have different levels of infrastructure if local conditions differ. Other policy objectives would likely to require even more unequal distribution of capital assets among localities. When these policy objectives are supported with effective policy tools, including grants, then we would observe an unequal stock of infrastructure accumulated over time, which nevertheless would be optimal for the given government policy objective.

In particular, unequal infrastructure allocation can be optimally pursued with capital grants under the following two kinds of circumstances,: 1) because of the existence/compensation for spillover of benefits from capital infrastructure across jurisdictions and 2) due to delegation of the construction of national infrastructure projects to the localities where this infrastructure would be located. In fact, these two justifications are related because a spillover of benefits occurs when a local government undertakes a capital project which actually should be undertaken by a higher-level government whose jurisdiction encompasses the entire area where the project benefits accrue. In practice, the spillover of externalities is inevitable due to less than perfect correspondence between the varying benefit areas of the numerous types of

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<sup>13</sup> The potential capital income is quite real as exemplified by the fact that the fortunate half of Macedonia's municipalities that inherited high schools buildings finance two thirds of non-labor costs in secondary education through facility-generated income, such as renting out school gyms for fitness classes (Feruglio et al., 2008).

<sup>14</sup> In addition to the intrinsic inequity in the conceptual nature of some conditional grants discussed in this subsection, lopsided levels of capital stock can result from peculiar administrative arrangements, where, for example, a disproportionate share of capital grants flows to subnational governments with better grantmanship skills or ability to come up with matching resources.

public infrastructure and a limited number of scales of local government to assign them to. As Hulten and Schwab (1997, p. 141) again put it: "...if each of these goods offers benefits to different subsets of the population, then logically we would need hundreds of overlapping levels of governments."

The externality justification for capital grants is exemplified by the construction of interstate highway system in the U. S., which is federally planned and financed but implemented by the state governments. These special cases call for earmarking of national financing not for general capital purposes but for specific capital projects that produce those externalities. Indeed, the central government would not want local officials to reprioritize these funds based on local needs, which by definition would disregard the spillovers of benefits. Thus, there is clearly a normative justification for project-based earmarking of capital grants in the case of externalities.<sup>15</sup>

The presence of these spillovers calls for intergovernmental financing in providing such infrastructure. However, under certain guidelines the administration of these infrastructure projects can be delegated to local authorities in order to achieve efficiency gains from utilizing their superior knowledge of local conditions. However, when the spillover of benefits occurs, conceptually it requires intergovernmental financing of both construction and maintenance of such assets. Following the logic in Hulten and Schwab (1997) cited earlier, "spillovers are generated by the flow of services from the stock of public capital," which is determined both by new investments and by preserving existing assets in the serviceable form. Therefore, conceptually, the spillover of benefits can justify earmarking of grants to infrastructure, which should include both the construction and maintenance costs.<sup>16</sup>

Crucially for our topic of equity, if the extent of spillovers varies across localities, then the matching rates of the Pigouvian subsidies should be inversely related to local costs and directly related to the extent of the benefit spillovers. The intuition is to signal the recipient

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<sup>15</sup> A normative case for a formula-based funding earmarked for the general purpose of capital expenditures would stem from the central government role in economic stabilization. In this case, the central government would want these funds to be used for absorbing unemployed labor in public works while allowing local governments to identify projects according to local infrastructure needs. For example, to recover from the economic recession of the early 1990s, the Canadian federal government was contributing one third of the total cost of local infrastructure projects broadly defined. The money was allocated among provinces on the basis of population and the rate of unemployment.

<sup>16</sup> Similarly, earlier we argued that maintenance outlays cannot be conceptually separated from amortization of the capital assets as, by being close substitutes, one determines the other.

government that these benefits can be produced more cheaply elsewhere and, given the reciprocal externalities, also enjoyed by the less cost-effective jurisdiction through the spillover of benefits from the more cost-efficient jurisdiction. This will further discourage the less cost-efficient local government from providing this service as, in addition to having higher per unit costs, it will also receive a lower per unit subsidy. For example if it costs less to achieve one ton reduction in carbon dioxide emissions by upgrading local utilities in one jurisdiction than in the other, not only will the second jurisdiction have higher costs per one ton reduction, they will also receive less in national subsidies per ton in the reduction of emissions. This will steer the second jurisdiction to use its resources for some more cost effective expenditures while the national emissions reduction quota can be achieved where it is more cost effective. To the extent that there is a local impact from carbon dioxide emissions, the high-cost local government might still spend some of its own resources on emission reduction.

In practice, the estimation of the extent of externalities is not a trivial matter. For example, no evidence of quantitatively important spillovers from state highways on private output is found at the regional level in the United States (Holtz-Eakin and Schwartz, 1995). Furthermore, Boarnet (1998) finds evidence of negative spillovers in California as changes in county output are negatively associated with changes in street-and-highway capital infrastructure in other counties, while being positively associated with changes in street-and-highway capital within the same county.

By contrast, Pereira and Roca-Sagales (2003) find that the aggregate effects on private output from public capital built in each Spanish region are due in almost equal parts to direct and spillover effects. Cantos et al. (2005) also find very substantial spillover effects on regional growth associated with the capital stock of transport infrastructures in Spanish regions. In addition to belonging to different countries and different types of infrastructure, the difference in results could be also due to capturing dynamic feedbacks in the VAR approach used by Pereira and Roca-Sagales, (2003) unlike in the production function approach used by Holtz-Eakin and Schwartz (1995) and Boarnet (1998).

In addition, given that external benefits of local infrastructure are spread over time, just like its direct benefits to local residents, the costs of subsidizing these external benefits should be spread across the generations of national taxpayers accordingly (to achieve inter-generational efficiency in the spirit of the Golden Rule). However, it would be more practical to provide a

one-time subsidy for the construction of these assets to avoid administrative costs of continuing subsidizing these external benefits as they occur in the future. Under accrual accounting, this upfront subsidy can be amortized in the national budget over the years. In general, capital grants subsidizing construction of local assets can be used as a practical way of subsidizing future services produced with these assets on the basis of externalities or national policy objectives (Varley, 2001). However, this will not completely eliminate the costs of future surveillance that would be necessary to make sure that these assets are used as intended; for example ensuring that social housing is allocated by local authorities according to the criteria envisioned by the national government. To make these national conditions enforceable, it could be more practical to provide national funding as a loan that will have to be paid back if local governments do not adhere to the conditions in the future.

The discussion in the above paragraphs on how spillover effects and other government policies can justify the earmarking of capital grants illustrates the very significant point that disparities in the stock of infrastructure are to be accepted within a wider scope of equity. That is, it is not inequitable for two subnational governments to have different levels of capital infrastructure if for example these jurisdictions have different local costs and generate different levels of benefit spillovers.

### **III. How are capital disparities addressed in practice?: Three country cases**

The normative considerations above suggest that, if a government pursues fiscal equity, it has to address disparity in the needs for capital infrastructure. It can also account for differences in the endowment of capital assets in the computation of revenue capacity and expenditure needs. When a government pursues policies other than fiscal equity, such as compensation for externalities, then the flow of intergovernmental grants does not have to be directed at asset-poor regions. In this section we examine several country cases to look for evidence of inter-regional disparities in public infrastructure endowment and how they link to actual practice of intergovernmental grants. In particular, we focus on the experiences of Peru, Russia and Spain to see how well they are aligned with the normative prescriptions. While the choice of the countries is determined by data availability and thus somewhat ad hoc, it is well suited for our research question. On the one hand, by representing different groups of countries (OECD member, middle-income commodity and energy exporter, middle-income raw mineral exporter) the

selection of countries makes our finding somewhat more general. On the other hand, these countries have some common issue in their intergovernmental policy set up and that is historic and economic differences between regions within those countries. Furthermore, we can build on previous comparative studies of these countries, for example Jarocinska (2006) juxtaposing Russia and Spain.

