Size and soft budget constraints

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Abstract

We look at a model where districts of different size provide local public goods with positive spillovers. Matching grants of a central government can induce socially-efficient provision, but districts can exploit the intervening central government by inducing direct central government financing of these goods (a bailout). We show that the ability of a district to induce a bailout *negatively* depends on its size. We provide a number of recent bailout episodes at sub-national level confirming this hypothesis.

Preliminary and incomplete. DO NOT CITE!

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1 Introduction

The main issue of this paper is the ability of local governments to induce a central government to directly finance the provision of the local public good, i.e. to induce bailouts. Recent episodes of these bailouts to lower-level governments include state (regional) governments in Germany, Italy, France and Sweden. Also in Latin America, a number of recent experiences in Argentina, Colombia and Costa Rica are present[1]. Although the nature and amount of bailouts differ from country to country, in all these experiences the following characteristics are present: 1) the risk of underprovision of a local public good that entails important spillovers and 2) the districts receiving a bailout are among the smallest in the country.

In Germany, the two smallest state governments in terms of population, Bremen and Saarland turned to the Federal Court in 1988 pursuing the Federal Government to support them in coping with their high public debt. Both states claimed that their high public debt was caused by negative economic developments not under their control[2]. Despite constantly increasing dependence on intergovernmental transfers, both continued to increase spending, ran large deficits compared with other West German states, and relied heavily on debt to fund current expenditures throughout the 1980s and 1990s (Rodden, 2003). Based on the Constitutional principle of uni-

[1]It is important to point out that we are not interested in episodes of generalized bailouts like, for example, the rescue operation implemented by the Federal Government in Mexico early after the financial crisis in December 1994 which included extraordinary transfers to *all* state governments. Other examples of generalized bailouts include Brazil, where the Federal Government assumed all state and municipal debt in 1993 and 1997 (Dillinger and Webb, 1998).

[2]The crisis in the ship-building industry in Bremen and the crisis in the iron and coal industry in Saarland (Seitz, 1999).

formity of living conditions throughout the Nation, the Federal Court supported in 1992 the claims of both state governments that the excessive per capita indebtedness and unusual high ratio of interest payments to total expenditures, together with the poor economic performance, could set the basic supply of local public services under risk (Seitz, 1999).

Other examples of bailout episodes in developed countries include the health system in Italy and municipalities in Sweden. In Italy, health care is provided by regional governments and financed mostly with transfers from the central government[3]. At the beginning of the 1990s, actual expenditures exceeded planned expenditures by about 15% and health services in small and poor regions mainly in south Italy[4] became under risk of underprovision until the central government stepped in and covered the deficits thus incurred (von Hagen et al, 2000). Regional governments have regularly overspent their annual budgetary allocations and turned to the central government for additional funding. Various attempts to control health spending more effectively by setting strict budget rules remained unsuccessful (Bordignon, 2000). In Sweden, the central government was empowered by law during the period 1974-1992, to provide discretionary transfers to support municipalities in financial distress[5]. Municipalities typically ask for additional resources arguing that their financial problems were due to external factors resulting in a deteriorated tax base. Econometric evidence for this period (Dahlberg and Pettersson, 2003), shows

[3]In 1992, ordinary regions spent 71% of their total resources on health services. Almost 96% of their revenues came from Central Government (matching) grants. (von Hagen et al, 2000).

[4]See for example Bordignon (2000), "prima facie evidence on the Italian context suggests that, larger local governments are more fiscal responsible than smaller governments"

[5]This relief program was not part of a regular intergovernmental transfer scheme (von Hagen et al, 2000).

that population size and density have a significant negative association with realized bailouts and accumulation of municipal debt.

