Are Hard Budget Constraints for Sub-National Governments Always Efficient?*

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Abstract

In fiscally decentralized countries, sub-national governments (SNGs) may face soft budget constraints and consequently invest and borrow too much. The policy literature claims that, with competitive capital markets and central governments imposing hard budget constraints (HBCs), inefficient investment by SNGs should not arise. We present a model where this is not the case: HBCs can be too "hard" and discourage investment that is socially efficient. The model combines a dynamic commitment problem as in Kornai, Maskin and Roland (2004) for central government with a moral hazard problem between central and SNG. The HBC over-incentivises the SNG to provide effort by penalizing it too much for project failure, thus leading ultimately to the possibility that socially efficient projects may not be undertaken.

Keywords: Fiscal federalism - Bailouts - Hard budget constraints.

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1 Introduction

Fiscal decentralization, the allocation of tax and spending powers to lower levels of government, is now an established policy objective, in many developed and developing countries. Moreover, it is actively promoted as a development strategy by organizations such as the World Bank (Azfar et al. (2001), World Bank (2000)). The usual advantages that are claimed for decentralization that one can find in the literature include the following (Azfar et al. (2001), Oates (1999)). First, decentralization is claimed to improve *allocative efficiency*, in the sense that the goods provided by governments in localities will be better matched to the preferences of the residents of those localities. Second, decentralization is argued to increase the *accountability* of government. There is now a growing theoretical and empirical literature[1] evaluating these claims.

However, it is increasingly claimed that one of the costs of fiscal decentralization is that central government may lose control over aggregate government borrowing. In particular, it is thought that if subnational governments (henceforth regional governments, RGs) face soft budget constraints[2], they will have an incentive to over-borrow, and/or pay insufficient attention to the quality of the investments that their borrowing finances. For example, Ter-Minassian, Albino-War, and Singh (2004) say; "Over the last two decades, the deepening of the decentralization process has resulted in many countries in a significant increase in subnational public expenditure and debt."

The "common pool" mechanism by which over-borrowing can occur has also been explored quite thoroughly in the academic literature (for example, Wildasin (1997) and Goodspeed (2002)). The commitment of central government (CG) to bail out RGs who cannot pay creates a negative externality if - as is usual - the cost of bailout is met through increases in taxes or reductions in spending nationally: other regions will partially finance one region's bailout. In turn, this induces excessive borrowing initially.

However, in both the existing academic and policy literature, it is universally assumed that because of this externality, a hard budget constraint (HBC) for RG is always desirable. Indeed, much of the literature is concerned with the design of institutional mechanisms that will harden the budget constraint (Rodden, Eskeland, and Litvack (2003)). It is the purpose of this paper to take issue with this presupposition; we would argue that in some circumstances, a HBC is too "hard".

[1] The theoretical literature evaluating the preference-matching argument includes Alesina and Spolaore (1997), Besley and Coate (2003), Ellingsen (1998), Lockwood (2002), Oates (1972), and Wallis and Oates (1988), while empirical contributions are fewer, but include Oberholzer-Gee and Strumpf (2002) and Faguet(2004).

Theoretical analysis of the accountability argument includes Seabright (1996) and Bardhan and Mookherjee (1998, 2000). Emprical contributions include Fisman and Gatti (2000), Galiani, Gertler and Schargrodsky (2004), Hutter and Shah (1998), Melo and Barenstein (2001), and Treisman (2002).

[2] Probably the best general definition of a soft budget constraint (SBC) is that of the survey by Kornai, Maskin and Roland (2004) in the Journal of Economic Literature: "A budget-constrained organization faces a hard budget constraint (HBC) as long as it does not receive support from other organizations to cover its deficit and is obliged to reduce or cease its activity if the deficit persists. The SBC phenomenon occurs if one or more supporting organizations are ready to cover all or part of the deficit."

Our argument is the following. First, *by definition*[3], a HBC necessarily implies that "bad" investment projects will be terminated, when ex post, it would be desirable to continue them though additional financing. Now suppose that by exerting some effort, RGs can lower the probability that projects are "bad". Then, with a HBC, RGs are over-incentivised to provide effort, as the payoff to the RG in the event of a bad project is excessively low. Thus, effort exerted may be inefficient. More importantly, when this is the case, some projects will not be initiated in the first place, even when it is efficient to do so. So, a HBC may lead to *underinvestment*.

In more detail, in our model, RGs have the option of choosing to initiate a discrete project or not. The initial cost of the project is covered by the financial resources of the RG e.g. tax revenue. The project may be good or bad. The probability that the project is bad is determined by effort expended by regional government, once the initial investment in the project is made. Effort may be high, in which case the project is always good, or low, in which case the project is bad with a positive probability.