For each of the three countries, we examine the grant elasticity with respect to regional service needs, service costs, revenue base and infrastructure endowments. This is motivated by our discussion above on normative issues, which suggests that grants should take into account disparities in infrastructure needs and in some circumstances also disparities in infrastructure endowments. Given the complementary between capital and operational inputs, which is present in all forms of CES production technology with finite elasticity of factor substitution, infrastructure needs are modeled with the same indicators of service needs (school-age population, sickness rate, etc..) as those traditionally used in the case of the recurrent (equalization and other) grants. For example for Cobb-Douglas technology, the impact of population size  $N$  and service load factors  $Z$  affects operational expenditure needs (OE) in exactly the same functional form as for capital expenditure needs captured in equation 2:

$$OE^* = P_O^{1-\beta} \left( \frac{1-\beta}{\beta} P_K \right)^\beta a^{\frac{1}{\tau}} (bSN^\alpha Z^\varphi)^{\frac{1}{\gamma\tau}}. \quad (3)$$

where

$a$  and  $b$  are constant parameters;

$\tau$  captures returns to scale in production (increasing when  $\tau > 1$ )

$\beta$  represents the cost share of capital;

$P_K$  is the cost of capital inputs;

$P_O$  is the cost of non-capital (operational) inputs;

$\gamma$  is the elasticity capturing differences between technical economies of scale and economies of quality scale;

$\alpha$  and  $\varphi$  are elasticities measuring the impact of population size  $N$  and service load factors  $Z$  (e.g. proportion of disadvantage students) on the service outcome.

The only difference between equations (2) and (3) is the impact of factor prices  $P_K$  and  $P_O$ .

In fact, traditionally the fiscal equalization literature has been focusing on total expenditure needs, inclusive of both capital and operational inputs.<sup>17</sup> Thus, for any form of the CES production technology, the total expenditure needs (TE) are affected by population size  $N$  and service load factors  $Z$  in exactly the same way as the needs for operational or capital expenditures individually:

$$TE^* = c(P_K, P_O) a^{\frac{1}{\tau}} (bSN^\alpha Z^\varphi)^{\frac{1}{\tau}}. \quad (4)$$

where  $c(P_K, P_O)$  is the unit cost function determined by the overall price level and the relative factor prices. Thus, for an efficient system of grants, we should expect the same service needs elasticity for capital grants as for general purpose grants or the sum of capital and operational grants.

Our estimates of the impact of grants on capital expenditures should further shed some light on the effectiveness of transfers in closing capital gaps.

The incidence of grants and public investments is modeled with cross-sectional and panel-data regressions, while controlling for other covariates. In the appendix, we provide the complete list of explanatory variables that we considered in our regressions along with their definitions and sources of data.

We use two alternative empirical strategies: the between estimation explores the incidence of grants and public investments in a cross-region analysis while the within estimation analyzes changes over time. Conceptually we cannot favor one specification over the other. On the one hand, the within estimation procedure discards information on cross-region variation by region-demeaning (differencing from the region average over time) all variables. On the other hand, without demeaning, we cannot control for some unobservable factors specific to each region. If these factors are correlated with some of the included regressors, then we are likely to obtain biased estimates using the between estimator.<sup>18</sup>

Another econometric issue is a possible bias from the endogeneity of transfers. Indeed, regions with lower propensity to invest in public infrastructure, might receive more grants. The

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<sup>17</sup> Thus, the Representative Expenditure System (RES) proposed for the United States by Robert Rafuse, then Deputy Assistant Secretary of the Treasury for Intergovernmental Fiscal Relations, utilized the estimation of a translog cost function performed by Ladd and Yinger (1989) for a sample 86 largest cities.

<sup>18</sup> We do not use the random effects model because the Hausman test rejects the absence of systematic differences from the fixed-effects model. While in the absence of consistency problems, the random effects model is expected to provide more accurate statistical inferences, in our cases it results in inconsistent estimates, which cannot be relied on.



best response to this problem is a set of valid instruments – that is, variables that affect regional outcomes only through their effect on grants. Unfortunately, it is hard to identify variables that would be good instruments for grant allocations. It is our hope that this potential endogeneity is partially mitigated in our panel data by including fixed region effects.

### The Case of Russia

The Russian Federation has a population of 142 million, out of which 73 percent reside in urban areas. Before the recent wave of regional amalgamations, the Federation was comprised of 89 subjects: ethnic republics, *krais*, *okrugs*, *oblasts*, and autonomous areas – hereafter referred to as “regions.” Below the regional level, there are two levels of local government (before 2006 many regions had only one sub-regional tier).

Since 1994, rates for derivation-based sharing of tax revenue between the federal government and regional governments have been uniform across regions (while varying by tax).<sup>19</sup> The implication was that all regions, be they rich or poor, from that year on had to be treated the same when it comes to revenue sharing at source. Therefore, the attainment of more predictable and transparent revenue assignments brought about potentially larger fiscal disparities in the country. The federal government had to rely on a new system of equalization grants to offset the potential increase in disparities in the distribution of fiscal resources.<sup>20</sup> In addition, the federal government maintained an ad hoc mechanism of “mutual settlements,”

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<sup>19</sup> Whereas revenue-sharing arrangements had been relatively stable from 1994 through 1997, several substantial changes were made in revenue-sharing arrangements before and after the economic crisis of August 1998 in the direction of recentralizing tax revenues. Changes in the assignment of revenues, especially periodic centralization of the share of PIT collections, reflected a tug of war over resources between the federal and regional governments. In the 2000s, fiscal policy reforms were aimed at reassigning tax revenues away from subnational governments and toward the federal government. Thus, the reassignment of the VAT to the central government most significantly contributed to the centralization of public-sector resources since 2000. The federal government’s share in overall tax collections reached 60 percent by 2001 from a low of 42.5 percent in 1997. In 2002, it further increased to 65.1 percent as a result of the reform in the taxation of mineral resources, in which revenue sharing in these taxes was eliminated for local governments and reduced for regional governments. The centralizing impact of this latter reform became even more pronounced in the environment of higher oil prices after 2004.

<sup>20</sup> Apparently, unification of sharing rates across regions was associated with reduced between-region variation in per-capita pre-transfer revenues. At the same time, the variation in per-capita expenditures increased. We can attribute this evidence to greater bargaining power of wealthier regions with respect to differentiated sharing rates. When the sharing rates were standardized, this bargaining power appears to have been redirected toward the distribution of intergovernmental grants.

which were mostly non-explicitly budgeted transfers granted to some regions during the process of budget execution.<sup>21</sup>

The total amount of federal transfers to Russia's regions is distributed under four major categories: equalization grants, subventions, subsidies, and mutual settlements. The most dominant federal-regional grant modality is the equalization grant (the Federal Fund for the Financial Support of the Regions). The size of the federal equalization grant pool is set prior to the beginning of the fiscal year in the annual federal budget law. Although the shares of individual regions in the equalization fund are drafted based on the need/capacity formula, the legislated amounts may end up considerably different as a result of political bargaining in Parliament, in particular over specific weights to be used in the formula.<sup>22</sup>

Moreover, actual shares of regions in the equalization fund may differ from the legislated ones if the total size of the fund falls below the planned amount, and the Ministry of Finance adjusts the planned allocation unevenly across regions. The share of equalization grants in total federal transfers increased from 50 percent in 1995 to 70 percent in 2000, dropped again under 50 percent by 2005 due to earmarked funding for federal mandates, and more recently slipped under 30 percent after having been diluted with federal stimulus funds. In 1995, the other half of grants was comprised of “mutual settlements,” which were typically not budgeted ex ante, but rather result ex post from emergency situations and political lobbying. The relative decline of mutual settlements over time is an indication of improvements in the objectivity, stability, and predictability of the federal-regional transfer system. In addition, regional governments have been provided with intergovernmental loans for liquidity purposes. These loans can be considered additional grants because they are often rescheduled and eventually offset or written off.

