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Fiscal Federalism and Soft Budget Constraint: Does the nature of public spending matter?*

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Abstract

This paper analyses the impact of both the nature of regional public spending and the federal government's fiscal tools on the softness of the regional budget constraint and the regional provision of public good. We show that i) whatever the nature of regional public spending, the regional budget constraint is harder when the federal government can no longer manipulate its lump sum tax and ii) under the assumption that the federal government can no longer manipulate its lump sum tax, the federal bailout is lower when the region provides a public input rather than a public good but the regional budget constraint can be either softer or harder.

JEL Classification: E62; H7
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1 Introduction

How does the nature of regional public spending financed by borrowing affect intergovernmental relationships in a federation? Does the implementation of a golden rule harden the budget constraint of subnational jurisdictions? We contribute to this debate by analyzing the effect on the soft budget constraint (SBC) phenomenon of a golden rule, which limits subnational governments' borrowing for financing investment.

In the absence of market discipline borrowing autonomy of subnational governments has been identified empirically as one of the main determinants of the emergence of a soft budget constraint[1] in intergovernmental relationships (Rodden, Eskeland and Litvack (2003)). Swedish municipalities that faced no borrowing restrictions or balanced budget rules were repeatedly bailed out over the period 1974-1992. Petterson-Lidbom and Dahlberg (2003) show that over this period, if the decision maker expected a bailout with a probability of 1 rather than a probability of 0, the municipal debt increased by 13%. Similarly, in Germany in 1992, the federal government's lack of control over the borrowing of the Länder, combined with their low level of autonomy in setting their tax rates, led to the German Constitutional Court's decision to support the Saarland and Bremen's demand for financial assistance from the federal government to cope with their high debt. The recent attempt of the heavily indebted city of Berlin to extract a massive bailout from the federal government indicates the persistence of this evil which threatens Germany's ability to stay within the general government deficit limit imposed by Stability and Growth Pact.

This empirical evidence raises the question of what policies should be introduced to curb the soft budget constraint problem associated with the borrowing autonomy of subnational governments. Apart from reinforcing market discipline and implementing administrative controls, a set of budgetary rules, such as balanced budget rules, can be conceived to reduce the borrowing autonomy of subnational governments. The balanced budget rules currently implemented vary in several dimensions, *i.e.* the budget period (annual or multi-annual) and the target (current budget balance, current budget balance and capital account). As shown by the *OECD Economic Studies* (2005), the golden rule of public finance, which targets the current budget alone and allows subnational governments to borrow only to finance public investment, has become more widespread among countries. To give just one example, it has been implemented in Sweden since 2000. The debate about the performance of the golden rule, which has been particularly intense in Europe with regard to the reform of the Stability and Growth Pact, has been mainly about procyclicity, intergenerational equity, or biases in public spending, but it does not address the issue of the soft budget constraint.

On the theoretical side, few recent papers deal with both public finance and the soft budget constraint. Exceptions are papers by Wildasin (1997), Qian and Roland (1998), Goodspeed (2002) and Köthenburger (2004). A key point of almost all these papers is that

[1] The concept of soft budget constraint was originally introduced by Kornai (1979, 1986) to characterize the opportunistic behavior of state-owned enterprises in socialist economies. These state-owned enterprises distorted their choices *ex ante*, expecting to be rescued by the State *ex post* in the case of financial difficulty. The inability of the State to commit dynamically to not bailing out induced firms to misbehave. This concept has recently been extended to a number of different institutional settings including fiscal federalism. See the survey on the soft budget constraint by Kornai, Maskin and Roland (2003).

the soft budget constraint is formulated in the context of a sequential game where the first move is made by regional governments which generally borrow, the federal government has the second move and, at that point, the costs to the federal government of not providing additional funds may exceed these of providing them. However, the authors give different reasons for the emergence of the soft budget constraint issue. Wildasin (1997) suggests that large sub-national jurisdictions are more likely to be rescued by the federal government than smaller ones, because, if they were to fail, there would be negative externalities for other jurisdictions (here the well-known "too big to fail" argument of the banking literature). Qian and Roland (1998) show that fiscal decentralization, together with tax-base mobility may serve as a commitment device for hardening budget constraints of state-owned enterprises by increasing the opportunity cost of bailouts. However, in their paper the federal government does not act as a player, and the hardness or softness of the budget constraints is derived exogenously. Goodspeed (2002) demonstrates that transfers from higher levels of government to lower ones generally involve a "common pool" effect, since part of the bailout must be paid for through increased taxes and then shared by all the regions. He derives the soft budget constraint bailout behaviour endogenously, but ignores tax interactions among governments, since transfers are financed through an immobile and exogenous tax base. Conversely, Köthenbürger (2004), in a static model, explicitly introduces capital mobility among regional governments. He shows that an *ex post* federal transfer policy results in the internalisation of the impact of interregional tax competition, but does so by bringing in a new source of inefficiency that causes a deterioration in welfare.