If it is good, it immediately generates a non-monetary benefit for the region greater than the cost. If it is bad, it generates no benefit unless additional resources are invested. If these resources are invested, the project pays a non-monetary benefit to the region greater than the additional resource cost, but less than the total resource cost. Thus, there is a *dynamic commitment problem.* The effort of RG, and the resulting type of project in any region (good or bad) may be observable by central government (or CG), but is not verifiable, in the sense that central government cannot condition any incentive scheme for RG on these variables.

Our precise definition of HBC and SBC in this setting is as follows. It is assumed that at the point at which a bad project needs to be refinanced, neither regional nor central government have any tax revenues available, but the RG can borrow from a competitive banking sector. When the loan is due for repayment, only central government has the fiscal capacity to make the repayment, by levying a national income tax. A SBC is in place when (i) CG allows the RG to borrow *and* (ii) it is willing to repay any loans by levying an income tax. A HBC is in place[4] when *either* (i) CG forbids the RG to borrow (rules-based HBC) *or* (ii) the CG precommits not to repay any loans incurred by RG (market discipline HBC).

In this setting, with a SBC, local governments have insufficient incentives to put in high effort (effort too low) for project implementation, and also may initiate projects when it is inefficient to do so ("too many" projects), because the cost of refinancing a bad project is shared with other regions though the tax system. This point is well-understood and has

[3] As stressed by Kornai, Maskin and Roland (2004), a *dynamic commitment problem* (where ex ante, bad projects are undesirable, but ex post, it is efficient to refinance them) is a necessary condition for a SBC to be inefficient, and thus for there to be a SBC problem in the first place.

[4] This follows Ter-Minassian (1997), who makes the distinction between a *rules-based* and *market discipline* HBCs. The first is the imposition of rules on borrowing, ranging from an outright ban on borrowing by RG, to weaker restrictions, such as borrowing only to fund investment, or imposing a maximum debt-service to income ratio. The second involves giving RGs free access to capital markets, along with precommitment by central government not to repay any loans incurred by RGs that RGs are unable or unwilling to repay (see also Lane (1993)).

been argued formally e.g. by Wildasin (1997).

Our new point, as mentioned above, is that with a HBC, local governments have excessively strong incentives to put in high effort (effort too high), and also may not initiate projects when it is efficient to do so ("too few" projects). The reason is the following. Once a project turns out to be bad, it is ex post efficient to complete it. But, with a HBC, the bad project is terminated. Thus, with a HBC, the net benefit to a region from a bad project is inefficiently low. Thus, the RG government has too high an incentive to put in high effort. In turn, this implies that a project may give the RG a negative payoff (taking into account the cost of effort) even when its true social benefit is positive. This key point is made via a numerical example in the next section.

Related literature is discussed more fully below, but here it is worth pointing out that our results are related to, but also distinct from, the literature on rules vs. discretion[5]. In that literature, a policy variable can be set by government either *ex ante* i.e. before the realisation of some stochastic shock or *ex post*. An ex ante setting (a policy rule) has the disadvantage that it cannot be conditioned on the shock (lack of flexibility) but the advantage that it prevents a sub-optimal response by either the private sector or a lower level of government (precommitment). In our model, a HBC (SBC) could be interpreted as a rule (discretion). It is certainly true that a HBC is inflexible, as it prevents an ex post optimal response in the event of a bad shock i.e. if the project turns out to be bad. But, the HBC does *not* induce an efficient response by RG - effort will generally be too high.

The layout of the remainder of the paper is as follows. Section 2 has a numerical example. Then, Section 3 presents the model and the efficient benchmark. Section 4 contains the main results, Section 5 considers full centralization and decentralization as solutions, and Section 6 concludes.

2 An Example

The key point of this paper can be illustrated by a simple example. We deliberately keep the example general so as to emphasize that our point has applications outside fiscal federalism. Consider an "agent" (here, the RG) who can choose an initial binary investment in a project at cost 1. The agent then can choose a low effort level (normalized to zero) or a high effort level (normalized to 1). The cost of low effort is zero to the agent, whereas the cost of high effort is 0.8. If effort is high, the project immediately realises a benefit of 2 with probability 1. If effort is low, the project realises a benefit (for the agent) of 2 with probability 0.5, and no benefit with probability 0.5. However, in this event (i.e. if the project turns out to be "bad") if an additional investment of 1 is made, a benefit of 1.5 for the agent is then realized.

The principal (here, the central government) only has the role of deciding whether to allow an additional investment to be made. If he does (does not) we say that there is a soft (hard) budget constraint. Finally, for consistency with the more general model that follows,

[5]A paper on fiscal federalism that fits much more into the rules vs. discretion framework is Sanguinetti and Tommasi (2004). See Section 6 below.

we suppose that the cost of the additional investment is shared equally between the principal and agent.