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<sup>21</sup> The size of the equalization pool was initially set at 15% of the federal government's internal revenue. However, the fixed percentage was reduced to 13 percent by 1999 and eventually fixed as the previous year nominal amount annually adjusted for inflation.

<sup>22</sup> The transfer formula undergoes some changes every year. Thus, for the 2005 transfers, the Index of Budget Expenditures was computed for the composite subnational expenditures rather than 15 separate expenditure categories as in previous years. However, the set of factors used in the formula is quite stable and traditionally has included variables accounting for differences in wage costs, price level, utility costs, accessibility of the region's localities by transport, and demographic composition of the population.

Since 2001, equalization grants, which are unconditional, have been complemented with earmarked transfers to reimburse subnational governments for the two major federal mandates: payment of monthly child benefits and subsidies for payment on various goods and services by persons with disabilities. These earmarked grants work as partial replacement of the pre-2000 equalization funds, as the latter used to account for the mandates' burden in the assessment of regions' need. At the same time as these two large conditional grant programs were introduced, the regional derivation-based share of VAT collections was entirely centralized to the federal budget for subsequent redistribution across regions via the earmarked grants.

In Russia, less than ten percent of the amount of federal grants to regions is earmarked for capital investments.<sup>23</sup> This is below the average for the upper-middle income group, where the share of capital grants has reached 20 percent over the last two decades. As we mentioned earlier, in transition countries capital grants have played a smaller role in the financing of local infrastructure than general purpose revenues of subnational governments, from own and intergovernmental sources. This often resulted from the ad hoc delineation of responsibilities and resources during the first years of transition. Because central governments were sensitive to political costs of wage arrears in schools and hospitals, they wanted local authorities to pay salaries first under the pretext that resources for capital expenses would be coming separately. Such designation of operational expenses as core ("protected") items is believed to have caused underinvestment in some of those countries.

### Estimation Results

Pairwise correlations suggest that wealthier regions in Russia tend to have more hospital beds, lower road density (due to vast areas of oil-reach regions), and no relationship to the bus fleet size. In multivariate regressions, we try to parse out these relationships by controlling for land area and other covariates.

First, we report the estimates of grant elasticity with respect to subnational service needs, service costs, revenue base and infrastructure endowments.<sup>24</sup> In the first column of Table 1 we

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<sup>23</sup> And even that small amount of capital grants is not explicitly classified as such in reporting of regional budget revenues. Thus precludes us from analyzing the incidence of capital grants in Russia.

<sup>24</sup> In all three country cases, our unit of analysis is a consolidated region, which is the sum of the regional budget and budgets of all constituent local governments.

report the results of the “between estimation,” based on the time averages of the longitudinal observations for different regions. All monetary variables are normalized by the GDP deflator and by regional population. The included variables jointly explain about three fourths of cross-region variation in per capita grants.

In the last t column of Table 1 we report the results of the fixed effects estimation based on the deviation from time averages for different regions. The included variables jointly explain only 16 percent of the within variation in per capita grants.<sup>25</sup>

From the between estimation, one can see that on average more grants are flowing to regions with lower revenue base (measured by Gross regional Product, GRP), higher service needs (measured by population of non-working age) and higher costs (measured with the regional subsistence level and land area). However, the grants do not seem to address disparities in transport infrastructure and in fact appear to counter-equalize disparities in social infrastructure, measured by hospital beds per person. Comparisons over time by means of the fixed effects estimation still show positive relationship to growing service needs captured with demographic changes. However, now we have a positive and weakly statically significant relationship between grants and road density. This might reflect a reverse causality capturing more roads in regions that saw a larger increase in grants. Another plausible explanation is that more grants are given for road maintenance and rehabilitation. At the same time, the inter-temporal relationship between grants and hospital beds appears to be negative. As the negative sign rules out reverse causality, the only explanation that comes to mind is the denominator effect: with increasing population size, the per capita stock of existing infrastructure goes down at the same time larger grants are flowing in to address the growing need. This is also corroborated by the evidence that regions with a drop in infant mortality saw an increase in grants.

Tables 2 and 3 show the determinants of public investments (regardless of the ownership of assets, public or private), and acquisition of public assets (regardless of the source of financing, public or private). Both tables suggest more investments in regions with higher more revenue, either from own base or grants, better outcomes, and a smaller population of elderly. There appears to be a positive relationship between investments and road density.

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<sup>25</sup> This approach should than While the random effects model could yield potentially more efficient estimates, in our case it is not consistent according to the Hausman test.

Thus, overall we can conclude that in the case of Russia grants and transfers are only partially designed to address regional differences in the endowments of capital infrastructure. They do however take mitigate disparities in revenues base and service needs and costs, which can potentially bridge expenditure needs in terms of both recurrent and capital inputs.

**Table 1. Determinants of intergovernmental grants**

	Between Estimation	Fixed region effects
Road density	0.1405 (0.1778)	0.2358 (0.1869)
Buses per 10,000 population	-0.0817 (0.1274)	-0.0222 (0.0708)
Hospital beds, per 10,000 population	1.0597*** (0.3801)	-1.1091* (0.5632)
First time diagnosis, per 1000 population	0.0809 (0.3329)	-0.1309 (0.3698)
Infant mortality rate	-0.0461 (0.3656)	-0.2548** (0.1258)
Population below working age, share	-0.0585 (1.0954)	1.4485** (0.7095)
Population over working age, share	-1.2443 (0.7700)	2.7413*** (0.8759)
Land area per capita	0.2648* (0.1396)	0.2174 (1.7728)
Real subsistence level	1.3772** (0.5577)	0.0576 (0.2547)
Real GRP, per capita	-1.1953*** (0.1996)	0.6948*** (0.2200)
Constant	-6.5467 (8.7454)	-8.1883* (4.4312)
N [regions]	498 [76]	498 [76]
R <sup>2</sup>	0.76	0.16

<b>Table 2. Determinants of public investments</b>		
	Between Estimation	Fixed region effects
Road density	0.2205 (0.1367)	0.3052* (0.1771)
buses per 10,000 population	0.0415 (0.0977)	-0.0284 (0.0965)
Hospital beds, per 10,000 population	-0.1589 (0.3073)	-0.0640 (0.7108)
First time diagnosis, per 1000 population	-0.5842** (0.2547)	0.3897 (0.4286)
Infant mortality rate	-0.6146** (0.2796)	-0.4119*** (0.1388)
Population below working age, share	0.0129 (0.8364)	-2.4491*** (0.9096)
Population over working age, share	-1.1868 (0.5962)	-0.8059 (2.1430)
Land area per capita	0.0307 (0.1096)	0.9481 (2.3908)
Real subsistence level	-0.0886 (0.4504)	1.0752*** (0.3008)
Real GRP, per capita	0.8138*** (0.1893)	0.5801*** (0.2027)
Real transfers, per capita	0.4584*** (0.0949)	0.1559** (0.0762)
Constant	11.0220 (6.7173)	4.7798 (7.4090)
N [regions]	497 [76]	497 [76]
R <sup>2</sup>	0.68	0.45