In Argentina, the central government has often used extraordinary resources to face fiscal and financial crises at provincial level since the return of democracy in 1983[6]. They took place in relatively poor and small jurisdictions that had experienced fiscal problems in previous years. Bailout episodes during the 1990s include mainly the provinces of Jujuy, La Rioja, Tucuman, Catamarca, Corrientes, Santiago del Estero and Rio Negro which are among the smallest jurisdictions in terms of population and the ones with the lowest level of GDP[7]. In one of these rescue operations, the central government provided financial assistance in the form of treasury loans to seven provinces that were suffering serious fiscal deficits and increasing debt in the period immediately before they received again loans between 1992 and 1994[8]. These funds represented a significant proportion of the financial needs of the jurisdictions: only in 1994, these loans covered 89.5% of the provinces' financial needs (Nicollini et al, 2002).

Size differences among local jurisdictions play an important role in this paper. The paper's take is that, in a federation with lower-level governments of different size

[6]Argentina is a federal country with twenty three provinces plus the City of Buenos Aires. However, Argentina is a very asymmetric federation in practice. The province of Buenos Aires together with the City of Buenos Aires have 48% of the Nation's population and generate well over half of the national GDP (Nicollini et al, 2002)

[7]In fact, these provinces are the smallest in terms of population if we exclude the extremely sparsely populated and oil producing provinces in Patagonia in the south of the country. Moreover, these provinces together represent less than 13% of the total population and less that 10% of national GDP.

[8]Provinces that received treasury loans were Catamarca, Corrientes, Formosa, Misiones, Rio Negro, Santiago del Estero and Tucuman.

providing local public goods, the ability of a district to induce a bailout depends *negatively* on its size. We develop a two-tier hierarchy model with the central government at the top and several jurisdictions of different size at the bottom that provide local public goods[9]. We assume that there are economies of scale and (positive) externalities in the provision of public goods. As in for example Alesina and Spolaore (1997), *economies of scale* are modelled with a fixed cost associated with public goods' provision. Furthermore, the *spillover* effect is modelled in a similar way as Besley and Coate (2003), that is, public goods provided in a district do not only benefit the individuals in this particular district, but also entail a positive externality for individuals in other districts.

Our paper is most closely related to Wildasin (1997), where it turns out that under certain conditions the ability of a lower-level government to induce a bailout and thereby to increase welfare, depends positively on its size. Recent literature on soft budget constraints and bailouts include: Qian and Roland (1998), who analyzes the implications of decentralization in the behavior of state-owned enterprises in China. Inman (2001) incorporates reputation on the part of the central government. Goodspeed (2002), analyzes a political economy model in which the central authority allocates grants to equate the weighted marginal utility of regions' voters. Sanguinetti and Tommasi (2002) incorporate the common pool problem in federations and find that small state-governments will be more prone to overspend and will receive proportionally more transfers from the central authority. See also Kornai (1986), who introduces the discussion on soft budget constraints in the study of

[9]Throughout this paper we write public goods though, strictly speaking, we mean publicly provided goods.

state-owned enterprises, and Maskin (1999) for a survey.

The paper first looks at the non-cooperative outcome (Section 2). Individuals choose the optimal amount of public goods to be provided in their district. It follows that districts only provide local public goods when district size is large enough relatively to the economies of scale effect in local public goods' provision. A common finding in this form of decision making is, however, that the spillover effect is not taken into account and, therefore, under-provision of local public goods occur. A system of matching grants implemented by a central government can be used to achieve an efficient Nash equilibrium without completely centralizing decision making. Section 3 characterizes the optimal level of local public goods' provision as a benchmark for normative evaluation of equilibrium outcomes and defines the optimal transfers' scheme. Not only is the (strictly positive) amount of public goods provided in a Nash non-cooperative equilibrium lower than the level in an efficient outcome, also in less cases than optimal, local public goods are provided when district size is small relative to the economies of scale in local public goods' provision.

The paper then shifts attention to the issue of *soft budget constraints* and analyzes whether and when the central government is willing to make an extraordinary transfer (*bailout*) to a district which decides not to provide any local public goods at all. This extraordinary transfer assures that at least some public goods are provided in this district. Section 4 shows that the amount of public goods provided under the bailout policy is lower than the amount chosen by the individuals in an efficient outcome. This implies that it is costly for individuals to induce a bailout - in case of a bailout there will be less local public goods in their districts than they are willing to pay for.