Our paper is mainly in line with the paper by Goodspeed (2002). However, unlike in his paper, we assume that (i) there is horizontal tax competition and (ii) the public spending can be either a public good or a public input. We set up a simple model of federal government transfer decisions with inter-temporal regional spending choices when there are horizontal tax externalities. The externalities result from horizontal tax competition among regions aimed at attracting mobile capital. Furthermore, we assume that the public spending in the first period can be either a public good or a public input. The provision of a public good is the most standard choice for modelling. There are few papers that deal with both kinds of public spending and the resulting inefficiency in relation to the optimal composition of public expenditure (the papers by Zodrow and Mieskowski (1986), Keen and Marchand (1997) and Matsumoto (2000)) are exceptions). Our choice of modelling is, however, relevant for at least two reasons. First, our model has connections with recent literature (see Justman, Thisse and van Ypersele (2002, 2004)) which shows that regional governments are likely to compete in terms of the quality of their infrastructures, and that this may have an impact on the intensity of tax competition and then on equilibrium tax rates. Second, in our model we assume that the public input (*e.g* an investment in infrastructure or human capital) is financed by borrowing in the first period, whereas the public good is financed through taxation in the second period. This assumption is clearly in line with the golden rule of public finance and the reform proposals of the European Stability and Growth Pact. In addition it is noteworthy that tax competition models do not use this assumption although it fits nicely with the public accountability rules in most countries, since they assume that both kinds of public spending are financed through taxation.

In our two-period framework, we show that the pattern of public spending crucially influences the softness of the regional budget constraint: the public input provision can limit or even cancel the softness of the regional budget constraint. Furthermore, in line with the standard literature on optimal taxation, we analyze our results with regard to the distortive/non distortive effect of the federal financing of the bailout.

Our paper is organized as follows. Section 2 presents the model and section 3 solves it when a centralization scheme is assumed. In section 4, the main features of the model are presented, in a context of decentralized choices, when a public good is provided in both periods. Section 5 looks at how the introduction of a public input in the first period modifies the previous results. Section 6 concludes.

2 The model

The economy consists of a federation run by a federal government with n identical regions governed by regional governments. Suppose, first, that a regional public good is provided for households in each period.

2.1 Consumers

The representative consumer of each region derives a utility $U(c_{i1}, G_{i1}, c_{i2}, G_{i2})$ from the consumption of the public good (G_{i1}, G_{i2}) and the private good (c_{i1}, c_{i2}) over two periods[2]:

$$U(c_{i1}, G_{i1}, c_{i2}, G_{i2}) = u(c_{i1}) + v(G_{i1}) + c_{i2} + v(G_{i2}) \tag{1}$$

where the utility functions u and v are increasing in every argument, twice differentiable and concave.

In period 1, each representative consumer is endowed with $\bar{w}$ units of the goods that are allocated between private consumption and savings:

$$c_{i1} = \overline{w} - S_i \tag{2}$$

where $S_i = s_i^i + \sum_{j \neq i} s_i^j$ with $s_i^i \geq 0$ and $\sum_{j \neq i} s_i^j \geq 0$. s_i^i stands for investments in the home region while $\sum_{j \neq i} s_i^j$ represents investments made in foreign regions. Savings invested in a region j are remunerated at the before-tax interest rate r_j on which a regional tax τ_j is levied according to the source principle[3].

In period 2, the representative agent consumes the proceeds of her savings plus a rent Π_i earned in her jurisdiction once the lump sum tax Γ has been paid to the federal government:

$$c_{i2} = \sum_{j=1}^{n} (1 + r_j - \tau_j) s_i^j + \Pi_i - \Gamma \tag{3}$$

In this way, we implicitly assume that the consumer owns the firm located in her region.

[2] As Keen and Kotsogiannis (2002), preferences with respect to c_{i2} are linear, this ensures that savings only depend on the net return of capital.

[3] There are two polar principles of inter-jurisdictional taxation: the residence (of the taxpayer) principle and the source (of income) principle. The source principle implies that all incomes originating in a region are taxed in this region regardless of the region of residence of the taxpayers.

2.2 Regional governments

Each regional government aims at maximizing the utility of the representative consumer located in its region. The regional public good (G_{i1}) provided in the first period is financed by an exogenous federal transfer (T_{i1}) and regional borrowing[4] (B_{i1}):

$$G_{i1} = T_{i1} + B_{i1} \tag{4}$$

The region has to maintain a balanced budget over the two periods. As a result, the repayment of the debt reduces the budgetary room for manoeuvre in the second period, *ceteris paribus*. The regional public good[5] (G_{i2}) provided in the second period, and the repayment of the debt, are financed by both a federal transfer (T_{i2}) and the revenue from regional taxation on capital ($\tau_i K_i$):

$$G_{i2} = T_{i2} + \tau_i K_i - (1 + r_i) B_{i1}, \tag{5}$$

where K_i stands for the amount of capital available in region i.