**Table 3. Determinants of acquisition of public assets**

	Between Estimation	Fixed region effects
Road density	0.3935** (0.1424)	0.1266 (0.1435)
buses per 10,000 population	0.0373 (0.1016)	0.0320 (0.0575)
Hospital beds, per 10,000 population	-0.2187 (0.3242)	0.1356 (0.5351)
First time diagnosis, per 1000 population	-0.5173* (0.2654)	-0.1001 (0.3497)
Infant mortality rate	-0.0663 (0.2966)	-0.2485** (0.0950)
Population below working age, share	0.0554 (0.8946)	-0.5130 (0.7220)
Population over working age, share	-0.2807 (0.6432)	-0.2677 (1.1849)
Land area per capita	0.2810** (0.1143)	2.9229 (2.2206)
Real subsistence level	0.8690* (0.4566)	0.6646*** (0.2445)
Real GRP, per capita	0.9045*** (0.1998)	0.8497*** (0.1917)
Real transfers, per capita	0.2414** (0.0987)	0.0927** (0.0479)
Constant	0.2281 (7.1536)	7.8798 (6.6962)
N [regions]	491 [76]	491 [76]
R <sup>2</sup>	0.70	0.38

## The Case of Spain

Spain has three subnational tiers of governments: 17 regions (called “autonomous communities”), 50 provinces and 8,000 municipalities.<sup>26</sup> While being a unitary and centralized state before adoption of the 1978 Constitution, over the last three decades the country has undergone deep transformations in terms of the role and organization of subnational governments. Currently, Spain is a highly decentralized country, having devolved a large share of public services to the seventeen autonomous communities (AC) (or *Comunidades Autónomas* in Spanish). Although constitutionally Spain remains a unitary country, its system of intergovernmental fiscal relations has many features of a federal system.<sup>27</sup> These ACs have their own regional parliaments and executive bodies and enjoy considerable budgetary discretion in expenditure decisions and their own financing. The ACs play a limited liaison role between the central and local levels, but in large the municipalities are fiscally disengaged from the ACs and receive direct transfers from the central government. In 2010, only 30 percent of transfers to municipalities came from regional budgets. Among these regions (autonomous communities), 15 have common intergovernmental fiscal arrangement and two (Basque Country and Navarre) are ruled by special laws. The two special charter regions are not receiving transfers from the central governments but instead collect most of national taxes in their territories and then transfer an agreed fraction (the annual quota or “cupo” in Spanish) to the central government at the end of each fiscal year.

Over the last 30 years, Spain has decentralized many aspects of the formerly centralized public administration system to the 17 ACs. Regional governments account for 8 percent of public investments but for 31 percent of public spending excluding pensions (Sole-Olle 2010). Sub-regional governments account for 27 percent of public investments but for only 18 percent of public spending excluding pensions.<sup>28</sup> Capital grants account for 30 percent of local government investments. The national government accounts for 57 percent of recurrent grants to sub-regional governments but only for 12 percent of capital grants. By contrast regional governments account for 26 percent of recurrent grants to sub-regional governments but for 52

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<sup>26</sup> The provinces and municipalities are often grouped as a single—the local—tier. The role of the provinces is quite limited mostly to support or provide basic services in small municipalities lacking capacity and to the coordination of certain services across municipalities.

<sup>27</sup> For a review of the institutional framework, see Lopez Laborda, Martinez-Vazquez and Monasterio (2007).

<sup>28</sup> However, according to the GFS data, subnational governments accounted for about 70 percent of public acquisitions of fixed assets, which about the OECD average.



percent of capital grants. While most of recurrent grants from the central governments are not earmarked, most of recurrent grants from regions are earmarked. All in all, about one fifth of grants received by sub-regional governments were earmarked for capital use, in fact specific capital projects. Thus in Spain capital earmarking is higher than the OECD average (13%) but close to the sample average including non-OECD countries.

After the 1978 decentralization reform, the central government established a system of grants that provide funding for education, health, and transport. In addition, Inter-Territorial Compensation Funds (ICF hereafter) were established to achieve greater financial equity between wealthy and impoverished regions. Over these years the system of grants was reformed several times (1991, 1997, 2001, 2009). With the most recent reform of 2009, the former Sufficiency Fund—a revenue sharing pool that had been allocated to the ACs since the mid-eighties—was replaced with two new main Funds, with the objectives of closing the vertical gap and regional horizontal imbalances. The first of the two funds, the Essential Public Services Fund (EPSF) is aimed at closing horizontal disparities by essentially redistributing resources from regions with above-average (adjusted) fiscal capacity per capita to those regions with a fiscal capacity below the average. The second large fund, the Global Sufficiency Fund (GSF) closes the remaining regional vertical gaps, measured as the difference between expenditure needs,<sup>29</sup> and the sum of aggregate regional fiscal capacity and the received EPSF funds.<sup>30</sup>

Although the general purpose grants from the two funds can be (and have always been) used to finance capital expenditure, their allocation does not take into account differences in the costs of construction and financing of fixed assets. Besides the general purpose grants, regional capital expenditures are also financed with revenues coming from a number of other sources: the Inter-territorial Compensation Fund, funds coming from the European Union (EU), other matching capital transfers that finance part of bilaterally (center-region) agreed investment projects, and regional borrowing (subject to the strong restrictions that apply under the current legislation on budget stability based on the EU Maastricht Treaty). The first two instruments,

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<sup>29</sup> Expenditure needs are measured as the regional share in population (with a weight of 30%), the size of the jurisdiction (1.8%), scattered population (0.6%), insularity (0.6%), equivalent (adjusted per age) population covered by the National Health System (38%), population over 65 (8.5%) and population below 16 (20.5%).

<sup>30</sup> The new system introduced in January 2009 is analyzed in De la Fuente (2009), Ruiz-Huerta and García (2010), and Lago Peñas and Martínez-Vázquez (2011).

ICF and EU funds, only apply to ACs with a per capita income below 75% of the European average.

Pairwise correlations suggest that wealthier regions tend to have more hospital beds and higher density of roads and highways. Similar to the Russia case, we employ multivariate regressions to parse out these relationships by controlling for other covariates. However, given the smaller number of regions, we are restricted in degrees of freedom available to analyze the between-region variation. All monetary variables are normalized by the GDP deflator and by regional population.

First, we report the estimates of elasticity of recurrent grants with respect to regional service needs, service costs, revenue base and infrastructure endowments, paralleling the case of Russia. In the first column of Table 6 we report the results of the “between estimation,” based on the time averages of the longitudinal observations for different regions. The covariates jointly explain half of the between-region variation but with the exception of regional GDP, none of the individual regressors play a statistically significant role. With only 17 regions, it is easy to run out of degrees of freedom in a multivariate regression. However, the indicators of capital endowment do not have a statistically significant impact when added one at a time to the GDP regressor. Thus, we can conclude that in Spain recurrent grants do not mitigate capital disparities beyond what is captured by differences in GDP.