Consider first what the efficient investment and effort, and refinancing decision is. First, if effort is high, the payoff is 2. If effort is low and the project turns out to be bad, refinancing is ex post efficient, in which case the expected payoff is $0.5 \times 2 + 0.5 \times (1.5 - 1) = 1.25$. So, the gain to high effort over low is 0.75, which is less than the cost of effort. So, low effort is efficient. Given that low effort is efficient, the ex ante payoff to the project (when the decision about initial investment is made) is 1.25, greater than the initial cost. So, initial investment in the project is efficient.

Now consider the outcome with a hard budget constraint. First, if effort is high, the payoff is 2. If effort is low and the project turns out to be bad, refinancing is impossible, in which case the expected payoff is $0.5 \times 2 + 0.5 \times 0 = 1$. So, the gain to high effort over low is 1, which is greater than the cost of effort. So, high effort will be chosen. Given this, the ex ante payoff to the project (when the decision about initial investment is made) is $2 - 0.8 = 1.2$, greater than the initial cost. So, initial investment in the project will occur. So, we see that a hard budget constraint induces an effort distortion (too much effort) because the payoff to the "bad" project is "too low". This is because the HBC does not allow continuation of the bad project, replacing a payoff of 0.5 with one of 0.

There is also another possible consequence of the HBC. Suppose now the initial cost of the project increases from 1 to 1.23. Then, it is still efficient to undertake the project, but in equilibrium with the HBC, the project will not be initiated, as the expected payoff from doing so is $1.2 < 1.23$. So, the inefficiency generated by the HBC may be in the form of *excessive effort or underfunding of projects*.

Note here that there is nothing unusual or pathological about our definition of the HBC - it is exactly[6] as in Kornai, Maskin and Roland (2004). Note however, that although our definition of the HBC is effectively identical to that of Kornai, Maskin and Roland (2004), our findings about the economic consequences about the HBC are rather different. At the heart of their model (which encompasses a number of special cases already in the literature), there is a problem of *hidden information*; the agent has the authority to choose projects, and he knows which are good and which are bad, whereas the principal does not. In that setting, a HBC always restores efficiency, as it deters the agent from choosing a bad project.

By contrast, in our model, there is a problem of *hidden action*: the principal would like to incentivise the regional government to put in high (or low) effort in certain situations (see Proposition 1 below), but cannot offer an explicit incentive contract to achieve this. The choice of HBC or SBC is too blunt an instrument to correctly incentivise the agent.

Of course, if the principal could make explicit payments to the agent conditional on the project outcome, as in the classical principal-agent literature, then efficiency could be restored. For example, if the principal could combine the SBC with a penalty if the project turned out to be bad, then the penalty can be set so that effort will be efficient: this is discussed in more detail below. But if payments conditional on project outcomes are possible,

[6]Here, the budget-constrained organization is regional government, and the supporting organization is central government.

then the distinction between hard and soft budget constraints disappears. Moreover, these payments are not observed in practice between CG and RGs.

3 The Model

3.1 Preliminaries

The model has three periods $t = 0, 1, 2$ and two regions, $i = a, b$. Each region has a continuum of residents of measure 1. In the last period, each resident derives utility from consumption of a numeraire good, which is produced in either region from labor input by competitive firms using a constant-returns technology, where units are chosen so that one unit of labor produces one unit of output. So, the wage is fixed at unity. Each resident is endowed with one unit of labor which it can supply to firms in that region. Residents may also benefit from public projects provided by the regional government. There are two levels of government, central (CG) and regional (RG). There is no discounting of future payoffs.

3.2 The Order of Events

The order of events, and relevant features of the model in more detail, are as follows.

$t = 0$

1. The central government decides whether to set a SBC or a HBC. A SBC is in place when (i) CG allows the RG to borrow *and* (ii) it is willing to repay any loans by levying an income tax. A HBC is in place when *either* (i) CG forbids the RG to borrow (rules-based HBC) *or* (ii) the CG precommits not to repay any loans incurred by RG (market discipline HBC).

$t = 1$

1. The regional government of i chooses whether or not to finance a project in its region, by making an investment of c of the numeraire good. Without any real loss of generality, we assume that regional government of i has an initial endowment of only c, so that any additional investment will need to be externally financed.

2. If the project is initiated, the regional government exerts effort $e_i \in \{0, \Delta\}$ on its implementation. If region i exerts effort $e_i = \Delta$, the project will be good. If $e_i = 0$, the project is good with probability p and bad with probability $1 - p$.

$t = 2$

1. The project type (good or bad) in region i is revealed to the regional government of i and the central government. If the project in region i is good, it generates a non-financial benefit for all the residents of region i of b_g. If the project is bad, it generates no benefit at this date, but requires an additional input of c in order to be completed.

2. If a SBC has been set, finance is provided[7] by a competitive banking sector, comprising profit-maximising, risk-neutral banks, with free entry into the sector. A bank $k \in N = \{1, 2, ..n\}$ offers a loan c to finance the project continuation and demands repayment r_i^k. Then, competition among banks, plus no discounting, will ensure that $r_i^k = c$. The regional government either borrows to finance continuation, or chooses not to continue with the project. If the project is terminated, the payoff to the project is zero. If continued, the bad project pays a non-financial benefit for all the residents of region i of b_b.