For that reason, the central government's bailout policy does not fully characterize the occurrence of bailouts, i.e. it does not imply that such a bailout is attractive for a district. Subsequently, the conditions under which local governments indeed choose to induce such a bailout are identified. It turns out that the ability and willingness of a district to induce a bailout and the size of this district are negatively correlated. Finally, Section 5 summarizes and concludes.

2 The non-cooperative equilibrium

Suppose that a country is divided in $\mathcal{N}$ geographically distinct districts of different size. The country has a population of N individuals and each district i has a population of n_i. Each individual has an endowment y and there are two types of goods in the economy, a private good x and a public good g. To simplify notation and to show that the results do not depend on heterogeneity among individuals, we assume that all individuals have identical preferences and endowments. We assume that an individual's payoff is quasilinear in the endowment, i.e. the utility function is additively separable.

We assume that there are economies of scale in public good provision. This feature is modelled with a fixed cost F for providing public goods, regardless of the size of the region. There is also a variable cost that depends on the exact amount of public goods that individuals want to provide. A district i provides per capita an amount g_i of the local public goods and each individual in district i pays a lump-sum district tax t_i to finance public good provision in district i. If a district provides an

amount g_i of the public good then individuals in this district will get a benefit $v(g_i)$ from these public goods. We assume that $v(g_i)$ is strictly concave for all i, that $v'(.) > 0$ and that $v(0) = 0$. An individual, however, does not only get a payoff from the public good in his own district but also from the public goods in all other districts. The degree of this (positive) spillover effect is denoted by κ, $0 < \kappa < 1$, so that an individual in district i gets a benefit $\kappa v(g_j)$ of the public goods provided in district j, $(i \neq j)$ [10]. Thus, the utility of an individual in district i is

$$v(g_i) + \sum_{j \neq i} \kappa v(g_j) + y - t_i \tag{1}$$

The costs of providing public goods differ per district and its variation is captured by the strictly positive parameter p_i. Since districts have balanced budgets, tax rates t_i are given by

$$t_i = \begin{cases} \frac{F}{n_i} + p_i g_i & \text{if } g_i > 0 \\ 0 & \text{if } g_i = 0 \end{cases} \tag{2}$$

We assume that all individuals in a district can choose the amount of public goods provided in their district. Since the individuals within a district are identical, however, we only have to look at the preferences of a single individual as these preferences

[10] To illustrate this consider two examples, safety (police) and education. In the model public goods are assumed to have the following two characteristics. (*i*) An individual's payoff is characterized by diminishing returns. While the benefits of prevention of anarchy or basic literacy are large, the benefits associated with speed controls or higher education are much smaller. (*ii*) An individual benefits directly from the public goods provided in its own district and only indirectly (and therefore less) from those provided in other districts. An individual may spend some of his time in other districts and then benefits from the safety measures provided there. For the same reason the individual benefits from the education provided in other districts by making his interaction with individuals from these other districts more valuable.

prevail for all individuals in the same district. The level of public goods provided in a district i is thus determined by the following maximization problem

$$\max_{g_i} \quad v(g_i) + \sum_{j \neq i} \kappa v(g_j) + y - t_i \tag{3}$$

We define $\overline{g_i}$ to be the non-cooperative Nash equilibrium outcome if $g_i = \overline{g_i}$ satisfies the following first-order condition of (3):[11]

$$\begin{cases} v'(g_i) = p_i & \text{if } v(g_i) > \frac{F}{n_i} + p_i g_i \\ g_i = 0 & \text{otherwise} \end{cases} \tag{4}$$

From the first-order conditions (4) it follows that districts only provide local public goods when district size is large enough compared to the economies of scale effect in the provision of local public goods.

3 Efficiency and grants

It is a common finding that in the form of decision making described in Section 2 the spillover effect is not taken into account and that, therefore, underprovision of local public goods occurs. A system of grants, however, can be used to achieve an efficient Nash equilibrium without completely centralizing decision making. We assume that such a system is implemented by a central government and that to finance this system, individuals pay a national lump-sum tax level T. In order to characterize

[11] In this and in subsequent maximization problems the strict concavity of $v(.)$ implies that the first order conditions are sufficient. Moreover, the assumed strict concavity implies that the solutions are unique.

such an equilibrium, we first characterize the optimal levels of local public provision as a benchmark for normative evaluation of equilibrium outcomes.