Similar to the Russia case, comparisons over time (2002-2008) by means of the fixed effects model also show a positive relationship to growing service needs captured with demographic changes (first column of table 7). Another similarity is a positive relationship between recurrent grants and additional highways, albeit with a weak statistical significance. Again we can explain it with either reverse causality or increased outlays on road maintenance. For the between-region incidence of capital grants, the same independent variables have much higher explanatory powers than for recurrent grants (second column of table 7). It appears that on average more capital grants are flowing to regions with lower revenue base (measured by GRP) and higher service costs (measures by land area per capita) but surprisingly lower service needs (measured by population of non-working age). However, the between estimation does not yield statistically significant relationship between the capital grants and disparities in infrastructure; not even when the latter are added one at a time. In the panel analysis we find a positive relationship of capital grants to additional highways.

Given the fungibility of funds, we also look at the incidence of the sum of capital and recurrent grants. However, the total does not seem to be any more responsive to the explanatory variables than capital and recurrent grants alone. Thus, the observed pattern (or lack of thereof) in grants incidence is not about some random splitting into capital and recurrent components.

Finally, in Table 8 we regress subnational capital expenditures on the recurrent and capital grants in addition to the same set of covariates as in tables 6 and 7. These variables explain over 70 percent of the between-region variation in per capita capital expenditures. However, no regressor is statistically significant, suggesting multicollinearity. After trying different combinations of regressors, it appears that all between-region variation in capital expenditures is driven by road density, land area, and economic product (all having a positive association). Neither recurrent or capital grants have a statistically significant impact on capital expenditures (second column of Table 8).

Across time periods, capital expenditures appear to have a statistically significant association with capital grants (positive), regional GDP (positive), land area per capita (negative), and roads (positive).

In summary, for the case of Spain, the only common determinant for both recurrent and capital grants, is regional GDP. When summed up across years, the amounts of grants, capital or recurrent, do not seem to be related to the infrastructure stock other than what is already captured by differences in regional GDP. There are some peculiar co-movements across time, for example a positive association between capital grants and highway density. Thus, overall we can conclude that in the case of Spain grants and transfers are only partially designed to address regional differences in the endowments of capital infrastructure, with the disparities in endowments are more clearly addressed in the case of capital grants. Also, as in the case of Russia, general grants and transfers do appear to mitigate disparities in revenues base and service needs and costs, which can also help address expenditure needs in terms of both recurrent and capital inputs.

**Table 4. Between-region regression of grants in Spain**

	General purpose grants	Capital Grants
	-0.0799	-0.0845
Road density	(1.6688)	(0.4936)
	0.1727	0.0309
Highway density	(0.9947)	(0.2877)
Hospital beds, per 10,000 population	1.1496 (2.1025)	0.3614 (0.6298)
Population below working age, share	0.9545 (5.8295)	-3.9258** (1.7280)
Population over working age, share	2.6022 (5.2576)	-2.6816 (1.5573)
	-0.3476	0.4935*
Land area per capita	(0.7808)	(0.2289)
Regional GDP per capita	-3.4772* (1.7087)	-2.2940*** (0.5086)
Constant	10.5664 (15.2587)	-6.4527 (4.5241)
N [regions]	118 [17]	119 [17]
R <sup>2</sup>	0.41	0.90

**Table 5. Fixed-effects regression of grants in Spain**

	General purpose grants	Capital Grants
Road density	0.4465 (0.4165)	1.2326 (1.3368)
Highway density	0.1423 (0.1149)	0.7389** (0.3171)
Hospital beds, per 10,000 population	-0.1083 (0.2463)	0.4955 (0.8152)
Population below working age, share	0.5479 (0.5825)	-1.7246 (1.9323)
Population over working age, share	1.2933* (0.6467)	2.7396 (2.5571)
Land area per capita	-0.4699 (0.5255)	2.1259 (1.3326)
Regional GDP per capita	0.3891 (0.2526)	-0.6567 (1.1257)
Constant	-2.6214 (5.3222)	-0.3471 (12.4380)
N [regions]	118 [17]	119 [17]
R <sup>2</sup>	0.19	0.16

**Table 6. Determinants of subnational investments in Spain**

	Between Estimation		Fixed region effects
	(1)	(2)	
Road density	0.5081 (0.3809)	0.4786* (0.2464)	1.5055* (0.8044)
Highway density	0.1760 (0.2270)		-0.0784 (0.1669)
Hospital beds, per 10,000 population	0.2576 (0.4895)		0.3362 (0.5494)
Population below working age, share	0.5319 (1.8589)		-0.0346 (0.4078)
Population over working age, share	-0.0262 (1.5702)		0.6150 (1.0623)
Land area per capita	0.3275 (0.2515)	0.2644** (0.1081)	-1.9982** (0.9420)
Regional GDP per capita	0.8255 (0.7112)	0.7235 (0.4180)	1.5182*** (0.4808)
Recurrent grants per capita	-0.0147 (0.0945)	-0.0028 (0.0685)	0.0151 (0.1329)
Capital grants per capita	0.2265 (0.3179)	0.1239 (0.1860)	0.1792*** (0.0393)
Constant	-4.6000 (4.4377)	-4.1400*** (1.1691)	-22.6768 (7.6953)
N [regions]	118 [17]	118 [17]	118 [17]
R <sup>2</sup>	0.73	0.69	0.47

### The Case of Peru

The territorial composition of Peru includes, at the intermediate level, 24 regions (or departments) plus the Constitutional Province of Callao; and at the local level, 1,834 municipalities, of which 195 are provincial municipalities and the rest district municipalities. All regional and local governments approve their own budgets. The dual coexistence at the same local level of provincial and district municipalities is a peculiarity of Peru's vertical government structure. Regional governments vary significantly in area size, from 370,000 to 4,657, with the median at approximately 36,000 square kilometers. With the exception of the Metropolitan

Municipality of Lima, the differences in population size are less pronounced, but nevertheless are still quite large ranging from 92 thousand to 1.6 million, with the median of 670 thousand.

Seven years after the decentralization was prompted by the deposition of President Fujimori, in 2009 subnational governments accounted for forty percent public expenditure, equally split between the regional and local tiers. At the same time subnational share in public investments increased from under 45 percent in 2001 to almost seventy percent in 2008. However, fiscal disparities pre-date the recent wave of decentralization reforms and can be traced back to the introduction of revenue sharing arrangements of rents from the exploitation of natural resources among the central government, local governments and, to a lesser extent, the intermediate level of government, the departments (“oil canon” in 1973 and “mineral canon” in 1993).<sup>31</sup> The upward spiral in the world prices of natural resources in the second half of the 2000s lead to a virtual explosion in fiscal disparities across local and regional governments. Because the canon funds are earmarked for capital infrastructure projects, this directly translates into infrastructure disparities.

The recent reform of the Regional Compensation Fund (Fondo de Compensación Regional, FONCOR) attempted to include in its formula an explicit measure of fiscal capacity thus depriving regional governments now relatively much richer because of the canon funds from receiving FONCOR funds. However, inter-regional fiscal disparities will not be resolved until similar modifications are made to the Municipal Compensation Fund (Fondo de Compensación Municipal, FONCOMUN) equalization transfers, which is the main tool to counterbalance the canon resources.

