Fiscal decentralization, regional inequality and bail-outs: Lessons from Brazil's debt crisis

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Abstract

This paper develops a simple two-period model of public good provision within a federation. A national public good is provided to both states by the federal government, while a local public good is supplied by each state government. The federal government levies a proportional income tax, and in each period the state governments receive a share of the revenues collected equal to the amount needed to finance the first best provision of the local public good. In the first period the local governments can also use borrowing to finance the provision of the public good, but any debt contracted must be repaid in the second period. We show that when the states face a hard budget constraint, they do not find it optimal to increase the provision of the local public good above the first best level guaranteed by the federal grant. However, if the federal government cannot credibly commit not to bail-out the states, then the local governments may find it optimal to borrow in order to increase the provision of the public good above the first best in the first period. Furthermore, we show that the commitment problem is more likely to arise vis-á-vis states whose default results in a negative externality on the federation. Hence, those states are more likely to carry on budget deficits and benefit from a federal bail-out.
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1. Introduction

Brazil is a federal country characterized by highly decentralized spending and taxation decisions. The authority of the federal government, states and municipalities on budgetary matters is strictly regulated by the constitution. States enjoy a substantial autonomy, but in an attempt to control sub-national budget deficit, the 1988 constitution restricts their borrowing ability which is scrutinized by the Senate. Despite these provisions, state deficits have been a persistent concern throughout the post 1988 period. The last state debt crisis of the mid 1990s, triggered by the soaring interest rates following the implementation of the "Plano Real" in 1994, exposed the serious macroeconomic threat posed by the risk of default of the four major debtor states of Sao Paulo, Rio de Janeiro, Minas Gerais and Rio Grande do Sul, and ended up requiring a bail-out by the central government. With the so called "troca" agreement, the federal government authorized in fact the exchange of state bonds for federal and central bank bonds and thus relieved the states from the burden of servicing their debt.

While forcing the major debtor states into default might have damaged the macroeconomic stability of the entire country, the softening of their budget constraint has undesirable implications both in terms of future incentives to borrow and of regional inequality. First, as the cost of borrowing by a state can be shared with the other members via the mechanism of federal bail-out, a so called "common pool" problem can arise, whereby states that are not liable for the entire repayment of their debt tend to borrow in excess of what would be optimal. Second, by threatening the economic stability of the entire country, the biggest and richest states acquire a bargaining power that limits the ability of the federal government to redistribute income towards the poorer states. This aspect of the federal budget is particularly problematic in a country like Brazil, where regional inequality is a severe problem (Azzoni, 2001; Milanovic, 2005). As documented by Rodden (2003), the average per capita GDP of the wealthiest states during the 1990–2000 period is five times bigger than that of the poorest states. At the same time, the dependence of Brazilian states on intergovernmental transfers varies enormously, with Sao Paulo receiving only 7% of its revenue from the federal government while Acre and Amazonas depend for more than 70% of their revenue from intergovernmental transfers. The 1988 constitution prescribes a very detailed system of intergovernmental transfers that should have addressed the issue of regional disparities, but according to Shankar and Shah (2000), revenue sharing agreements mandated by the constitution had no effect on regional income inequality in Brazil. This is perhaps not surprising if one considers that the wealthiest and most fiscally independent states, holding the majority of the total sub-national debt,[1] were the main beneficiaries of a large federal bail-out.

In this paper we propose a theoretical framework where the incentives to borrow within a federation of heterogenous states are explicitly modeled. In a two-period setting, a large and a small state, belonging to the federation, are the recipients of federal funds used to finance the provision of a general and local public good. Federal funds are raised through a proportional income tax that is in part directly spent by the federal government to provide the general public good, and in part allocated to the state government in the form of a grant that must be spent to supply a local public good. The first period provision of the local public good can also be financed by borrowing at the current interest rate, however in the second period the entire debt must be repaid. The amount of the national public good and the federal transfer are set in each period as to maximize the total welfare of the federation (first best provision). Furthermore, the transfer

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[1] See Section 2 for detail.