Since in this model the payoffs are quasilinear in the endowment, for efficiency it suffices to focus on an outcome in which all individuals pay the same tax level. The objective is to maximize the equally weighed sum of all individual utilities. The maximization problem for determining g_i can then be written as

$$\max_{g_i} \; n_i v(g_i) + \textstyle\sum_{j \neq i} n_j \kappa v(g_i) + Ny - NT \tag{5}$$

and since the budget is balanced

$$T = \sum_{j|g_j>0} \frac{F + n_j p_j g_j}{N} \tag{6}$$

We define $\hat{g}_i$ to be the socially optimal or efficient outcome if $g_i = \hat{g}_i$ satisfies the following first-order condition of (5):

$$\begin{cases} v'(g_i) = \frac{n_i p_i}{n_i + (N - n_i)\kappa} & \text{if} \quad n_i v(g_i) + \sum_{j \neq i} n_j \kappa v(g_i) > \\ & \quad F + n_i p_i g_i \\ g_i = 0 & \text{otherwise} \end{cases} \tag{7}$$

A comparison of the first-order conditions (7) with (4) yields that there is indeed underprovision of public goods. Firstly, the strictly positive levels of public goods in a non-cooperative Nash equilibrium are lower than the level in an efficient outcome. Furthermore, the minimum size of the district for provision of the public good is

smaller than in the efficient outcome.

In the following we consider a system consisting of matching (or conditional) grants. The timing is now as follows.

1. The central government chooses a system of matching grants.

2. The local governments observe the system of matching grants and choose the amounts of local public goods that will be provided.

Let m_i denote the share of total spending the local government of district i can reimburse. This reimbursement is chosen such that the marginal incentives to provide local public goods are efficient. Again, districts have balanced budgets and therefore tax rates previously given by expression (2) are now given by

$$t_i = \begin{cases} \left(\frac{F}{n_i} + p_i g_i\right)(1 - m_i) & \text{if } g_i > 0 \\ 0 & \text{if } g_i = 0 \end{cases} \tag{8}$$

and where the national tax rate is given by

$$T = \frac{\sum_{j|g_j>0} (F + p_j n_j g_j)\, m_j}{N} \tag{9}$$

The level of public goods provided in a district i is then implicitly given by maximization problem (10) with tax rates t_i and T given by expressions (8) and (9), respectively.

$$\max_{g_i} \quad v(g_i) + \sum_{j \neq i} \kappa v(g_j) + y - t_i - T \tag{10}$$

The first-order condition of this maximization problem is given by

$$\begin{cases} v'(g_i) = p_i(1-m_i) + \frac{n_i p_i m_i}{N} & \text{if } v(g_i) > \left(\frac{F}{n_i} + p_i g_i\right)(1-m_i) + \frac{(F+n_i p_i g_i)m_i}{N} \\ g_i = 0 & \text{otherwise} \end{cases} \tag{11}$$

From a comparison of the conditions in (7) and (11) it follows that the marginal incentives to provide local public goods is optimal with the following conditional transfers $\hat{m}_i$

$$\hat{m}_i = \frac{N\kappa}{n_i + (N-n_i)\,\kappa} \tag{12}$$

The marginal incentives to provide public goods are now efficient, moreover, a comparison of the conditions in (7) and (11) with $m_i = \hat{m}_i$ reveals that the decision whether to provide public goods is now also efficient, that is $g_i = \hat{g}_i$ for all i. Another feature of the transfer scheme characterized by (12) is that the transfers $\hat{m}_i$ do not depend on the exact values of the p_i's. Furthermore, the choices of $\hat{g}_i$ and $\hat{m}_i$ constitute the unique Nash equilibrium. Finally, note that the above transfer scheme would be the majority voting outcome when individuals vote over pairwise comparisons of transfer schemes as well as the outcome that a benevolent, social-welfare maximizing, national government would prefer.