If a HBC has been set, the project is terminated.

3. If a SBC has been set, the central government sets an income tax at rate τ to finance the total repayment r of the loans taken out by the regional governments, if any. Following an extensive literature, the central government is assumed to set a *uniform* tax rate in both regions i.e. $\tau = \tau^a = \tau^b$. As the total tax base is simply the aggregate pre-tax wage bill of 2, the budget constraint of the central government is $2\tau = r$.

The timing and structure of the model are depicted in Figure 1.

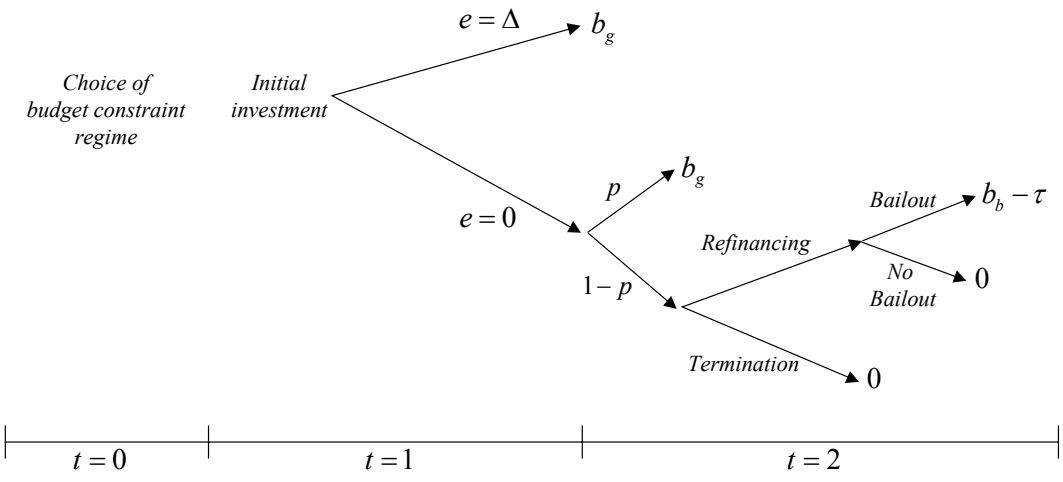

Figure 1: Timing and structure of the model

For the rest of the paper, we concentrate our attention on projects satisfying

$$0 < \frac{b_b}{2} < c < b_b < b_g$$

These inequalities imply that the projects we deal with are such that the central government faces a dynamic commitment problem if no effort is made: that is, a bad project is inefficient

[7]Note that with a market discipline HBC, the RGs are free to borrow from the banking sector, but the banks are unwilling to lend, as the rationally anticipate not being repaid.

ex ante, but one initiated, it is ex post efficient to refinance it. Moreover, the project yields higher benefits if it is done with effort than if it is undertaken with no effort and refinanced. We can interpret this lower benefit as the consequence of the delay in finishing the project. We also assume that projects are identical between regions. By identical projects we mean: same cost c, same values of benefits (b_b, b_g), same cost of effort and same probability of having a bad project after no effort.

Throughout, we assume that governments are benevolent i.e. both regional and central governments maximize the sum or average of the welfares of the residents of their jurisdictions, minus the cost of effort (if any). For simplicity, we take the cost of effort e to be e itself.

3.3 Discussion

There are four decisions that either level of government must make in this model: whether to finance the project at the beginning of $t = 1$, the effort to be expended on project implementation, whether to continue the project (given the menu of loans on offer from the banks) and the setting of the taxes at the end of $t = 2$.

In the model exposited above, we have assumed that regional governments make initial investment decisions and project implementation and central government authorizes the continuation borrowing and makes the tax decision. This describes the situation in many countries very well. For example, in a detailed survey of fifteen countries, Ter-Minassian, Albino-War, and Singh (2004) found that in seven of them, regional governments had (at some time) been subject to centrally imposed fiscal rules on debt, borrowing, etc. So, it is a widely observed practice for governments to constrain the borrowing of sub-central government: this corresponds to our definition of the HBC. Also, in most of the remaining countries, borrowing limits of sub-national government have been cooperatively negotiated with central government, and in many cases, enforced by market-based discipline. In our model, ex post i.e. once the project is initiated, national and regional governments have the same preferences vis-à-vis project continuation, so cooperative bargaining (more of less however it is modelled) would lead to a decision to continue the project i.e. a SBC. We call this scenario *divided government* and it will be the focus of our analysis. Other forms of government are considered in Section 6 below.