In 2009, through Ministerial Resolution No. 322-2009-EF-15, the General Directorate of Economic and Social Affairs introduced a new methodology to compute the FONCOR transfers, which should significantly improve its equalizing power. Under the new methodology, the aforementioned factors are used to compute the capital expenditure needs of each regional government, and then the net capital expenditure needs are obtained by subtracting from this amount the revenues received from canon, sobrecanon, royalties, and custom duties. Finally, the transfer is distributed proportionally among those regional governments with positive net capital expenditure needs. As a result, those governments for which the revenues from extractive

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<sup>31</sup> The canon, sobrecanon, and royalties are the major natural resource sources of transfer. We will follow the convention of abbreviating all those sources under the name of canon.

industries exceed their capital expenditure needs receive no transfers from the FONCOR, and the available resources can be concentrated exclusively on the regions where there is not enough funding for capital expenditures.

In our empirical analysis we focus on the incidence of grants after the FONCOR reform (2009-2011). Because this gives us only three longitudinal observations per region, we are only able to perform a between-region estimation by regressing on the lagged cross-section of covariates. All monetary variables are normalized by the GDP deflator and by regional population. In columns of Table 7 we report the incidence of three groups of transfers: 1) canon; 2) capital grants; and 3) all other transfers. The estimates suggest that none of the three groups of grants compensate for infrastructure gaps. In fact, non-canon grants have a positive association in the three-year period, which is statistically significant for roads. Even after the 2009 reforms, all grants are positively related to regional economic product, and this association is statistically significant for canon transfers. Non-canon grants are a positive and statistically significant association with underage population, which is a proxy for the future need of infrastructure due to population growth. Finally, canon and capital grants have a positive association with land area per capita, which is a proxy for the costs of infrastructure.



**Table 7. Between-region regression of grants in Peru**

	Canon	Capital Grants	Other grants	Total grants
Road density	0.1408 (0.3134)	0.2885*** (0.0959)	0.0432 (0.0330)	0.2112** (0.0793)
Hospital beds, per 10,000 population	-1.0335 (1.5270)	0.7131 (0.5790)	0.0524 (0.1920)	0.0284 (0.3201)
Infant mortality rate	0.7355 (1.3788)	-0.4090 (0.2692)	0.0019 (0.1326)	-0.0632 (0.2812)
Population below working age, share	3.7614 (6.6767)	4.2147* (2.0596)	2.4275*** (0.6319)	2.3511 (1.5766)
Population over working age, share	3.0369 (2.4331)	-0.8305 (0.6345)	-0.0266 (0.2372)	0.2863 (0.5409)
Land area per capita	0.3287* (0.1697)	0.1570 (0.1113)	-0.0218 (0.0757)	0.2228* (0.1109)
Regional GDP per capita	3.1201* (1.7651)	0.4763 (0.5242)	0.2730 (0.2068)	0.8978* (0.4073)
Constant	3.4365 (4.6655)	0.5553 (1.3271)	0.9679* (0.4444)	1.6875* (0.9711)
N [regions]	75 [25]	75 [25]	75 [25]	75 [25]
R <sup>2</sup>	0.36	0.49	0.40	0.41

### III. Policy Implications

This paper makes a strong case that disparities in the availability of and need for capital infrastructure matters very significantly for fiscal equity. But, as we have also remarked, the objectives pursued with all intergovernmental policies largely condition what is the appropriate treatment of infrastructure disparities. Thus, for example, emphasis on the objective of fiscal equity in service provision here and now can lead to capital transfers policies that are different from those needed to address longer term regional disparities in economic development. In this sense, an equitable distribution of infrastructure at the subnational level needs to be interpreted in the light of other government policy objectives, which no doubt have separate independent results in the spatial distribution of the stock of infrastructure.

At the same time, we have argued that the proper framing of infrastructure and fiscal equity should be in terms of the incidence of outputs and outcomes of public services produced with this infrastructure and the financing ability to get there. From that perspective, infrastructure projects alone should not be assigned any type of priority that is independent of the programs and public services that utilize these capital assets as inputs. Therefore, the question that matters from a policy viewpoint is: what is the best form of intervention? Should disparities in infrastructure be addressed in an earmarked fashion—in the line of project-based conditional capital grants still used in many countries or possibly separate capital equalization grants earmarked for capital use but not for specific projects? Or, should policymakers incorporate capital infrastructure disparities into a general-purpose equalization grant?

The answer to these questions is likely to depend on the type of infrastructure and it may also vary with country specific parameters such as the availability of credit financing, technical capacity to manage loans, and so on. As a first approximation to an answer, it can be useful to distinguish between three different types of infrastructure:

(i) infrastructure that has associated very large operation and maintenance costs, as is the case of many public schools and health centers; (ii) infrastructure, which is largely fee recoverable for the principal and also for maintenance and operation costs, such as is the case for many utilities (water, sewerage systems, incinerators); and (iii) infrastructure that is largely non fee-recoverable, with sizable maintenance costs, such as public parks, no toll roads, and so on . In the first category, given the large importance of operation and maintenance costs, and their recurrent nature, the best form of intervention to address disparities in infrastructure may be through the inclusion of these expenditure needs in the general purpose equalization grant. This is because, by removing the life-time costing of facilities from making investment decisions, capital earmarking would make the errors of omission and commission particularly grave for local finances. As sectors like education are highly labor intensive,<sup>32</sup> allowing separated capital funding decision would commit local governments to disproportionately larger life-time operational costs, which is like allowing the “tail to wag the dog.”

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<sup>32</sup> There are estimates showing that in education capital costs account for only ten percent of total costs after the costs of facilities are spread over their lifespan.

In the case of the second category, the opportunity of using fees to cover the full cost plus maintenance and operation of the facilities would call for using credit markets and borrowing to facilitate those investments and fully abstain from any form of transfers. This is because the stream of future use fee receipts can be more easily pledged as a collateral for debt financing than general tax revenues vulnerable to the uncertainties of the political climate,

In the third category, given the importance of the infrastructure construction and maintenance costs in relation to the recurrent costs in operation, the best form of intervention may be conditional grants for construction and maintenance (but not operation) of infrastructure. This is because, for example, by disallowing road maintenance, separation of construction funds will prompt local managers to defer maintenance and convert these costs into an earlier or more extensive capital rehabilitation. By contrast the costs of road operation, such as powering traffic lights or manning intersections, are minor and do not pose a threat of deferred maintenance.

A good example of this third type of grants can be found in many transitional countries in the form of road funds. Fuel excises are collected nationally for administrative expediency but redistributed—ideally based on a formula, as for example in Latvia— among localities and earmarked for local roads (both construction and maintenance). In this case, intergovernmental redistribution is normatively justified by inter-jurisdictional externalities and tax efficiency while excise-financing brings elements of benefit taxation by creating a link to local road use. In Macedonia such a local road fund (0.08% of GDP in 2010) is apportioned among municipalities based on population and land area as well as length of municipal roads and the number of registered vehicles. As a precondition, municipalities have to submit to the Road Fund administration an annual work plan for road construction and maintenance; however, the disbursement and use of these funds is not earmarked for any specific projects.

.Thus, from a normative point of view, disparities in the stock of capital infrastructure may be addressed as part of the general revenue equalization, through credit enhancement, and, in some cases through earmarked capital grants depending on the type of infrastructure. In addition, the exact form of policy intervention will depend also on the relative importance of competing policy objectives, and it is logical to expect that those objectives will differ from country to country. In particular, intergovernmental grants can pursue a broad range of objectives:

- Improving the vertical fiscal balance of the system of intergovernmental relations;
- Funding national priorities or “merit goods;”
- Compensating for the presence of spillovers or “externalities” between jurisdictions in the provision of local public services;
- Improving the horizontal fiscal balance between local governments (in other words, equalization);
- Creating a level-playing field for evaluating performance of appointed heads of deconcentrated government units;
- Promoting a positive change in some aspects of the performance of local governments (i.e. performance-based grants).