4 The soft budget constraint

In Section 3 we show that the first-best outcome can be reached with matching transfers. The principle that a central government makes transfers to increase efficiency

creates, however, another possibility. When a district does not provide any local public goods at all, the central government can, with the same motivation as for the conditional transfers, make a transfer to this district so that at least some public goods are provided in this district. This motivation seems to be an essential feature of *bailouts* or *soft budget constraints*.

We focus on the decision of the individuals in a single district i and in the analysis we assume that all other districts choose the positive levels given in Section 3. The choice of the individuals whether to induce a bailout obviously depends on the policy of the central government, determining the increase in the central tax level necessary to finance the bailout, and the amount of local public goods provided in the district that gets a bailout. The decision on the bailout is thus taken after the decisions on the amount of local public goods are made by the districts. The timing is thus:

1. The central government chooses a system of matching grants.

2. The local governments observe the system of matching grants, choose the amounts of local public goods that will be provided and choose whether to induce a bailout.

3. The central government, observing the choices made by local governments, decides on bailouts induced by local governments.

Instead of "the central government" one can read "voters in a nationwide election" and instead of "local government" "voters in each district". In the following analysis we look at this game recursively, that is first at the government's bailout policy and then at the decision over local public goods provision in district i. Bailouts are costly,

that is the central government has to put effort in finding out what the local cost parameter p_i is. The costs of this effort are denoted by c_{BO}. Finally, we assume that the bailout policy is carried out in the interest of those individuals that are not located in the district needing a bailout. This leads to the same outcome as with majority voting, that is when individuals vote over pairwise comparisons of bailout levels.

4.1 Central government bailout policy

In this section we look at the reaction of the central government when the individuals in a district choose a g_i and thus a t_i such that $g_i < \hat{g}_i$. Assume that the central government can intervene in district i's provision of local public goods g_i by making a conditional lump-sum grant of $\underline{m_i} > 0$, resulting in an amount of local public goods in district i of $g_i + \underline{m_i}$. We will not drop the assumption that budgets should be balanced, so to finance this transfer the central tax level is increased by $n_i p_i \underline{m_i}/N$. Finally, we assume that bailouts are costly, that is additionally the central tax rate increases by c_{BO}/N for each bailout that takes place.

Given these assumptions, the central government's maximizes the payoff of individuals located outside the district that might get a bailout, and this optimization problem can be written as

$$\max_{\underline{m_i}} \kappa v(g_i + \underline{m_i}) - T_{BO} \tag{13}$$

where T_{BO} is given by

$$T_{BO} = \begin{cases} \frac{F+n_i p_i g_i + c_{BO} + n_i p_i \underline{m_i} - t_i n_i}{N} & \text{if } \underline{m_i} > 0 \\ \frac{c_{BO}}{N} & \text{if } \underline{m_i} = 0 \end{cases} \tag{14}$$

The first-order condition of this maximization problem is given by

$$\begin{cases} \kappa v'(g_i + \underline{m_i}) = \frac{p_i}{N} & \text{if } \kappa v'(g_i) > \frac{n_i p_i}{N} \text{ and} \\ & \kappa v(g_i + \underline{m_i}) > \frac{F+n_i p_i g_i + n_i p_i \underline{m_i} - t_i n_i}{N} \\ \underline{m_i} = 0 & \text{otherwise} \end{cases} \tag{15}$$

A comparison of conditions (15) with (7) reveals that the amount of public goods provided under the bailout policy is lower than the amount chosen by the individuals when there is a hard budget constraint. This implies that it is potentially costly for individuals to induce a bailout - in case of a bailout there will be less local public goods in their districts than they are willing to pay for. In the next subsection we look at more detail at the decision whether individuals will induce a bailout.

Condition (15) makes it possible to characterize the central government's bailout policy.