received by each state can only be spent for the provision of the local public good. Hence, if a state borrowed in first period, it will need to reduce its citizens private consumption in order to repay the debt. If the state is not able to repay the outstanding debt, it will default unless the federal government decides to bail it out. The default has a negative impact on the income of the insolvent state, and in the case of the large state also on that of the entire federation (negative externality). We show that if the federal government can credibly commit not to bail-out the states (hard budget constraint), then the sub-national entities will not find it optimal to increase the provision of the local public good above the first best level guaranteed by the federal grant. However, when there is a prospect of bail-out, state governments might borrow to increase the provision of the public good above the first best. Furthermore, the commitment problem is more likely to arise when the default of a state may have a negative externality on the federation. As a consequence, big states, by threatening the stability of the federation, are more likely to face a soft budget constraint and run a budget deficit at the expense of smaller states. These results are consistent with the Brazilian experience, where the four major debtor states (that are also among the biggest in the federation), unable to service their debt in the budget crises following the implementation of the plano real, were the first to sign bail-out agreements with the federal government. Because they were "too big to fail", not only the most fiscally independent states were paradoxically less prone to fiscal discipline, but their overspending clearly worked against the principle of federal redistribution that had been designed to reduce the gap between poorer and richer areas of the country. Not surprisingly, with a massive federal bail-out in favor of the most indebted wealthy states, Brazil's regional imbalances have not shown any declining tendency during the last decade.

The debt crisis of the mid 1990s and the subsequent bail-out of the major debtor states showed the limits of the new budgetary rules prescribed by the 1988 constitution in an attempt to curb the budget deficit and redistribute income from the richest to the poorest regions. A particularly interesting aspect of Brazil's debt crisis is the regional distribution of the budget deficit. In federal states, the mismanagement of budgetary policy is usually associated with fiscally dependent states relying on federal transfers from the richer and more independent members of the federation. Hence, we would expect poorer states to be more exposed to the possibility of debt crises. Contrary to these expectations, the four major debtor states in Brazil are also among the richest and most fiscally independent within the federation. Therefore, there is an important lesson to be learned from the Brazilian experience. When a federation displays regional heterogeneity to the extent that the economic performance of the country is largely dependent on a subset of the member states, then more attention should be paid to the behavior of those states that can exploit their bargaining power to run excessive deficits that will result in a burden for the poorer and most vulnerable regions.

The reminder of the paper is organized as follows. In Section 1 we provide an overview of the most recent state debt crisis and federal bail-out episodes in Brazil. In Section 2 we lay out our theoretical framework. In Sections 3 and 4 we analyze the borrowing incentives faced by the federal states. In Section 5 we analyze the optimal bail-out policy of the federal government. Section 6 concludes the paper.

2. State debt and federal bail-out in Brazil

The Brazilian constitution of 1988 prescribes in great details the responsibilities of federal entities with respect to their spending and taxation decisions. Federal states enjoy a substantial autonomy on both dimensions, so that decentralization is certainly one of the main result of the current constitutional arrangement. While a more decentralized decision making process
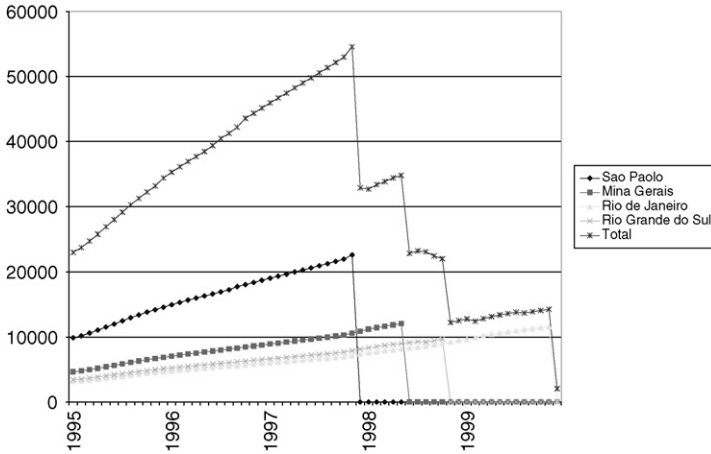
Fig. 1. Monthly state and municipal debt (million R$) 1995–1999 (*source*: IPEA).