3.4 The Efficient Policy

Consider a social planner who can make all the decisions that are above divided between the two levels of government i.e. (i) whether to undertake the project initially; (ii) the level of effort for project implementation in either region, and (iii) can decide whether to continue the bad project after the first period or not. If continuation is chosen, it must be financed by borrowing from a bank. We assume that the social planner has the same objective as that of central government i.e. the sum of the welfares of the two regions, and moreover, the social planner is assumed to face the same informational constraint as central government and regional government i.e. he observes the project quality only after effort is chosen.

Solving the social planner's decision problem backward, first, note that given that a bad project cannot be identified until the project is funded and effort is exerted, continuation is always better, as $b_b > c$. The net social benefit from a high level of effort in either region is therefore $W_h^* = b_g - \Delta$. The net social benefit from no effort depends on whether a bad project is terminated or continued. So, as the project will be continued, the return from a low level of effort in either region is

$$W_l^* = pb_g + (1-p)(b_b - c)$$

Effort is optimal if $W_h^* \geq W_l^*$ which holds if

$$\Delta \leq (1-p)(b_g + c - b_b) = \Delta^*$$

One can see that the threshold Δ^* increases with the cost of refinancing a bad project. When this cost c increases, it is efficient to exert effort even for higher levels of the cost of effort. The reason is that the social planner prefers to exert effort in order to generate a good project and thus to prevent the second round of financing.

Finally, we consider the decision whether to initiate the project.[8] Note that when $\Delta \leq \Delta^*$: the social planner undertakes the project if $\Delta \leq b_g - c$, and when $\Delta > \Delta^*$: the social planner undertakes the project if

$$c \leq \frac{pb_g + (1-p)b_b}{2-p} = c^*$$

To summarise:

Proposition 1. *If $\Delta \leq \min\{\Delta^*, b_g - c\}$, investment and high effort are efficient in both regions. If $\Delta > \Delta^*$ and $c \leq c^*$ investment and low effort are efficient in both regions. Otherwise, no investment in either region is efficient.*

The efficient project choice, plus choice of effort is depicted in the following figure.

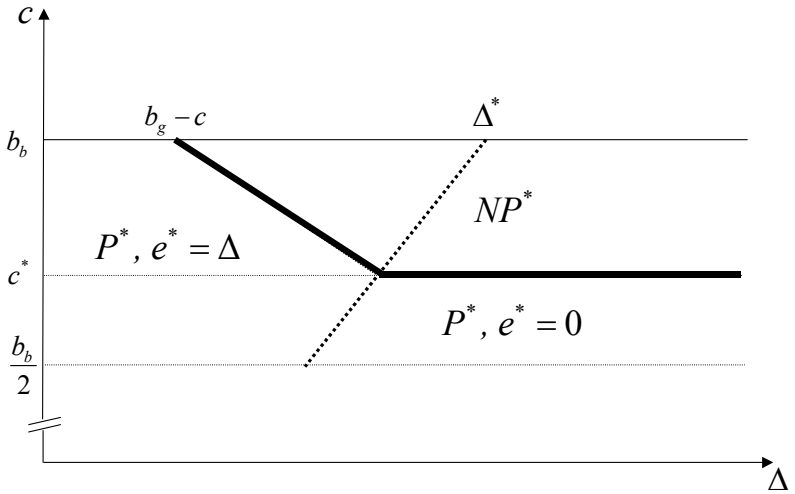

Figure 2: Efficient project and effort choice

[8] Recall that the initial investment is paid with initial resources.

Each point in this graph represents a project, characterized mainly by the values of Δ and c. To draw this figure, we have assumed that $pb_g < b_b$.[9] So $c^* \in \left(\frac{b_b}{2}, b_b\right)$. The bold line separates the parametric areas where projects are undertaken (denoted by P^* in the figure) or not undertaken (denoted by NP^*). On the one hand, when $b_g - c < \Delta < \Delta^*$ and $c \in [c^*, b_b]$, projects are not undertaken (in spite of the fact that they will be good because effort should be made) because their net benefit is below the opportunity cost of keeping the initial resources that can be used for private consumption. On the other hand, when $\Delta > \Delta^*$ and $c \in [c^*, b_b]$, projects are not undertaken because the cost of two rounds of financing is above their benefit.

4 Divided Government

In this section, we analyse the model when government is divided. At this stage, we are taking the form of the budget constraint (hard or soft) as fixed. This generates two different games.

4.1 A Soft Budget Constraint

We solve the game backwards. We will initially assume that both regions initiate projects. The final event is that central government sets a tax to finance total loan repayments, which are $r = (I_a + I_b)c$, where $I_i = 1$ if the project in region i is bad and $I_i = 0$ otherwise. Recalling that $2\tau = r$, we see that

$$\tau = \frac{c}{2}[I_a + I_b] \tag{1}$$

i.e. the resident of either region only pays half the cost of additional financing of a bad project in his region, as this cost is shared though a national tax.