Lemma 1 *There exist critical values* $\overline{n_{i;C}}$, $\underline{t_{i;C}}$ *and* $\overline{g_{i;C}}$ *such that:*

1. *if* $n_i > \overline{n_{i;C}}$ *the central government does not provide district* i *a bailout, even when district* i *chooses a zero level of own-contribution to local public good provision;*

2. *if* $n_i < \overline{n_{i;C}}$ *the central government provides a bailout to district* i *if and only if* $t_i > \underline{t_{i;C}}$ *and* $g_i < \overline{g_{i;C}}$.

Proof of Lemma 1:

(1): From condition (15) it follows that when $g_i = 0$ a necessary condition for $\underline{m_i} > 0$ is $\kappa v'(0) > \frac{n_i p_i}{N}$. Hence, for $n_i > \overline{n_{i;C}} = \frac{\kappa N v'(0)}{p_i}$ the central government never provides a bailout.

(2): Let $\overline{g_{i;C}}$ be so that $\kappa v'(\overline{g_{i;C}}) = n_i p_i / N$ and $\underline{t_{i;C}} = \frac{F + n_i p_i g_i + c_{BO} + n_i p_i \underline{m_i} - N\kappa v(g_i + \underline{m_i})}{n_i}$. Then for $g_i < \overline{g_{i;C}}$ it holds that $\kappa v'(\overline{g_{i;C}}) > n_i p_i / N$. If in addition $t_i > \underline{t_{i;C}}$ then from condition (15) it follows that the government will provide a bailout. □

A closer look at the values $\overline{n_{i;C}}$, $\underline{t_{i;C}}$ and $\overline{g_{i;C}}$ shows that $\frac{\partial}{\partial n_i}\overline{n_{i;C}} = 0$, $\frac{\partial}{\partial n_i}\underline{t_{i;C}} > 0$ and $\frac{\partial}{\partial n_i}\overline{g_{i;C}} < 0$. It therefore follows from Lemma 1 that the willingness of the central government to provide bailouts and district size are negatively correlated. In the following section we look at whether local governments indeed choose to induce such a bailout.

4.2 Local government bailout policy

The central government bailout policy, implicitly given by condition (15), does not fully characterize the occurrences of bailouts. The conditions show how and when a district can induce a bailout from the center. This does not, however, imply that such a bailout is attractive for a district. In other words, conditions (15) are *necessary*, but not *sufficient*. Below we analyze the choice made by individuals in a district, given the soft-budget constraint.

First, for any g_i such that $\kappa v'(g_i) < p_i/N$ the district will receive no bailout at all. In this case the optimal choice for the individuals in district i therefore is $\hat{g}_i$. Secondly, when g_i is such that $g_i < \hat{g}_i$ and as long as the conditions in the first line of (15) are met, it follows that the amount of public local goods provided under a bailout is not affected by the value of g_i. In the latter case there are two possibilities, either $g_i = 0$ and $t_i = 0$ or that $g_i > 0$, while for $g_i > 0$ the optimal choice is to have $t_i = F/n_i$ so that (an infinitesimal small) positive amount of the public good is provided. In these cases individuals are better off with $t_i = 0$ than with $t_i = F/n_i$, but with $t_i = 0$ it might be the case that $\kappa v(g_i + \underline{m_i})$ is not big enough so that not all conditions in the first line of (15) are met.

Individuals within a district prefer the first case with $g_i = \hat{g}_i$ over the second case with $t_i = (1 - \hat{m}_i)F/n_i$, g_i infinitesimal small and T given by expression (6) when

$$\begin{gathered} v(\hat{g}_i) + \textstyle\sum_{j \neq i} \kappa v(\hat{g}_j) + y - \left(\frac{F}{n_i} + p_i \hat{g}_i\right)(1 - \hat{m}_i) - T > \\ v(\underline{m_i}) + \textstyle\sum_{j \neq i} \kappa v(\hat{g}_j) + y - \frac{F}{n_i}(1 - \hat{m}_i) - \left(T + \frac{c_{BO} + n_i p_i \underline{m_i}}{N} - \frac{n_i p_i \hat{g}_i \hat{m}_i}{N}\right) \end{gathered}$$

which can be rewritten as

$$v(\hat{g}_i) - v(\underline{m_i}) > p_i \hat{g}_i (1 - \hat{m}_i) + \frac{n_i p_i \hat{g}_i \hat{m}_i}{N} - \frac{c_{BO} + n_i p_i \underline{m_i}}{N} \tag{16}$$