will typically imply a better match between spending decisions and citizen's preferences, its consequences in terms of fiscal discipline are more controversial. On the one hand, as states become more independent in their spending and taxing decision, they should be less prone to run fiscal deficits that they will have to repay with future higher taxes. On the other, when the system of intergovernmental transfers leaves open the possibility of a federal bail-out of defaulting states, then decentralization might well compromise fiscal discipline. As states become more autonomous in their spending decisions, they may overspend expecting further transfers from the central government in case they will not be able to repay their debt. The recent Brazilian experience suggests that higher decentralization may come with higher state deficit. As we can see in Fig. 1, state debt increased sharply starting in the early nineties until the end of 1997.

Another interesting feature of the state debt during the same period is its distribution across federal states. As we can see from Fig. 2, the largest states of the federation (Sao Paulo, Minas Gerais, Rio de Janeiro and Rio Grande do Sul) owned, up until the crises, the vast majority of
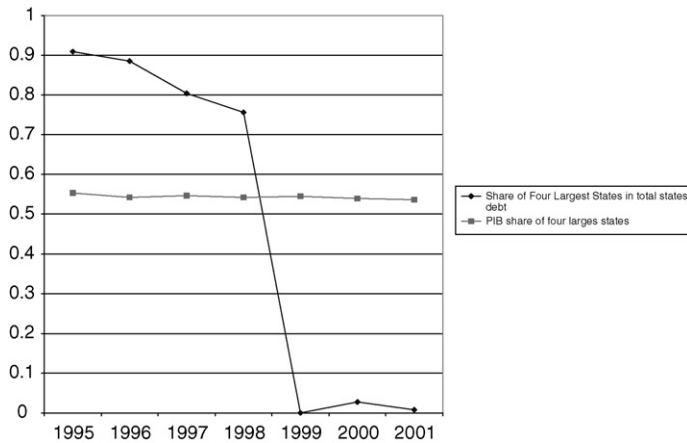

Fig. 2. Debt and GDP shares of large states (*source*: IPEA).

the total debt. In the mid-1990s, following the implementation of the Plano Real, interest rates increased to the point of exposing the major debtor states to the risk of default. Furthermore, as a large fraction of the debt was actually owed to state banks, the default of the large states posed a serious threat to the financial stability of the entire country. Amid the fear of a liquidity crisis and bank run, the Central Bank decided to assume the control of the state banks of Sao Paulo (BANESPA) and Rio de Janeiro. At the same time, the federal government allowed the exchange of state bonds (no longer marketable because of the risk of default) for federal bonds. Finally, following the inability of the states to honor also short-term cash obligations toward contractors and employees, a Program of Fiscal State Restructuring and Fiscal Adjustment providing funds to cover short-term liabilities was implemented. Overall, through various channels, the Brazilian states were completely relieved from servicing their debt, and more importantly the biggest states where the main beneficiaries of the federal largesse. While the intervention of the federal government and the central bank are likely to have shielded the country from a major financial crisis, the fundamental question remains open of how future crises of this type can be prevented. The question is even more urgent if one considers the perverse incentives faced by the states given the past experience of federal bail-out following their inability to repay their debt. Large states which are "too big to fail" may be tempted to exploit their bargaining power even further to receive federal bail-outs at the expense of the small states, an outcome that in turn would fuel an increase of the already big regional disparities. To analyze the consequences of a federal bail-out in terms of fiscal discipline, in the reminder of the paper we will propose a simple theoretical model where the incentives to borrow of federal states in the presence of a bail-out will be explicitly modeled.

3. The model

We consider a federation of two states, $j = \{S, L\}$, that differ in their population size. We denote by N_j the residents of each state and we assume that $N_L > N_S > 1$. All residents are endowed with per capita income y so that the total income of the large state, $N_L y$, exceeds the one of the small state, $N_L y$. This federation is characterized by two levels of governments: the state government, providing a local public good denoted by g_j, and the federal government, which provides a federal public good denoted by G. For simplicity, we assume that the price of both G and g_j is p and a proportional tax revenue τ is levied on the residents to provide both goods.[2] Besides the general and local public good, residents of each state also consume a private good x whose price is $p_x = 1$, i.e. we choose x as the numeraire in our model.