2.3 Federal government

The federal government, which is assumed to be benevolent, maximizes the aggregated utility of citizens $W_i = \sum_{i=1}^{n} U_i$. The transfers granted to the regions in the second period are financed by a lump sum tax Γ, identical in each region:

$$\sum_{i=1}^{n} T_{i2} = n\Gamma \tag{6}$$

2.4 Capital market

$F(K_i)$, the output in region i, is a function of the capital K_i located in this region. The production function is assumed to be monotonously increasing in capital ($\frac{\partial F}{\partial K_i} > 0$) with decreasing marginal product ($\frac{\partial^2 F}{\partial K_i^2} < 0$). All rents arising in region i

$$\Pi_i = F(K_i) - r_i K_i$$

are assumed to accrue to the representative consumer. Firms' profit maximizing behaviour implies the following familiar condition for marginal factor productivity: $F'(K_i) = r_i \ \forall i$, which determines the demand for capital $K_i(r_i)$ in each region i. The demand for capital $K_i(r_i)$, as well as the rents $\Pi_i(r_i)$, are decreasing functions of the interest rate r_i, *i.e.* $\frac{\partial K_i}{\partial r_i} = K_{ri} = \frac{1}{F_{K_i K_i}} < 0$ and $\frac{\partial \Pi_i(.)}{\partial r_i} = \Pi_{ri} = -K_i < 0$.

[4] We assume here that the regional debt is held by foreign investors, however this does not affect the generality of our results.

[5] Contrary to Wildasin (1997) we assume that there are no externalities of production or consumption.

For each region i, the amount of capital K_i equalizes the total amount of savings $\sum_{j=1}^{n} s_j^i$ invested in the region. Capital is mobile across regions without cost so that the capital relocates until it earns the same post-tax return ρ in each region:

$$\rho = r_i - \tau_i = r_j - \tau_j \qquad \forall\ i, j. \tag{7}$$

The amount of savings $S_i(\rho)$, which satisfies the first-order condition $\frac{\partial u}{\partial c_{i1}} = (1+\rho)$ from the consumer's program, increases with this net return ρ, *i.e.* $S_i' = -\frac{1}{\frac{\partial^2 u}{\partial c_{i1}^2}} > 0$.

The capital market clearing condition of the federation

$$\sum_{i=1}^{n} K_i(\rho + \tau_i) = \sum_{i=1}^{n} S_i(\rho)$$

implicitly defines the net return ρ which is a decreasing function of the regional tax rate:

$$\frac{d\rho}{d\tau_j} = \frac{K_{r_j}}{\sum_{i=1}^{n} S_i' - \sum_{i=1}^{n} K_{r_i}} \in [-1, 0].$$

The interest rate consequently moves as follow:

$$\frac{dr_j}{d\tau_j} = 1 + \frac{d\rho}{d\tau_j} \in [0, 1] \text{ and } \frac{dr_j}{d\tau_i} = \frac{d\rho}{d\tau_i} \in [-1, 0]$$

Finally, in line with empirical findings, we postulate that the elasticity of the regional tax base with respect to the regional tax rate, denoted by $\varepsilon_i \equiv \frac{\partial K_i}{\partial \tau_i}\frac{\tau_i}{K_i} = K_{r_i}\frac{dr_i}{d\tau_i}\frac{\tau_i}{K_i}$ belongs to the interval $[-1, 0]$.

3 Centralization as a benchmark case: the hard budget constraint policy

As mentioned by Kornai, Maskin and Roland (2003), "although the intuitive meaning of SBC was reasonably clear from the outset, there is still no consensus on a precise definition". Based on their long discussion about the SBC syndrome, we adopt the following definition: the SBC phenomenon occurs when a "BC-organization" (organization which faces a budget constraint) can manipulate a "S-organization" (solving organization) in order to cover all, or part, of its deficit.

Conversely a "BC organization faces a Hard BC as long as it does not receive outside support to cover its deficit and is obliged to reduce or cease its activity if the deficit persists" (Kornai, Maskin and Roland (2003)). According to this definition, the regional budget constraint is hard, by definition, as soon as the federal government does not react to an increase in the regional borrowing, which is typically the case when there is centralization.

So we assume in a first step that decisions are taken by a benevolent social planner. The SBC phenomenon – linked to the inability of the federal government to refuse to

bailout *ex post* –is totally ineffective in this context. Simultaneous decisions are sufficient to offset the perverse incentives of the regions. By the way, the regional budget constraints are hard.

The social planner maximizes the aggregated utility of citizens located in the federation with respect to the vector of transfers $\mathbf{T}_2$, the lump sum tax Γ, the vector of borrowing $\boldsymbol{B}_1$ and the vector of regional tax rates $\boldsymbol{\tau}$, subject to the budget constraints:

$$\begin{aligned}
& \underset{\mathbf{T}_2,\Gamma,\mathbf{B}_1,\boldsymbol{\tau}}{Max} \quad \sum_{i=1}^{n} \left[u\left(c_{i1}\right) + v\left(G_{i1}\right) + c_{i2} + v\left(G_{i2}\right)\right] \\
& s.t. \\
c_{i1} &= \overline{w} - S_i \\
c_{i2} &= (1+\rho)S_i + \Pi_i - \Gamma \\
\sum_{i=1}^{n} T_{i2} &= n\Gamma \\
G_{i1} &= T_{i1} + B_{i1} \\
G_{i2} &= T_{i2} + \tau_i K_i - (1+r_i)\, B_{i1}
\end{aligned}$$

At the optimum, the sharing of the transfers satisfies the following condition:

$$\frac{\partial v}{\partial G_{i2}} = \frac{\partial v}{\partial G_{k2}} \qquad \forall i,k => \; G_{i2} = G_{k2} \; \forall i,k, \tag{8}$$

and

$$\frac{\partial v}{\partial G_{i2}} = 1 \; \forall i. \tag{9}$$

The social planner allocates the optimal transfers so as to equalize the marginal utilities of the regional public good among the regions. The marginal rate of substitution between the private and the public goods in the second period is equal to unity, which is a common result in the literature on taxation.