Canavire-Bacarreza et al. (2013) summarize the existing normative guidance and policy wisdom on the design approaches that are most suitable for each of the aforementioned objectives of a grant system. A key point of this discussion is that grants pursuing different objectives might require different designs of the allocation mechanism including measures of capital expenditure needs. Even in the case of the merit good objective aiming at a uniform level of service outcome, we need to be reminded that the optimal level of capital inputs will vary depending on local costs and other local conditions, and that in the case of spillover of benefits, the optimal level of infrastructure is more likely to be unequal than not. Table 8 summarizes the normative implications of capital disparities for various policy objectives.

**Table 8. How policy objectives shape the form of addressing subnational disparities in infrastructure**

Objective	Revenue sharing/Adequacy	“Merit goods” /solidarity	Efficiency-enhancing equalization	Spillovers or “externalities”
Grant design choice				
General purpose vs. capital grants	Infrastructure needs taken into account in determining the pool of general purpose grants; capital earmarking under the centralization of borrowing capacity	Earmarked for the merit goods	Capital inputs taken into account in the determination of local expenditure needs (top-down)	Earmarked for the externality-generating activities
Global vs. sector-earmarked	Global	Sector-earmarked	Global use but in determination of expenditure needs there is a trade-off between formula simplicity (perception of fairness) and accuracy of capturing disparities	project-earmarked
Needs-based adjustment	Need for economic infrastructure can be addressed through differentiated retention rates since local economic infrastructure produces vertical externalities by increasing the yield of national/shared taxes in the locality	Differences in the proportion of population groups entitled to merit goods	Differences in the proportion of population groups entitled to capital-intensive local services; in case of inequitable distribution of existing infrastructure, imputed net capital income is subtracted from expenditure needs	Only needs of the neighboring jurisdictions
Cost-based adjustment	Only proportional to the extent of vertical fiscal externalities. As with other Pigouvian grants, the optimal matching rate can be inversely related to the local cost level.	Full funding of capital needs which are optimal given local capital costs;	Only if local services are not fully congestible (not fully private);	Inverse relation to the costs
Means- based adjustment	None	Subtracting of revenue capacity is equivalent to a matching rate: $EN-RC=EN*(1-RC/EN)$ . Thus, no need for means-testing if revenue capacity is equalized with the general purpose grant. If capital disparities are of higher concern for equity, than means-testing for investments can bring out	Only for source-based taxes and local rents; for residence-based taxes, grants should equalize potential earning (human capital) but not actual taxable income	Pigouvian subsidies should be derived from compensated demand functions, thus accounting for income

		extra equalization.		
Asset- based adjustment	None	No need for asset-based adjustment if net capital income is equalized with the general purpose grants	Net capital income is equalized away like any other source of local rent	None

Source: Canavire-Bacarreza et al. (2013), further modified by the authors

This summary of normative guidance provides no room for earmarking grants for capital use other than under centralized borrowing and onlending/ongranting to municipalities. This is not surprising as capital earmarking is inherently against all principles of modern public finance as allocation of funds by economic item (i.e., investment) shifts the focus of budgeting away from prioritizing policy goals to merely funding inputs. However, as we mentioned earlier, the inefficiencies of capital earmarking (deferred maintenance, lack of life-time costing, etc) might be overridden by non-economic reasons, such as moral hazard, liquidity constraints, etc. As these non-economic rationales are not specific to the issue of equity—on the contrary, we show that equity considerations equally apply to capital and non-capital inputs— we do not explore it any further in this paper.

Most of this normative guidance was developed with models featuring social infrastructure, that is infrastructure serving as capital inputs to the production of public services. For public inputs to the production of private goods (i.e. economic infrastructure) the working of the model is not the same.<sup>33</sup> Thus, while better social infrastructure translates in lower wages (workers accepting lower wages in order to have access to better local amenities), economic infrastructure is likely to increase wages due to higher productivity. However, the normative guidance for equalization remains the same: we should not equalize higher wages and higher capital returns stemming from better infrastructure but not only the differences capitalized as the rent on local immobile factors. While not being easy to implement in practice, the theory calls for compensating for differences in the composition of residents in in terms of their income-earning abilities, but not the differences in their actual income, as for example determined by local income-generating opportunities.

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<sup>33</sup> In fiscal federalism literature, economic infrastructure was mostly studied from the positive perspective as a strategic tool for local governments to attract mobile capital, with the causal links similar to those in tax competition (Keen and Marchand, 1997). In this literature, the role of equalization is preventing overinvestment (“arms race” analogous to the “race to the bottom” in tax competition) by redistributing some of the gains in this zero-sum game.

The normative bases provided in the above discussion would seem to justify a rather sparse use of capital transfers within the desired architecture of intergovernmental fiscal relations. Furthermore, normative considerations suggest that the allocation of capital grants should be determined by the same indicators of service need as those driving the allocation of general-purpose grants (e.g. demographics). The only difference in the allocation of capital grants should be due to relative costs of capital and the level of infrastructure stock. However, in reality many countries regularly implement capital transfer programs, in many cases quite considerable in size by comparison to other transfers, which do not always conform to the normative prescriptions, as illustrated by our three country cases (see Box 2).

### **Box 2**

#### **International Cases and Best Practice in the Design of Capital Transfers**

International experience with the design of capital transfers shows that a large variety of approaches are used. Most countries use some form of capital transfers in support of subnational governments for specific sectoral expenditure areas such as roads, water and sewerage treatment plants, transportation, housing, education, health, and so on. Regarding the mechanism used to allocate capital transfers, country experiences vary from ad hoc allocation decisions to formalized approaches using pre-established formulae. Similarly, country experiences vary in flexibility from the least flexible “project-based grants” to unconstrained funds provided as part of a general revenue transfer. Often the amount of capital grants has to be matched with locally raised resources and the matching rate is sometimes inversely related to the local income (e.g. Finland)

The lack of information and the variety of approaches observed make it particularly difficult to generalize and extract lessons useful for just any country trying to establish or reform a system of capital transfers. At the risk of oversimplification, one can say that the typical country has a variety of capital transfers which are closed-funded in the national budget, have earmarked funds within specific capital expenditure categories, require some level of matching funds from subnational governments, and whose funds are allocated either by an objective formula or on a specific project basis. The variety of specific details in the design of capital transfers is a reflection of the many institutional features associated with capital transfers and the multitude of objectives that may be pursued by governments in this area. The range of objectives for capital transfers include: closing disparities in local infrastructure stocks, subsidizing capital projects with cross-jurisdictional spillovers of benefits, addressing vertical imbalance in the assignment of revenue sources, addressing lack of credit availability, and others.

*Source:* Martinez-Vazquez (2000)..