Let $\{G^t, g_j^t, x_j^t\}$ denote the consumption vector of each resident of state S at time t where $t \in \{1, 2\}$. The per-period utility function of each citizen, which is assumed to be quasi-linear, can be written as follows:

$$U_j^t(G^t, g_j^t, x_j^t) = x_j^t - \tfrac{1}{2}(\bar{G} - G^t)^2 - \tfrac{1}{2}(\bar{g} - g_j^t)^2$$

where $\bar{G} > 0$ and $\bar{g} > 0$.

We assume that the first best amount of the public goods (i.e. the quantity maximizing the total welfare of the federation) must be provided and that, in the first period, the corresponding expenditure may be financed by a tax paid by all residents as well as by borrowing an amount B_j. The tax revenue raised in each period, $\tau y(N_S + N_L)$, is allocated between the federal and state

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governments via a formula assigning to each of them a share of the total revenues that is equal to their share of the first best provision of public goods. Hence, denoting by G^* and g_j^* the first best amount of federal and state public goods, the federal and state governments respectively receive the shares $G^*/(G^* + g_S^* + g_L^*)$ and $g_j^*/(G^* + g_S^* + g_L^*)$ of the total revenue. The funds allocated by the formula are bound to the provision of the public goods, i.e. the governments cannot make any alternative use of them.[3]

If the state governments borrow B_j in the first period, an amount $(1 + r)B_j$ must be repaid in the second period, where the interest rate r is a random variable distributed on a support $[0, b]$ with $b > ((1 - r^*)(N_S + N_L)y/B_j)$, according to a density function $f(r)$ with mean $E(r) = \mu_r$ and cumulative function $F(r)$. At the beginning of the second period, having observed the interest rate, if the state governments are unable to repay their debt, they will ask for a federal bail-out. Given that the provision of both the federal and local public goods is constrained to be at the first best level determined by the formula, if the states demand a federal bail-out, additional tax revenues need to be raised in order to provide them with the required funds.[4] When the states receive additional funds to repay their debt, we say the budget constraint they face is "soft". On the other hand, if an insolvent state is denied access to federal bail-out, then it must decrease the private consumption of their own residents to repay the debt, in which case the budget constraint of the states is "hard".

We model the interaction between the federal government and the state governments as a two-period game. In this setting, we will study under which conditions each state finds it optimal to borrow to increase the provision of the local public good above the level guaranteed by the revenue sharing formula. However, before determining the optimal states' borrowing decision, we characterize the first best allocation of resources.

4. The first best allocation and optimal taxation

To keep the analysis as simple as possible, we consider an economy in which individual agents do not discount the future and individual income is constant over time. The federal government and each individual state have access to international capital markets, where they can borrow at the (random) rate r.

The first best consumption vector maximizing the joint surplus of the federation, denoted by $W(\cdot)$, can be obtained solving the social planner problem, i.e.

$$\max_{G^t, g_s^t} W = \sum_{t=1}^{2} \sum_{j=S,L} N_j \left[x_j^t - \frac{1}{2}(\bar{G} - G^t)^2 - \frac{1}{2}(\bar{g} - g_j^t)^2 \right]$$

$$\text{s.t.} \quad p \left[G^t + \sum_{j=S,L} g_j^t \right] + \sum_{j=S,L} N_j x_j^t \leq y(N_S + N_L), \quad \text{for} \quad t = 1, 2$$

The set of constraints points out that the value of the consumption of public and private goods in the two states cannot exceed the total income generated in the federation in each period. It is

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[3] In particular, they cannot be used to repay any debt eventually assumed by the states.
[4] In other words, states do not reduce the provision of public goods to repay the debt. This assumption is consistent with the pattern of public expenditure in Brazil. As documented by Rodden (2003), the real public expenditure per capita in Brazil increased steadily after the debt crisis of the mid-1990s.

easy to show that the optimal provision of the public good, which does not depend on income and does not change over time, is given by:

$$G^* = \bar{G} - \frac{p}{N_S + N_L}, \qquad g_j^* = \bar{g} - \frac{p}{N_j}, \quad j = S, L$$