Under a hard budget constraint policy, the optimal level of borrowing satisfies the following condition:

$$\frac{\dfrac{\partial v}{\partial G_{i1}}}{\dfrac{\partial v}{\partial G_{i2}}} = (1+r_i).$$

The region's opportunity cost of borrowing is equal to the cost of the debt repayment $(1+r_i)$. Due to the distortive effect of the regional tax competition, the optimal regional tax rate is equal to zero. The public good is optimally provided in the second period and is financed by the non-distortive federal taxation. This outcome will be contrasted with the outcome under a soft budget constraint policy.

4 Budgetary decisions under a SBC policy

4.1 Sequence of budgetary decisions

Each level of government interacts in a two-period model. In the first period, regional governments play as Nash competitors when choosing their level of the public good (G_{i1}) and their level of debt (B_{i1}). They also play a Nash game when choosing their tax rate level (τ_i) and their level of regional public good (G_{i2}) in period 2. Conversely, they play as Stackelberg leaders[6] towards the federal government when determining how much they borrow, whereas they play as Nash competitors with the federal government when choosing their tax rate (τ_i). In other words, the level of the regional debt depends on the credibility of the federal government's commitment not to bail out. Finally, consumers, who are supposed to be immobile, choose their level of savings and consumption. We solve the model by backward induction.

4.2 The incentives to bail out

The federal government maximizes the aggregated utility of citizens located in the federation with respect to the vector of transfers $\mathbf{T}_2$ and the lump sum tax Γ, subject to the budget constraints of consumers, regions and its own budget constraint:

$$\begin{aligned} &\underset{\mathbf{T}_2,\Gamma}{Max} \quad \sum_{i=1}^{n} \left[u(c_{i1}) + v\left(G_{i1}\right) + c_{i2} + v\left(G_{i2}\right)\right] \\ &s.t. \quad (2),\ (3),\ (4),\ (5) \text{ and } (6) \end{aligned}$$

The first-order conditions are equivalent to conditions (8) and (9) of the centralization case. The federal government aims at implementing inter-individual equalization across the whole territory and chooses the lump sum tax such that the marginal rate of substitution between private and public goods equals the unity in the second period.

A key issue of the paper consists in determining the reaction function of the federal government, *i.e.* how it will react in terms of transfers granted to regions in the second period, following an increase in region i's borrowing in the first period. Differentiating the first-order conditions (8) and (9) with respect to T_{i2}, T_{j2} $\forall j \neq i$, B_{i1} and Γ gives

$$\frac{dT_{i2}}{dB_{i1}} = (1 + r_i), \quad \frac{dT_{j2}}{dB_{i1}} = 0 \quad \text{and} \quad \frac{d\Gamma}{dB_{i1}} = \frac{(1 + r_i)}{n}. \tag{10}$$

The federal government is always inclined to increase the region i's second-period transfer, when that region increases its borrowing, in order to help the regional government to repay its debt in the second period ($(1 + r_i)\, dB_{i1}$) while maintaining an optimal level of regional public good in every region. As a consequence, an increase in the regional debt does not tighten the regional budget constraint because the additional cost of the debt repayment is entirely compensated by an extra transfer from the federal government. The inability of the federal government to commit dynamically to not rescuing the region

[6] The fact that the regional governments act as Stackelberg leaders vis-à-vis the federal government creates a favourable environment for the emergence of a soft budget constraint problem.

(because of its aim to equalize marginal utilities of the public good across the territory as a whole) always goes towards softening the regional budget constraint. Once the regional governments have played, the cost of not bailing out $\left(\frac{dT_{i2}}{dB_{i1}} = 0\right)$ is from the federal government's point of view *ex post* higher than the cost of bailing out. Indeed, a rise in the first-period borrowing lowers the regional public good provision *ceteris paribus*, which no longer satisfies the equalization condition in the second period. The bailout is entirely financed by an increase in the federal tax rate levied on consumers. Note that the bailout provided for the region i does not affect the amount of transfers provided for the other regions.