So, conditional on project realizations I_a, I_b, the utility of a resident of region i in equilibrium is

$$\begin{aligned} u_i &= (1 - I_i)b_g + I_i b_b - \tau \\ &= \begin{cases} b_g - \frac{c}{2} I_j & \text{if } e_i = \Delta \\ (1 - I_i)b_g + I_i b_b - \frac{c}{2}[I_i + I_j] & \text{if } e_i = 0 \end{cases} \end{aligned} \tag{2}$$

where in the second line, we have used the formula for τ in (1) above, and also the fact that $I_i = 1$ is impossible if $e_i = \Delta$. Note the *fiscal externality* generated by the aggregate budget constraint: u_i depends negatively on the possibility of a bad project in region j ($I_j = 1$), as each region only bears a fraction (in this case half) of the cost of bailout.

We are now in a position to analyse equilibrium effort choice by each region. Now, let $u_i(e_i, e_j)$ be the expected present value of utility to a resident of region i from choice of effort

[9] This assumption is only made for the sake of expositional purposes. Our main result does not depend upon it.

levels $e_i, e_j \in \{0, \Delta\}$. From (2), it follows immediately that:

$$u_i(\Delta, \Delta) = b_g \tag{3}$$

$$u_i(0, \Delta) = pb_g + (1-p)(b_b - \frac{c}{2}) \tag{4}$$

$$u_i(\Delta, 0) = b_g - (1-p)\frac{c}{2} \tag{5}$$

$$u_i(0, 0) = p^2 b_g + p(1-p)(b_g - \frac{c}{2}) + (1-p)p(b_b - \frac{c}{2}) + (1-p)^2(b_b - c) \tag{6}$$

These can be explained as follows. First (3) follows because if both regions choose high effort, both projects are good and each region gets total benefit b_g and $\tau = 0$. Second, (4) follows because if region i puts in low effort, but region j puts in high, it gets a good project with probability p; otherwise, with a bad project, it gets non-pecuniary benefit b_b, and from (1), $\tau = \frac{c}{2}$. Third, (5) follows because if region i puts in high effort, but region j puts in low effort, it gets a good project with probability 1, but with probability $1-p$ the project in region j is bad, in which case $\tau = \frac{c}{2}$. Fourth, (6) follows as the aforementioned possibilities can all occur in this case, plus the possibility that both projects are bad, in which case each region gets net benefit $b_b - c$.

From these expressions, it is easily calculated that

$$u_i(\Delta, \Delta) - u_i(0, \Delta) = u_i(\Delta, 0) - u_i(0, 0) = (1-p)(b_g - b_b + \frac{c}{2})$$

So, for either region, it is a dominant strategy to put in effort in project implementation, if

$$\Delta \leq (1-p)(b_g - b_b + \frac{c}{2}) = \Delta^{SBC}$$

and no effort otherwise, conditional on the project having been initiated.

Now we turn to the project initiation decision. Denote by $d_i \in \{0, 1\}$ the decision adopted by the regional government of region i, where 1(0) means investment (no investment). Let $v_i(d_i, d_j)$ be the expected present value of utility to a resident of region i from choice of investment $d_i, d_j \in \{0, 1\}$.

When $\Delta \leq \Delta^{SBC}$, the government of region i anticipates that both regions will exert effort if projects are initiated. So

$$v_i(1, 1) = v_i(1, 0) = b_g - \Delta, \;\; v_i(0, 1) = v_i(0, 0) = c \tag{7}$$

These can be easily explained because as both regions exert effort if investment is made, no bailout will be necessary and so there is no fiscal externality. Therefore, from (7), we have:

$$v_i(1, 1) - v_i(0, 1) = v_i(1, 0) - v_i(0, 0) = b_g - \Delta - c$$

So, for either region is a dominant strategy to invest if $\Delta \leq b_g - c$.

Now suppose that $\Delta > \Delta^{SBC}$. Now, the government of region i anticipates that both regions will exert low effort if investment is made. So

$$v_i(1,1) = p^2 b_g + p(1-p)(b_g - \frac{c}{2}) + (1-p)p(b_b - \frac{c}{2}) + (1-p)^2(b_b - c) \tag{8}$$

$$v_i(0,1) = -(1-p)\frac{c}{2} + c \tag{9}$$

$$v_i(1,0) = pb_g + (1-p)(b_b - \frac{c}{2}) \tag{10}$$

$$v_i(0,0) = c \tag{11}$$

These can be explained as follows. First (8) follows because if both regions invest, they will afterwards choose no effort. So both projects can be either good (in which case no bailout is needed) or bad (so a bailout is needed) ; therefore all possibilities may occur. Second, (9) follows because if region i does not invest but region j does, region i will bear the cost of a bailout in j with probability $(1-p)$. Third, (10) follows because if region i invests, it gets a good project with probability p, but with probability $(1-p)$ the project is bad, in which case a bailout will be needed. Fourth, (11) follows immediately. Therefore

$$v_i(1,1) - v_i(0,1) = v_i(1,0) - v_i(0,0) = \frac{2[pb_g + (1-p)b_b]}{3-p} - c$$