As for the consumption of the private good, its equilibrium level will depend on how the public good provision will be financed. If the first best provision G^* and g_j^* is entirely financed in each period by a tax τ so that $\tau y(N_S + N_L) \geq p\left[G^t + \sum_{j=1}^{2} g_j^*\right]$, then private consumption will be constant over time and equal to $(1 - \tau)N_j y$. On the other hand, if in the first period the tax revenue raised is inferior to public spending, then the deficit will have to be financed by borrowing an amount B_j at the current interest rate r, that will be repaid in the second period. This will imply that the first period consumption of private good will be higher than the second period consumption. Given that the future is not discounted and thus the marginal utility from the consumption of the private good is the same over time and across federal states, then it is clearly not optimal to increase the first period consumption by borrowing. In other words, the optimal taxation policy requires that in each period the tax revenue covers just the value of the first best amount of public goods.

Therefore, the optimal taxation and private consumption will satisfy the following:

$$\tau^* = \frac{p\left[G^* + \sum_{j=S,L} g_j^*\right]}{y(N_S + N_L)}, \qquad x_j^*(1 - r)N_j y, \quad j = S, L$$

4.1. State borrowing with hard budget

In the previous section we have determined the amount of federal and local public good which is provided according to the revenue sharing formula. However, as state governments have the authority to borrow, then the actual provision of local public good will be $g_j^t = g_j^{t*} + (B_j/p)$. Note that if states do not find optimal to borrow, i.e. if $B_j = 0$, then after the federal transfer has been carried out, the first best allocation will be achieved. On the other hand, when $B_j > 0$, then typically states will over-provide the local public good in the first period. The optimal borrowing strategy from the point of view of the state government will clearly depend on whether they expect federal bail-out to be a possibility.

If the federal government is able to impose a hard budget constraint on the states, then they will not receive extra-funds in addition to the ones allocated by formula. This implies that if a state borrows in the first period, then it must repay its own debt in the second period. Therefore, the budget constraint of each state in the second period is given by:

$$N_j x_j^2 = (1 - \tau)N_j y - (1 + r)B_j$$

As a result, the state government chooses the optimal level of B_j maximizing the residents intertemporal utility, i.e. by solving the following problem:

$$\max_{B_j} E\left[N_j \sum_{t=1}^{2}\left(x_j^t - \frac{1}{2}(\bar{G} - G^t)^2 - \frac{1}{2}(\bar{g} - g_j^t)^2\right)\right] \quad \text{s.t.} \quad p g_j^t = p g_j^* + B_j,$$

$$N_j x_j^1 = N_j(1 - \tau)y, \quad N_j x_j^2 = (1 - \tau)N_j y - (1 + r)B_j$$

From which it follows that

$$B_j^* = p^2 \left[\frac{1}{N_j} - (1 + \mu_r) \right]$$

Since $1/N_j \leq (1 + \mu_r)$, then borrowing is never optimal ($B_j^* = 0$). Hence, when the central government is able to enforce a hard budget constraint, the first best allocation is achieved.

4.2. State borrowing with soft budget

In the previous section we have shown that if states anticipate that they will not receive further funds from the federal government, they will not borrow. How do the incentives to borrow change if states anticipate that they will face a soft budget constraint? Suppose that state governments can obtain extra-funds in order to repay their debt. In this case, given that the amount of federal and local public goods is bound by the formula, additional funds need to be raised for the bail-out. Therefore, the second period budget constraint of the public sector when the debt born by the two states is pooled is given by:

$$\hat{\tau} y (N_1 + N_2) = p \left[G^* + \sum_{j=S,L} g_j^* \right] + (1 + r)(B_S + B_L)$$

and rearranging we have that

$$\hat{\tau} = \frac{p \left[G^* + \sum_{j=S,L} g_j^* \right]}{(N_S + N_L) y} + \frac{(1 + r)}{(N_S + N_L) y} (B_S + B_L)$$