4.3 The opportunistic behaviour of the region

The opportunistic regional policy maker makes its budgetary decisions expecting the federal government to be unable to commit dynamically to not bailing out. The regional Stackelberg leader thus maximizes the intertemporal utility of the representative household taking into account the reaction function of the federal government:

$$\begin{aligned} & \underset{B_{i1},\tau_i}{Max} \quad u(c_{i1}) + v\left(G_{i1}\right) + c_{i2} + v\left(G_{i2}\right) \\ & s.t. \\ c_{i1} &= \overline{w} - S_i \\ c_{i2} &= (1+\rho)S_i + \Pi_i - \Gamma \\ G_{i1} &= T_{i1} + B_{i1} \\ G_{i2} &= T_{i2} + \tau_i K_i - (1+r_i)\, B_{i1} \end{aligned}$$

$$\text{and expecting } \frac{dT_{i2}}{dB_{i1}}, \frac{d\Gamma}{dB_{i1}}.$$

The first-order conditions with respect to τ_i and B_{i1} are respectively:

$$\left[\frac{d\rho}{d\tau_i}S_i - K_i\frac{dr_i}{d\tau_i}\right] - \frac{\partial v}{\partial G_{i2}}\left(\frac{dr_i}{d\tau_i}B_{i1} - K_i - \tau_i K_{r_i}\frac{dr_i}{d\tau_i}\right) = 0 \tag{11}$$

and

$$\frac{\partial v}{\partial G_{i1}} + \frac{\partial v}{\partial G_{i2}}\left[-(1+r_i) + \frac{dT_{i2}}{dB_{i1}}\right] - \frac{d\Gamma}{dB_{i1}} = 0 \tag{12}$$

which boils down to

$$\frac{\partial v}{\partial G_{i1}} = \frac{1}{n}(1+r_i)$$

after integrating the values of $\frac{dT_{i2}}{dB_{i1}}$ and $\frac{d\Gamma}{dB_{i1}}$.

A main point of our paper is to analyze the impact of the soft budget constraint phenomenon on the regional budgetary decisions. We evaluate how the expected reaction of the federal government modifies the regional opportunity cost of borrowing, *i.e.* the

regional incentives to borrow. As shown before, the federal government entirely compensates the additional cost of the debt repayment $(1 + r_i)$ through extra transfers. Thus, the regional government only bears the cost linked to the increase in the federal tax rate. Compared to the centralized case, the opportunity cost of borrowing is much more lower since for decentralized choices, the regional government is able to manipulate B_{i1} and then to share out the cost of the bailout with the other regions.

4.4 Intergovernmental budgetary interactions with a pure redistribution scheme

Suppose now that the federal government is no longer able to manipulate its lump sum tax and that it can only redistribute[7]: transfers granted to some regions are financed by contributions made by the other regions. As a consequence, the condition (9) disappears. Differentiating the first-order conditions (8) with respect to T_{i2}, T_{j2} $\forall j \neq i$ and B_{i1}, summing them and using the federal budget constraint, leads to the following reaction function of the federal government:

$$\frac{dT_{i2}}{dB_{i1}} = \underbrace{(1 + r_i)}_{(A_i)} - \underbrace{\frac{1}{n}(1 + r_i)}_{(B_i)} \text{ and } \frac{dT_{j2}}{dB_{i1}} = -\frac{1}{n}(1 + r_i) \quad \forall j \neq i \tag{13}$$

The federal government is still always inclined to increase the region i's second-period transfer when that region increases its borrowing, but to a lesser extent than previously. The region i is entirely compensated for the additional cost of the debt repayment (A_i) but at the same time bears a part of the financing (B_i) of the bailout as all the regions do. The federal government makes all the regions including i bear the burden resulting from the extra transfer granted to region i. As a result, the larger the number of regions, the higher the bailout granted to the region i and this softens the budget constraint. This result is simply due to the fact that a larger number of regions allows the federal government to finance the bailout from a larger fiscal base and this limits the reduction of transfers to each region. The reallocation mechanism clearly generates negative externalities for the other regions because they contribute to financing the bailout. Note that the regional public good is still equally provided over the whole territory but to a lesser extent than when the federal government was able to manipulate its lump sum tax Γ. The regional public good provided in a region j is now altered by an increase in the region i's borrowing.

The regional marginal cost of borrowing and the marginal cost of public funds respectively become:

$$\frac{\dfrac{\partial v}{\partial G_{i1}}}{\dfrac{\partial v}{\partial G_{i2}}} = \frac{1}{n}(1 + r_i) \tag{14}$$

and

$$\frac{\partial v}{\partial G_{i2}} = \frac{1}{(1 + \varepsilon_i) - \frac{dr_i}{d\tau_i}\frac{B_{i1}}{K_i}} > 1. \tag{15}$$

[7] Germany and Canada, for example, have such a redistribution.

The opportunity cost of borrowing boils down to the part of the bailout financed by the region itself. The larger the number of the regions in the federation, the lower the burden borne by each of them, and this encourages the region i to borrow more than the efficient level. As the federal government will bail out the region and thus compensate most of the cost of the debt repayment, it generates opportunistic behaviour at the regional level.

In addition, the distortive effects of the regional taxation, together with the inefficiently high level of the debt induce an underprovision of the regional public good in the second period.

The ability of the federal government to manipulate its lump sum tax plays a crucial role in the soft budget constraint problem, as stated by the following proposition:

Proposition 1 *When the federal government can no longer manipulate its lump sum tax, it tends to harden the regional budget constraint. The additional cost of the bailout is now financed by a cut in federal transfers to all regions.*

Proof. Directly from equations (10), (12) to (15) ■

5 Provision of a public input

In this section, we consider that a public input (I_i), which increases the marginal productivity of the capital, is produced in the first period instead of the public good, in order to determine the impact of the nature of the public spending on the soft budget constraint problem. This public input can be seen as public infrastructure or human capital.