So, for either region is a dominant strategy to invest if

$$c \leq \frac{2[pb_g + (1-p)b_b]}{3-p} = c^{SBC}$$

So, we have established the following characterization of the SBC equilibrium:

Proposition 2. *If $\Delta \leq \min\{\Delta^{SBC}, b_g - c\}$, investment occurs, and high effort is supplied in both regions. If $\Delta > \Delta^{SBC}$ and $c \leq c^{SBC}$ investment occurs, and low effort is supplied in both regions. Otherwise, there is no investment in equilibrium in either region.*

The equilibrium project choice, plus choice of effort is depicted in the following figure.

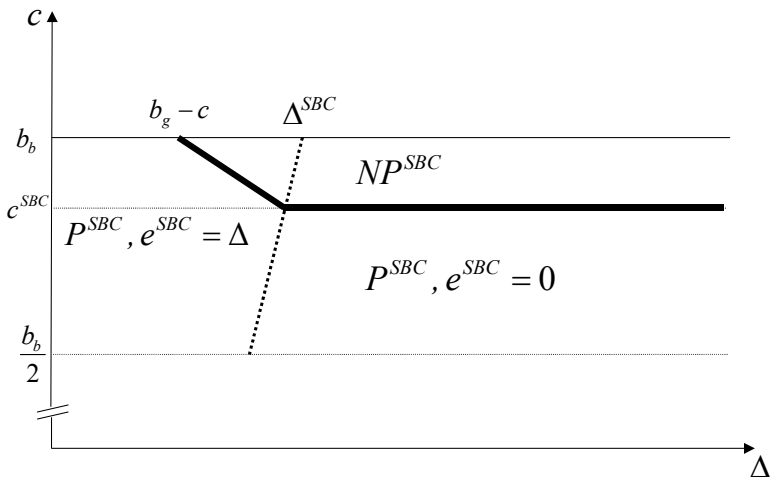

Figure 3: Equilibrium project and effort choice under SBC

Comparing Propositions 1 and 2, and in particular, comparing critical values Δ^*, Δ^{SBC} and c^*, c^{SBC}, and noting that $c^{SBC} > c^*$, $\Delta^* > \Delta^{SBC}$, we can establish the following

Proposition 3. *If the SBC equilibrium is inefficient, the inefficiency takes one of the following two forms: either (i) investments are made in equilibrium when it is inefficient to do so; or (ii) investments are made in equilibrium and are efficient, but low effort is supplied when it is efficient to supply high effort.*

Thus with a SBC, inefficiency involves either *oversupply of projects*, or *undersupply of effort*. This Proposition is most easily proved with reference to Figure 4, which superimposes Figure 3 on Figure 2.

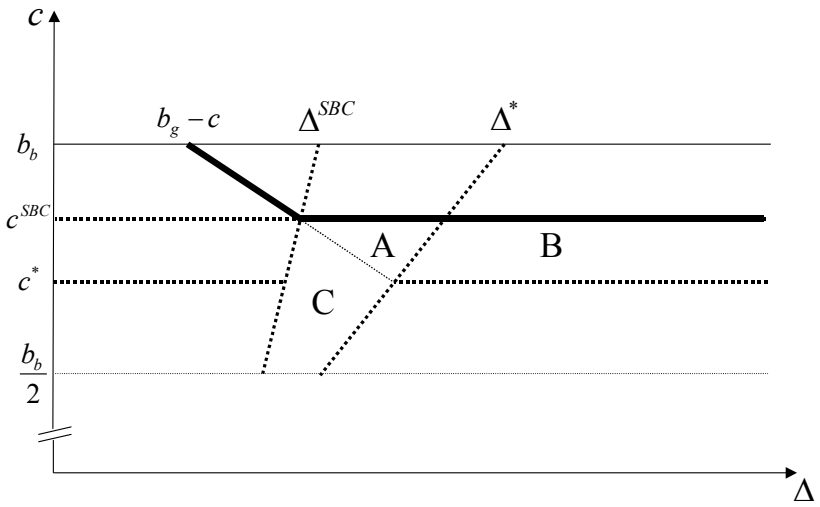

Figure 4: Inefficiencies under SBC

To draw this figure, we have assumed that $2pb_g < (1+p)b_b$.[10] By construction of the Figure 4, in regions A and B, investments are made in equilibrium when it is inefficient to do so[11]. In region C, investments are made in equilibrium and are efficient, but low effort is supplied when it is efficient to supply high effort.