Remembering that $\tau^* = \left(\left(p \left[G^t + \sum_{j=S,L} g_j^* \right] \right) / (N_S + N_L) y \right)$ and denoting by $\tau_b = ((1 + r)/(N_S + N_L) y)(B_S + B_L)$ the part of the tax that is used for the bail-out, the contribution of each state towards the debt repayment is given by $\tau_b N_j y$. Defining by $\alpha_j = N_j y / ((N_S + N_L) y)$ the share of national income of state j, it is easy to show that each state's contribution towards the repayment of the total debt coincides with its share of national income, i.e.:

$$\tau b N_j y = \alpha_j (1 + r)(B_S + B_L)$$

Hence, state j pays a share α_j of his own debt and of the debt of the other state. Alternatively, $\alpha_j (1 + r) B_j$ is used to pay state j' own debt while $\alpha_{j'}(1 + r) B_j$ is transferred to state j':

$$N_j x_j^2 = (1 - \tau) N_j y - \alpha_j (1 + r) B_j - \alpha_{j'}(1 + r) B_{j'}$$

Given that in the presence of a soft budget constraint the borrowing of the two states is financed with a tax levied on all the residents of the federation, there is the potential for the usual "common pool" problem resulting in an excessive borrowing as compared to the first best. This can be seen by solving the problem of each state with the prospect of a bail-out:

$$\max_{B_j} E \left[N_j \sum_{t=1}^{2} \left(x_j^t - \frac{1}{2}(\bar{G} - G^t)^2 - \frac{1}{2}(\bar{g} - g_j^t)^2 \right) \right] \quad \text{s.t.} \quad pg_j^t = pg_j^* + B_s,$$

$$N_j x_j^1 = N_j (1 - \tau) y, \quad N_j x_j^2 = (1 - \tau) N_j y - \alpha_j (1 + r) B_j - \alpha_j (1 + r) B_{j'}$$

from which it follows that

$$\tilde{B}_j = p^2 \left[\frac{1}{N_j} - \alpha_j(1 + \mu_r) \right]$$

Note that, when $\alpha_j(1 + \mu_r) \geq 1/N_j$ then $\tilde{B}_j = B_j^* = 0$. However, if $\alpha_j(1 + \mu_r) \leq 1/N_j \leq (1 + \mu_r)$, then $\tilde{B}_j > 0$. Hence, when the federal government cannot enforce a hard budget constraint, the state government in the first period may find it optimal to borrow in order to raise the provision of g_j above the first best value, even if that would not be the case under a hard budget constraint. Therefore, it is important to investigate whether the federal government can commit not to implement an hard budget constraint policy.

5. Cost of default and soft budget

When state governments face a hard budget constraint, they do not find it optimal to borrow. Hence, provided that the central government can credibly commit not to provide further funds toward the states' debt repayment, the first best allocation of resources will be achieved. Note that, from an *ex-ante* point of view it is never optimal for the federal government to offer a debt relief which would provide incentives to carry on a debt. However, the credibility of the hard budget crucially depends on whether the central government will face the same incentives not to rescue states *ex-ante* (i.e. before the states have borrowed) and *ex-post* (i.e. after the state have contracted the debt). Suppose that notwithstanding the first period stand of hard budget constraint, states ask in the second period for extra federal transfers to repay their debt. Clearly, whenever the state disposable income is sufficient for the debt repayment, i.e. $(1 - \tau)N_j y \geq (1 + r)B_j$, the federal government can carry on the no-bail-out policy since there is no cost for federation from doing so, or put it differently the maximization of the federation's welfare in the second period does not require a change of the no bail-out policy announced in the first period. However, when the state net disposable income is not sufficient to repay the debt, i.e. $(1 - \tau)N_j y < (1 + r)B_j$, so that in the absence of bail-out the state is forced into a default, then the optimal policy of the federal government might be quite different depending on the consequences of the default. Typically the default involves a cost for the economy of the state and/or of the federation, and when this cost is substantial, the total welfare of the federation in the second period may be higher if a debt relief is offered. In other words, the hard budget constraint, although optimal from an *ex-ante* point of view to prevent state borrowing, might not be optimal from an *ex-post* point of view as it would generate a default that is too costly for the federation. If this is the case, the commitment not to bail-out is not credible and states that anticipate to benefit from debt relief will typically over-borrow. To analyze the relationship between optimal bail-outs and default let us explicitly introduce in our framework a cost of default. Following Alesina and Tabellini (1988) and Sachs (1985), we assume that the income of a defaulting state shrinks by a fraction d, so that its net disposable income is $(1 - \tau - d)N_j y$ with $(1 - \tau - d) \geq 0$. Furthermore, as the two states are different in size, we assume that the default of L (the large state) has a negative impact also on the income of state S and denote by d_{SL} the fraction of income of state S lost when state L defaults. Therefore, for the federation as a whole, the default of state S generates a loss $dN_S y$, while state L's default implies a loss $d_{SL}N_S y + dN_L y$. Suppose also that in case of default, $dN_j y > (1 + r)B_j$ so that states will not find it optimal to default when they have resources available to repay their debt. Remember that, if a state is bailed out, the debt is payed using the revenues of an additional tax levied on the residents of the federation, i.e. the burden of state debt will be shared between the two states.