5.1 Consumers

The utility of the representative consumer in the region i becomes:

$$U(c_{i1}, c_{i2}, G_{i2}) = u(c_{i1}) + c_{i2} + v\left(G_{i2}\right) \tag{16}$$

The expressions of the first-period and second-period private consumption are unchanged.

5.2 Regional and federal governments

In the first period, the regional government now finances a public input (I_i) with the exogenous federal transfer (T_{i1}) and regional borrowing (B_{i1}):

$$I_i = T_{i1} + B_{i1} \tag{17}$$

Note that, according to this budget constraint, the decision to borrow and to produce the public input are strictly linked. In this way, our paper differs from those of Keen and Marchand (1998) or Zodrow and Mieskowski (1986) since the provision of the public input alters the provision of the regional public good in the second period. The regional and federal budget constraints remain unchanged in the second period.

5.3 Capital market

The public input is assumed to increase both the production[8] and the marginal productivity of capital, *i.e.* $\frac{\partial F}{\partial I_i} = F_{I_i} > 0$ and $\frac{\partial^2 F}{\partial K_i \partial I_i} = F_{K_i I_i} > 0$. Rents arising in region i are given by

$$\Pi_i = F\left(K_i, I_i\right) - r_i K_i.$$

The demand for capital resulting from the profit maximization $K_i\left(r_i, I_i\right)$ and the rents $\Pi_i\left(r_i, I_i\right)$ positively depend on the public input, *i.e.* $\frac{\partial K_i}{\partial I_i} = K_{I_i} = -\frac{F_{K_i I_i}}{F_{K_i K_i}} > 0$ and $\frac{\partial \Pi_i}{\partial I_i} = F_{I_i} > 0$.

The capital market clearing condition

$$\sum_{i=1}^{n} K_i\left(r_i, I_i\right) = \sum_{i=1}^{n} S_i\left(\rho\right)$$

allows us to determine

$$\frac{d\rho}{dI_j} = \frac{K_{I_j}}{\sum\limits_{i=1}^{n} S_i' - \sum\limits_{i=1}^{n} K_{r_i}} > 0 \ .$$

The decision sequence of the game remains unchanged. I_i is determined in the first period, together with B_{i1}.

6 Impact of the public input provision on the SBC

6.1 The incentives to bail out

The federal government still maximizes the aggregated utility of citizens located in the federation with respect to both the vector of transfers $\mathbf{T}_2$ and the federal lump sum tax Γ.

$$\begin{aligned}
&\underset{\mathbf{T}_2, \Gamma}{Max} \quad \sum_{i=1}^{n} \left[u(c_{i1}) + c_{i2} + v\left(G_{i2}\right)\right] \\
&s.t. \\
&c_{i1} = \overline{w} - S_i \\
&c_{i2} = (1+\rho) S_i + \Pi_i - \Gamma \\
&\sum_{i=1}^{n} T_{i2} = n\Gamma \\
&I_i = T_{i1} + B_{i1} \\
&G_{i2} = T_{i2} + \tau_i K_i - \left(1 + r_i\right) B_{i1}
\end{aligned}$$

[8] This assumption is based on a review of the empirical evidence on aggregate production relationships that suggests that public infrastructure has, indeed, almost always been found to be complementary to private capital (see Sturn and al (1996)).

The first-order conditions are unchanged, that is, the federal government chooses the allocation of transfers so as to equalize the marginal utilities of the regional public good provision, *i.e.* $\frac{\partial v}{\partial G_{i2}} = \frac{\partial v}{\partial G_{j2}} \Rightarrow G_{i2} = G_{j2} \ \forall i, j$, and the marginal rate of substitution is equal to the unity.

Differentiating the first-order conditions with respect to T_{i2}, T_{j2} $\forall j \neq i$, B_{i1} and Γ, leads to the following reaction function of the federal government following an increase in the region i's borrowing:

$$\frac{dT_{i2}}{dB_{i1}} = (1 + r_i) - \tau_i K_{I_i} + \frac{d\rho}{dI_i}\left[B_{i1} - \tau_i K_{r_i}\right] \tag{18}$$

and

$$\frac{dT_{j2}}{dB_{i1}} = \frac{d\rho}{dI_i}\left[B_{j1} - \tau_j K_{r_j}\right] \tag{19}$$

and

$$\frac{d\Gamma}{dB_{i1}} = \frac{1}{n}\left[(1 + r_i) - \tau_i K_{I_i}\right] + \frac{1}{n}\sum_{j=1}^{n}\frac{d\rho}{dI_i}\left[B_{j1} - \tau_j K_{r_j}\right]$$

Proposition 2 *The funding of a public input rather than a public good through borrowing*
i) increases the amount of the bailout for $\tau_i K_{I_i} < \frac{d\rho}{dI_i}\left[B_{i1} - \tau_i K_{r_i}\right]$
ii) reduces the amount of the bailout for $\tau_i K_{I_i} > \frac{d\rho}{dI_i}\left[B_{i1} - \tau_i K_{r_i}\right]$
The federal government also increases the transfers granted to the other regions in order to compensate the negative externalities arising from the public input provision in the region i.