Individuals within a district prefer the first case with $g_i = \hat{g}_i$ over the second case

with $t_i = 0$ and T given by expression (6) when

$$v(\hat{g}_i) + \sum_{j \neq i} \kappa v(\hat{g}_j) + y - \left(\frac{F}{n_i} + p_i \hat{g}_i\right)(1 - \hat{m}_i) - T > v(\underline{m_i}) + \sum_{j \neq i} \kappa v(\hat{g}_j) + y - \left(T + \frac{F + c_{BO} + n_i p_i \underline{m_i}}{N} - \frac{(F + n_i p_i \hat{g}_i)\hat{m}_i}{N}\right)$$

which can be rewritten as

$$v(\hat{g}_i) - v(\underline{m_i}) > \left(\frac{F}{n_i} + p_i \hat{g}_i\right)(1 - \hat{m}_i) + \frac{(F + n_i p_i \hat{g}_i)\,\hat{m}_i}{N} - \frac{F + c_{BO} + n_i p_i \underline{m_i}}{N} \quad (17)$$

A provision for conditions (16) and (17) is that the central government is willing to give a bailout. When the central government is willing to give a bailout when $t_i = 0$ it is also willing to give a bailout when $t_i = (1 - \hat{m}_i)F/n_i$. The local government in this case prefers, when it induces a bailout, to do so with $t_i = 0$. For certain parameter values, however, the central government is not willing to give a bailout when $t_i = 0$ while it would give a bailout when $t_i = (1 - \hat{m}_i)F/n_i$.

Conditions (16) and (17) make it possible to show how district size and the local government's bailout policy are related.

Lemma 2 *There exists critical values $\overline{n_{i;L}}$ such that if $n_i < \overline{n_{i;L}}$ and if the central government is willing to give a bailout to district i, then the local government of district i will induce a bailout.*

Proof of Lemma 2: First note that when the central government is not willing to give a bailout, the local government will not induce a bailout since the per-capita costs of inducing would be c_{BO}/N.

A comparison of (7) and (15) reveals that $\hat{g}_i > \underline{m_i}$. Moreover, it follows that $\frac{\partial}{\partial n_i}\underline{m_i} < \frac{\partial}{\partial n_i}\hat{g}_i < 0$. By the concavity of $v(.)$ it therefore holds that $v(\hat{g}_i) - v(\underline{m_i})$ increases when n_i increases.

The right hand side of the inequalities (16) and (17) both denote the difference in the per-capita costs of providing $\hat{g}_i$ and $\underline{m_i}$, respectively. Since $\frac{\partial}{\partial n_i}\underline{m_i} < \frac{\partial}{\partial n_i}\hat{g}_i < 0$ it follows that these differences are decreasing in n_i.

From the above it follows that the left-hand sides of conditions (16) and (17) are increasing in n_i while the right-hand sides are decreasing in n_i. Then there exists a $\overline{n_{i;L}}$ such that if $n_i < \overline{n_{i;L}}$ then conditions (16) and (17) are satisfied.□

4.3 Bailouts

The analysis in Sections 4.1 and 4.2 specified the bailout policies of the local government and of the central government. In this section we are even more precise about bailouts and show that under certain parameter restrictions these policies are equilibrium strategies. To do this, consider the following set of strategies.

> **Central government**: Choose a system of matching grants specified by expression (12). When a local government induces a bailout, provide one when the conditions of Lemma 1 hold.
>
> **Local government**: Induce a bailout when the conditions of Lemmas 1 and 2 are met, otherwise provide an amount of the public good that satisfies conditions (7).

Like in the previous sections, one can read "Strategy of the voters" instead of "Strategy of the central government" and "Strategy of the voters in district i" instead of "Strategy of local government in district i".