Clearly, for the bail-out itself to be meaningful it must be the case that when the debt is shared, the following holds:

$$(1 - \tau)N_j y - \alpha_j(1 + r)B_j - \alpha_j(1 + r)B_{j'} > 0$$

In other words, the sharing agreement reduces the contribution of state j towards the repayment of the federation's overall debt level, so that it does not need to default. Clearly, if $(1 - \tau)N_j y - \alpha_j(1 + r)B_j - \alpha_j(1 + r)B_{j'} < 0$ for all j, then the bail-out agreement cannot rescue both states from defaulting on their debt. However, if the bail-out of both states is not feasible, but the bail-out of one of them is possible, then it may be optimal to let only one state default. Remember that the consequences of default for the two states are different because the default of the big state involves a negative externality, while this is not the case for the small state. Hence, suppose that there are enough resources available in the federation to make the bail-out of L feasible, i.e. assume that:

$$(1 - \tau)(N_S + N_L)y > (1 + r)B_L \geq 0$$

Given the stochastic nature of r, the previous inequality is satisfied if and only if $r \leq \bar{r}_L = (((1 - \tau)(N_L + N_S)y)/B_L) - 1$. Clearly, the bail-out is optimal from the point of view of state L and also for the federal government because the total cost of default by both states, $(dN_S y + d_{SL}N_1 y + dN_L y)$, is bigger than the cost of default for the small state alone $(dN_S y)$, which in turn is smaller of the cost of default by the big state only $(d_{SL}N_S y + dN_L y)$. However, as long as $d_{SL} < d$, the small state would prefer to be bailed out at the expense of the big state. Hence, although efficient, the bail-out of the big state is not Pareto-efficient. At the same time, since the bail-out of the big state generates a surplus, then a Pareto-efficient bail-out is possible by compensating the small state with the amount $R = (d - d_{SL})N_S y$ where the transfer R must satisfy the feasibility requirement:

$$(1 - \tau)N_L y - \alpha_L(1 + r)B_L - R \geq 0$$

Hence, to make our analysis interesting, we will assume that there always exists a feasible Pareto-improving bail-out i.e., given that the interest rate is distributed on the support $[0,b]$, we assume that

$$(1 - \tau)N_L y - \alpha_L(1 + b)B_L - R \geq 0$$

Finally, the bail-out option also arises in the asymmetric situation where one state is solvent and the other cannot repay his debt. In these cases, we assume that it is never optimal to bail-out an insolvent small state, while it is optimal to bail-out an insolvent big state, provided that the bail-out operation does not trigger the default of the otherwise solvent small state. Formally, given that the cost of bailing out state j is $\alpha_{j'}(1 + r)B_j$, the cost of default $dN_j y$ and the externality $d_{SL}N_S y$, we assume the following:

Assumption 1. Let $dN_j y < \alpha_{j'}(1 + r)B_j$ for all j, j' and $\alpha_1(1 + r)B_L + dN_S y > d_{SL}N_S y + dN_L y > \alpha_1(1 + r)B_L$ for every $B_j > 0$.