Proof. Directly from the comparison of (10), (18) and (19). ■

An increase in the public input provision in the region i, unlike the public good provision, generates negative externalities towards the other regions. By increasing the net return of capital ρ, it makes debt repayment higher and reduces the regional tax base in every region. In order to maintain an optimal provision of the regional public good in each region in the second period, the federal government is inclined to provide extra transfers for an amount $\frac{d\rho}{dI_i}\left[B_{k1} - \tau_k K_{r_k}\right]$ to each region k. These extra transfers are entirely financed through a rise in the federal lump sum tax. Compared with the provision of a public good in the first period, an increase in the public input provision can either increase or reduce the amount of the bailout, depending on the comparison between the negative externalities $\frac{d\rho}{dI_i}\left[B_{i1} - \tau_i K_{r_i}\right]$ and the additional amount of fiscal revenues $\tau_i K_{I_i}$.

6.2 The opportunistic behaviour of the region

The regional policy maker takes the budgetary decisions which maximize the intertemporal utility of the representative household, expecting the bailout from the federal government and the associated increase in the federal tax:

$$
\begin{aligned}
& \underset{B_{i1},\tau_i}{Max} \quad u(c_{i1}) + c_{i2} + v\left(G_{i2}\right) \\
& s.t. \\
c_{i1} &= \bar{w} - S_i \\
c_{i2} &= (1+\rho)S_i + \Pi_i - \Gamma \\
I_i &= T_{i1} + B_{i1} \\
G_{i2} &= T_{i2} + \tau_i K_i - (1+r_i)\, B_{i1}
\end{aligned}
$$

$$
\text{and expecting } \frac{dT_{i2}}{dB_{i1}}, \frac{d\Gamma}{dB_{i1}}.
$$

The mechanisms that determine the equilibrium level of the regional tax rate are not altered by the provision of the public input so that the condition (11) still holds. In contrast, the condition which determines the equilibrium level of the borrowing, and thus the public input provision, changes as follows:

$$
\frac{d\rho}{dI_i}S_i + \frac{\partial \Pi_i}{\partial r_i}\frac{d\rho}{dI_i} + \frac{\partial \Pi_i}{\partial I_i} - \frac{d\Gamma}{dB_{i1}} + \frac{\partial v}{\partial G_{i2}}\left[\tau_i K_{I_i} + \tau_i K_{r_i}\frac{d\rho}{dI_i} - \frac{d\rho}{dI_i}B_{i1} - (1+r_i) + \frac{dT_{i2}}{dB_{i1}}\right] = 0 \tag{20}
$$

which boils down to:

$$
\frac{\partial \Pi_i}{\partial I_i} = \frac{d\Gamma}{dB_{i1}} \Longleftrightarrow F_{I_i} = \frac{1}{n}\left[(1+r_i) - \tau_i K_{I_i}\right] - \frac{1}{n}\sum_{j=1}^{n}\frac{d\rho}{dI_i}\left(\tau_j K_{r_j} - B_{j1}\right) \tag{21}
$$

The amount of the regional debt thus depends on the relative extent of the marginal gain in rents ($\frac{\partial \Pi_i}{\partial I_i}$) and the marginal tax cost $\left(\frac{d\Gamma}{dB_{i1}}\right)$ following a change in the regional borrowing.

6.3 Budgetary decisions with a pure redistribution scheme

When the federal lump sum is fixed, the federal government's reaction function to regional borrowing becomes (see appendix for more detailed calculus):

$$
\frac{dT_{i2}}{dB_{i1}} = \left[\frac{(n-1)}{n}\left((1+r_i) - \tau_i K_{I_i} + \frac{d\rho}{dI_i}B_{i1} - \tau_i K_{r_i}\frac{d\rho}{dI_i}\right) + \frac{d\rho}{dI_i}\frac{1}{n}\sum_{j\neq i}\left(\tau_j K_{r_j} - B_{j1}\right)\right]
$$

which gives

$$
\frac{dT_{i2}}{dB_{i1}} = \frac{(n-1)}{n}\left((1+r) - \tau K_I\right) \text{ and } \frac{dT_{j2}}{dB_{i1}} = \frac{-1}{n}\left((1+r) - \tau K_I\right) \tag{22}
$$

in a perfectly symmetric case where the tax rates and the levels of debt are identical ($\tau_i = \tau_j = \tau$ and $B_{i1} = B_{j1} = B_1$).

Proposition 3 *Under the assumption that the federal government can no longer manipulate its lump sum tax, the funding of a public input rather than a public good through borrowing reduces the amount of the bailout. The transfers granted to the other regions are cut in order to finance the bailout.*

Proof. From equations (13) and (22). ■

The federal government is not always willing to bailout the region i when that region increases its borrowing. Its behaviour depends on the relative weight of the increasing cost of the debt repayment and the expected additional tax revenues. As the federal government can no longer use the lump sum tax, the only way to finance the bailout is the redistribution mechanism between regions, which forces the federal government to ask other regions for financing the bailout. If the additional cost of the debt repayment is higher than the additional receipts, the federal government helps the region i to provide a level of regional public good which satisfies its aim of equalization. Otherwise, it reallocates the additional revenues of the region among the federation. Note that, for the particular case of $(1+r) = \tau K_I$, the allocation of transfers is not altered *ex post* by an increase in the region i's borrowing, as it is under a hard budget constraint policy.