Proposition 1 *The above-mentioned strategies are the unique subgame-perfect Nash equilibrium when* $c_{BO} > \underline{c_{BO}}$.

Proof of Proposition 1: It follows from the discussion in the previous section that in the second and the third stage the players are choosing a best-response.

In the first stage, however, a central government could choose a system of matching grants in such a way that at least part of the costly bailouts are prevented. Bailouts are costly because inefficient low levels of the public good are provided under a bailout and because of the costs c_{BO}. To design such a system it is necessary for the central government to find out what the values of each p_i is, while for the grant system described by expression (12) this is not necessary. It would be worthwhile for the central government to prevent a bailout in district i when

$$\begin{aligned} &n_i v(\hat{g}_i) + \textstyle\sum_{j \neq i} n_j \kappa v(\hat{g}_i) + Ny - (F + n_i p_i \hat{g}_i) > \\ &n_i v(\underline{m_i}) + \textstyle\sum_{j \neq i} n_j \kappa v(\underline{m_i}) + Ny - \left(c_{BO} + F + n_i p_i \underline{m_i}\right) \end{aligned} \tag{18}$$

that is, when

$$\begin{aligned} &c_{BO} > \\ &\left(n_i p_i \hat{g}_i - n_i p_i \underline{m_i}\right) + n_i v(\underline{m_i}) - n_i v(\hat{g}_i) + \textstyle\sum_{j \neq i} n_j \kappa n_i v(\underline{m_i}) - \sum_{j \neq i} n_j \kappa n_i v(\hat{g}_i) \end{aligned} \tag{19}$$

From this it follows that as long as the expected gain from finding out the local costs parameter p_i (the expected gain from bailouts) is smaller than the costs of finding out the value p_i (which amounts c_{BO}), the central government will adjust the system of matching grants to prevent bailouts. This cutoff level is given by

$$\underline{c_{BO}} = \frac{1}{\mathcal{N}} \sum_{i=1}^{\mathcal{N}} v(\underline{m_i}) - v(\hat{g}_i) + \sum_{j \neq i} n_j \kappa \left(v(\underline{m_i}) - v(\hat{g}_i) \right) + n_i p_i \left(\hat{g}_i - \underline{m_i} \right) \tag{20}$$

□

The analysis also allows us to draw the following conclusion.

Corollary 1 *The occurrence of bailouts and district size are negatively related when the p_i's are unrelated to the corresponding n_i.*

Corollary 1 immediately follows from the results stated in Lemmas 1 and 2.

5 Concluding remarks

Like Wildasin (1997), our contribution focuses on the relationship between size and soft budget constraints in a model where externalities in the provision of local public goods explain the allocation of bailouts among sub-national governments. The central authority will find it optimal to complement the provision of local public goods if state governments decide to under-provide them.

We complement this analisis by including the existence of economies of scale, feature that is modelled assuming a fix cost in the provision of local public goods.

We also assume that bailouts are costly. To design such a system of transfers, it is necessary for the central government to find out the costs of providing public goods which differ across districts. This is not the case for the system of matching grants used to achieve the efficient outcome presented in section 3. From the analysis follows that the ability and willigness of a district to induce a bailout from the central government and the size of this district are negatively correlated. It can be indeed, that a district that is so small, that in the socially optimal solution no local public goods are provided (and thus also no public goods are provided in the majority voting outcome with hard budget constraints), provides a positive but infinitesimal amount of local public goods and subsequently receives a bailout from the central government.

The evidence overwhelmingly points in the direction of small and poor jurisdictions having largely benefited from bailouts. Recent experience of bailout episodes in developed as well as developing countries confirm our hypothesis. Regarding technical issues, and in contrast with previous literature, we offer in this paper an answer to the following issue: in the first stage, the central government could have chosen a system of matching grants in such a way that bailouts are prevented in a further (third) stage. We show that as long as the expected gain from bailouts is larger than the costs of finding out the costs of providing local public goods in each jurisdiction, the central government will not adjust the system of matching grants to prevent bailouts. Thus the existence of bailouts is part of the unique subgame-perfect Nash equilibrium.

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