The inequality $dN_j y < \alpha_{j'}B_j$, states that in the absence of the externality, the cost of bail-out is bigger than the cost of default, thereby implying that it is never optimal to bail-out the small state. The term $\alpha_S(1 + r)B_L + dN_S y$ is the loss imposed on state S by a bail-out of state L generating a default of the small state. Hence, the inequality $\alpha_S B_L + dN_S y > d_{SL}N_S y + dN_L y$ states that it is not optimal to carry on a bail our triggering a default of state S, while the condition $d_{SL}N_S y + dN_L y > \alpha_S(1 + r)B_L$ implies that a bail-out that does not trigger default is optimal. For simplicity we assume that the size difference between the two states is such that the bail-out of

Table 1
Optimal bail-out policies

Scenario	Federal government decision
Both states can repay their debt	No bail-out
State L can repay, state S cannot	No bail-out
State S can repay, state L cannot	No bail-out
No state can repay, bail-out of one is feasible	Bail-out of L
No state can repay, none can be bailed-out	No bail-out

the big state always triggers the default of the small one, i.e. $\alpha_S(1 + \hat{r}_L)B_L \geq (1 - \tau^*)N_S y$ for every $B_L > 0$. As a consequence, the federal bail-out will occur only when both states are not able to repay their debt. Table 1 summarizes all the possible scenarios and optimal bail-out policies.

Note that, although from an *ex-ante* point of view it is optimal for the federal government to impose a hard budget constraint on all the members of the federation to prevent them from borrowing, once states have contracted a debt that they cannot repay, the *ex-post* incentives to bail-out are different since the default is costly and its consequences vary depending on the size of the states.[5] Interestingly, the combination of default and bail-out options may change the borrowing incentives faced by the two states, since when total debt cannot be bailed-out, the small state will be forced to default, while the large one might in fact face a soft budget constraint. Because of the externality involved, the default of the large state would damage the entire country, and as consequence the federal government cannot deny the debt relief necessary to avoid this outcome. Furthermore, as the scope for bail-out increases with the externality, states whose default is more detrimental for the federation are more likely to receive the federal bail-out. As the members of the federation anticipate that the *ex-post* incentives faced by the federal government with respect to their bail-out are different, clearly small states will be less willing to borrow than large states. Hence, paradoxically, and consistently with the Brazilian experience, the richest and most fiscally independent states are the ones that are more likely to run fiscal deficit and benefit from the federal largesse.

6. Conclusions

Brazil has been characterized by a long history of sub-national debt crisis.[6] The most recent one has unveiled the danger posed by the excessive borrowing of federal states. In particular, the size of debt accumulated by the states of Sao Paulo, Rio de Janeiro, Minas Gerais and Rio Grande do Sul was such that if those states were to default, the macroeconomic stability of the country would have been under serious threat. As a consequence, those states called for, and obtained federal bail-out of their debt. While the federal government had not much leeway to safeguard the macro-economic stability of the country, in the aftermath of the crisis is was clear that the existing constitutional budgetary provision had failed to prevent excess state borrowing. More importantly, the states that were more heavily indebted were not the most fiscally dependent poor regions, but the rich and fiscally independent ones. The reckless fiscal behavior of the four big debtors is a source of major concern because, beside threatening the economy of the federation, it endangers

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[5] For a pioneering analysis of the soft budget constraint as a commitment problem see Dewatripont and Maskin (1995).

[6] Prior to the most recent crisis of the mid 1990s, two other majors episodes occurred during the 1980s, when states found themselves unable to service their foreign debt, and at the beginning of 1990s.

the redistribution from richer to poorer states, thereby preventing the reduction of the severe regional imbalances that characterize Brazil. To address the failures of the previous constitutional framework, in may 2000 a new fiscal responsibility law was approved with the objective to provide the central government with a credible commitment device to impose a hard budget constraints on federal states. In particular, article 35 of the fiscal responsibility law explicitly forbids bail-out from the federal government of any member of the federation. Furthermore, the law prohibits the exchange of states' debt securities for federal public debt, which was one of the main instrument in past bail-outs episodes. Whether the new provisions will have a positive impact on the fiscal behavior of federal states and on Brazil's inter-states inequalities is an interesting question that only time will answer.

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