At the regional level, the condition (15) is still at work and characterizes an underprovision of the public good. When solving the regional government program with respect to B_{i1}, the marginal cost of borrowing at the symmetric equilibrium becomes:

$$\frac{F_{I_i}}{\frac{\partial v}{\partial G_2}} = \frac{1}{n}\left[(1+r) - \tau K_I\right] - \frac{d\rho}{dI_i}\left(\tau K_r - B_1\right). \tag{23}$$

Proposition 4 *Under the assumption that the federal government can no longer manipulate its lump sum tax, the funding of a public input rather than a public good through borrowing tends to harden (soften) the regional budget constraint for* $\tau K_I < (>) \frac{d\rho}{dI}\left[B_1 - \tau K_r\right]$

Proof. By comparing the terms of the right-hand sides of equations (14) and (23). ■

If the negative impact of the rise in the interest rate ($\frac{d\rho}{dI}\left[B_1 - \tau K_r\right]$) dominates the increase in the regional tax revenues (τK_I), following a rise in the public input provision, the regional budget constraint tends to be harder. This tends to support the idea that a golden rule would increase the soundness of the public finance.

7 Conclusion

The aim of this paper is to study how the nature of public spending affects the softness of the regional budget constraint. More precisely, we aim to evaluate the impact of the golden rule, which targets the current budget alone by allowing regions to borrow only to finance public investments, by using the yardstick of the soft budget constraint problem. We are able to state that, when a public good is provided in each period, the regional budget constraint is always soft. In contrast, the provision of a public input can crucially modify this result, depending on the comparison between the negative impact of the rise in the interest rate and the increase in the regional tax revenues following a rise in the public input provision. As a result, fiscal discipline is altered by the pattern of the public

spending. We also show that, when the federal government can no longer manipulate its lump sum tax for financing the regional transfers, the regional budget constraints tend to be harder.

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9 APPENDIX

1) Let us consider the $(n-1)$ first-order conditions of the federal government's program for the region i:

$$G_{i2} = G_{j2} \quad \forall j \neq i$$

Differentiating these first-order conditions (FOCs) with respect to T_{i2}, T_{j2} $\forall j \neq i$ and B_{i1} leads to

$$\frac{\partial}{\partial T_{i2}}\left[G_{i2} - G_{j2}\right] dT_{i2} + \frac{\partial}{\partial T_{j2}}\left[G_{i2} - G_{j2}\right] dT_{j2} + \sum_{l \neq i \neq j} \frac{\partial}{\partial T_{l2}}\left[G_{i2} - G_{j2}\right] dT_{l2} + \frac{\partial}{\partial B_{i1}}\left[G_{i2} - G_{j2}\right] dB_{i1} = 0 \quad \forall j \neq i$$

Summing these expressions gives:

$$(n-1)\frac{\partial}{\partial T_{i2}}\left[G_{i2}\right] dT_{i2} + \sum_{j \neq i} \frac{\partial}{\partial T_{j2}}\left[-G_{j2}\right] dT_{j2} + (n-1)\frac{\partial}{\partial B_{i1}}\left[G_{i2}\right] dB_{i1} + \sum_{j \neq i} \frac{\partial}{\partial B_{i1}}\left[-G_{j2}\right] dB_{i1} = 0$$

$\Leftrightarrow$

$$(n-1)\, dT_{i2} - \sum_{j \neq i} dT_{j2} + (n-1)\left[\tau_i K_{I_i} + \tau_i K_{r_i}\frac{d\rho}{dI_i} - \frac{d\rho}{dI_i} B_{i1} - (1 + r_i)\right] dB_{i1} - \sum_{j \neq i}\left[\tau_j K_{r_j}\frac{d\rho}{dI_i} - \frac{d\rho}{dI_i} B_{j1}\right] dB_{i1} = 0$$

$\Leftrightarrow$

$$dT_{i2} = \left((1 + r_i) - \tau_i K_{I_i} - \tau_i K_{r_i}\frac{d\rho}{dI_i} + \frac{d\rho}{dI_i} B_{i1} + \frac{1}{(n-1)}\sum_{j \neq i}\left(\tau_j K_{r_j}\frac{d\rho}{dI_i} - \frac{d\rho}{dI_i} B_{j1}\right)\right) dB_{i1} + \frac{1}{(n-1)}\sum_{j \neq i} dT_{j2}$$

By differentiating the federal government's budget constraint (6), given a fixed Γ, we obtain:

$$\frac{n}{n-1} dT_{i2} = \left((1 + r_i) - \tau_i K_{I_i} - \tau_i K_{r_i}\frac{d\rho}{dI_i} + \frac{d\rho}{dI_i} B_{i1} + \frac{1}{(n-1)}\sum_{j \neq i}\left(\tau_j K_{r_j}\frac{d\rho}{dI_i} - \frac{d\rho}{dI_i} B_{j1}\right)\right) dB_{i1}.$$