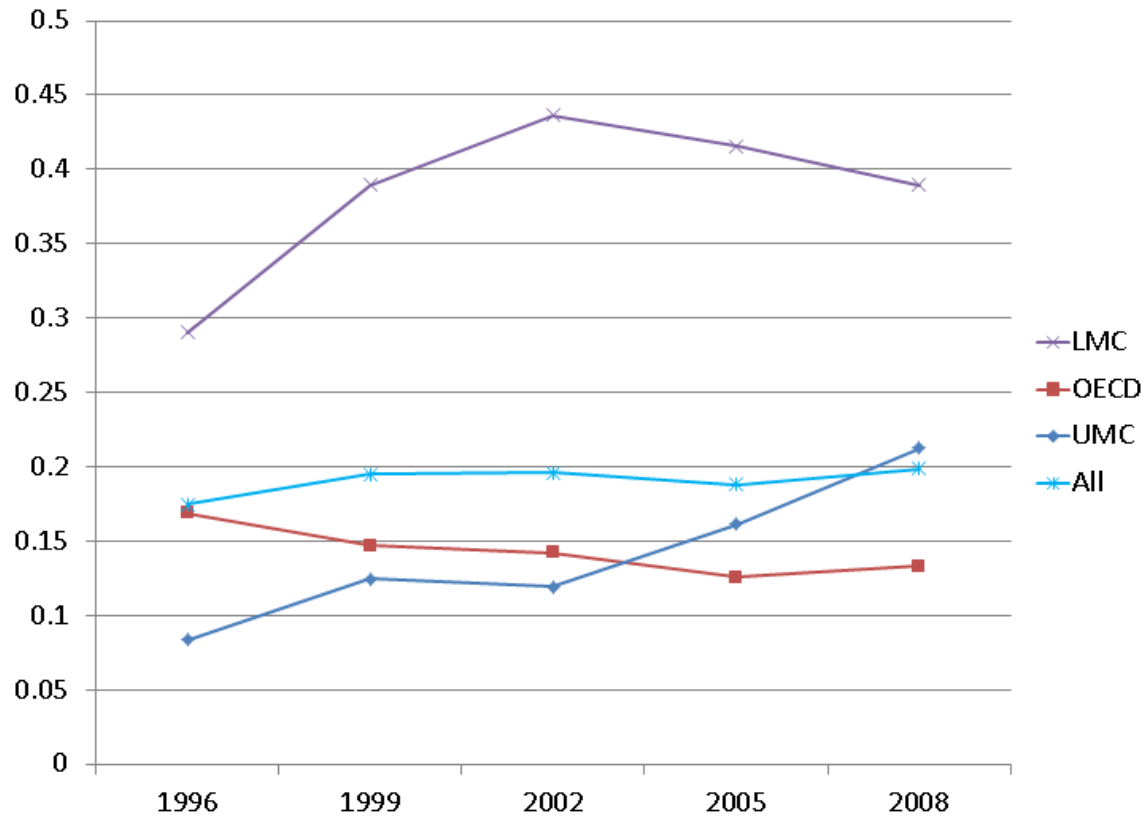


How does this actual practice fit into the theoretical normative framework and policy recommendations we have described? According to the IMF GFS data, on average, twenty percent of intergovernmental grants in the sample are earmarked for capital use (Figure 3). This earmarked share is the lowest in OECD countries (13 percent) and the highest in upper-middle income countries (40 percent). From juxtaposing Figures 1 and 3, it is interesting to note that OECD countries are the most decentralized in terms of the subnational share of capital expenditures but at the same time they use the least earmarking of intergovernmental grants for capital use. Similarly, a qualitative survey of governments revealed that three in five developed countries earmark transfers for capital use as opposed to four in five transitional countries; this latter can be explained by the legacy of central planning (OECD/World Bank 2003). In transition countries, capital transfers are often channeled through a plethora of extra-budgetary funds created within various line ministries (e.g., Romania until 2004).<sup>34</sup>

In practice, central governments implement capital grants for a variety of stated reasons including the need to address externalities across local governments, assist subnational governments in financing “lumpy” capital investments, offset significantly different infrastructure endowments (when these are not the result of voluntary decisions), and pursue sectoral policy objectives (Martinez-Vazquez, 2000). In other cases, capital transfers are implemented in the pursuit of regional economic development objectives toward economically lagged territories, as opposed to those pursuing more equal access to public services (Josie et al., 2008). Guaranteeing minimum standards of services across a country is often seen as a main reason for creating specific capital transfers (Levtchenkova and Petchey, 2007 and Petchey and MacDonald, 2007, and Herrero et al., 2011). Other times practical considerations regarding budgeting issues can come into play; for example, Ahmad and Searle (2006) view capital transfers as appropriate in tight financing environments where the pressure to fund immediate current needs may displace longer term investment needs.

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<sup>34</sup> One significant exception is Vietnam, where capital expenditure needs are allowed for in the general equalization grant formula by using a gross up factor to the estimate of recurrent expenditure needs for each year, with the factor fixed for all provinces. See Gomez Reino and Martinez-Vazquez (2005).

**Figure 3. Capital grants as a share of total grants, 1993-2008**

Source: Martinez-Vazquez and Timofeev, 2012

Notes: The sample includes 44 countries, out of which 1 low income, 9 lower middle income, 9 upper middle income, 3 non-OECD high income, and 22 OECD countries.

#### IV. Conclusion

In this paper we have argued that the equity of fiscal outcomes is affected by disparities in infrastructure endowments and infrastructure needs. Therefore, we conclude that equalization grants should take into account these disparities. However, the exact treatment of these disparities will depend on the policy objectives underlying equalization: efficient allocation of mobile resources, social solidarity, or merit goods. Furthermore, political and institutional

considerations might require earmarking some of these grants for capital use.<sup>35</sup> Given the general complementarity between capital and operational inputs, the assessment of infrastructure needs should take into account the same indicators of service needs (school-age population, sickness rate, etc.) as for recurrent grants, in addition to the additional indicators assessing capital costs.

While the country cases do not provide a clear evidence of equalization of capital disparities, surprisingly there are quite a few similarities between these very different country cases. In none of these three country is the incidence of grants related to disparities in capital endowments when the grants are summed up over the entire time period. Given the lumpiness of capital grants and capital projects, these between-region estimates are the key piece of evidence for our research question. To further understand what produces this outcome, some insights can be gained from looking at the inter-temporal statistical associations, which might also represent reverse causality, confounding, and other statistical artifacts. In both Russian and Spain, improvements in road density over time are associated with increases in grants.

The experiences of three countries, even as diverse as Peru, Russia and Spain, are far from being representative of the vast array of developed and developing countries that have undergone considerable decentralization in the past. However, the practices in these three countries quite likely are pointing at a common policy deficiency in many other countries: the failure of transfers systems to specifically address territorial differences in capital infrastructure endowments that are not necessarily the product of self-made decisions. To be sure, there are many countries that use some form or other of earmarked capital grants and as many more use different forms of recurrent equalization grants. But it is rarely the case that these grants and transfers attempt to incorporate needs differences related to disparities in the endowments of infrastructure; to the extent that differences in expenditure needs capture some of those disparities, then equalization transfers that are expenditure need-based may partially address the problem. All this means that there appears to be a generalized need to develop new policy tools

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<sup>35</sup> Higher visibility of infrastructure construction can bias intergovernmental grants towards capital earmarking as for a legislative representative it would be easier to claim credit for new infrastructure built in his electoral district (Lee et al 2003). While most of the normative rationales for capital grants require project specific allocation as opposed to block grants, in practice such mechanism of grant allocation is also more susceptible to "log-rolling" than a formula-based allocation.

and/or reconvert existing ones within the conventional array of grants and transfers that can better address regional equity objectives in public infrastructure.<sup>36</sup>

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<sup>36</sup> As a possible example of a first step in this direction, see the recent paper by Herrero et al. (2011).

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