4.2 A Hard Budget Constraint

Again, we solve the game backwards. In this case, there is no continuation if a project is bad, so no tax is set at the end of $t = 2$, i.e. $\tau = 0$. So, conditional on project realizations

[10] Again, this assumption is only made for graphical considerations. If $2pb_g \geq (1+p)b_b$, the intersection between $b_g - c$ and Δ^{SBC} is in a point above b_b. In that case, the unique difference with Figure 4 is that the size of the parametric regions A, B and C change.

[11] This result is well known and is mainly driven by the externality effect. The parametric area A represents projects that should not have been undertaken by a social planner (because if so, they should have been done with effort which is socially too costly) but are nevertheless initiated by a regional government because they will be undertaken with no effort. The parametric area B represents projects that should not have been undertaken by a social planner (because if so, they should have been done with no effort and the cost of two investments is socially too costly) but are nevertheless initiated by a regional government.

I_a, I_b, the utility of a resident of region i in equilibrium is

$$u_i = (1 - I_i)b_g = \begin{cases} b_g & \text{if } e_i = \Delta \\ (1 - I_i)b_g & \text{if } e_i = 0 \end{cases} \tag{12}$$

Again, let $u_i(e_i, e_j)$ be the expected present value of utility to a resident of region i from choice of effort levels $e_i, e_j \in \{0, \Delta\}$. From (12), we see immediately that:

$$u_i(\Delta, \Delta) = u_i(\Delta, 0) = b_g, \;\; u_i(0, \Delta) = u_i(0, 0) = pb_g \tag{13}$$

From (13), it is easily calculated that

$$u_i(\Delta, \Delta) - u_i(0, \Delta) = u_i(\Delta, 0) - u_i(0, 0) = (1 - p)b_g$$

So, for either region, it is a dominant strategy to put in effort in project implementation, if $\Delta \leq (1 - p)b_g = \Delta^{HBC}$ and no effort otherwise.

Now we turn to the investment decision. When $\Delta \leq \Delta^{HBC}$, the government of region i anticipates that both regions will exert effort if investment has occurred. So

$$v_i(1, 1) = v_i(1, 0) = b_g - \Delta, \;\; v_i(0, 1) = v_i(0, 0) = c$$

Therefore, for either region is a dominant strategy to invest if $\Delta \leq b_g - c$. When $\Delta > \Delta^{HBC}$, the government of region i anticipates that both regions will exert low effort. So

$$v_i(1, 1) = v_i(1, 0) = pb_g, \;\; v_i(0, 1) = v_i(0, 0) = c$$

Therefore, for either region it is a dominant strategy to invest if $c \leq pb_g = c^{HBC}$. So, we have established the following characterization of the HBC equilibrium:

Proposition 4. *If $\Delta \leq \min\{\Delta^{HBC}, b_g - c\}$, investment occurs, and high effort is supplied in both regions. If $\Delta > \Delta^{HBC}$ and $c \leq c^{HBC}$ investment occurs, and low effort is supplied in both regions. Otherwise, there is no investment in equilibrium in either region.*

The equilibrium project choice, plus choice of effort is depicted in the following figure.

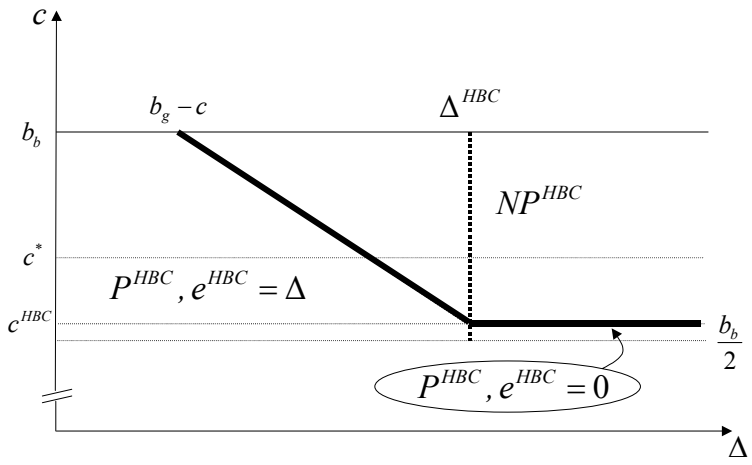

Figure 5: Equilibrium project and effort choice under HBC

Comparing Propositions 1 and 4, and in particular, comparing critical values Δ^*, Δ^{HBC} and c^*, c^{HBC}, and noting that $c^{HBC} > c^*$, $\Delta^* < \Delta^{HBC}$, we can establish the following.

Proposition 5. *If the HBC equilibrium is inefficient, the inefficiency takes one of the following two forms: either (i) investments are not made in equilibrium when it is efficient to do so; or (ii) investments are made in equilibrium when it is efficient to do so, but high effort is supplied when it is efficient to supply low effort.*

Thus inefficiency involves either *undersupply* of projects, or *oversupply* of effort, the *reverse* to the inefficiency arising with a SBC. This Proposition is most easily proved with reference to Figure 6, which superimposes Figure 5 on Figure 2.

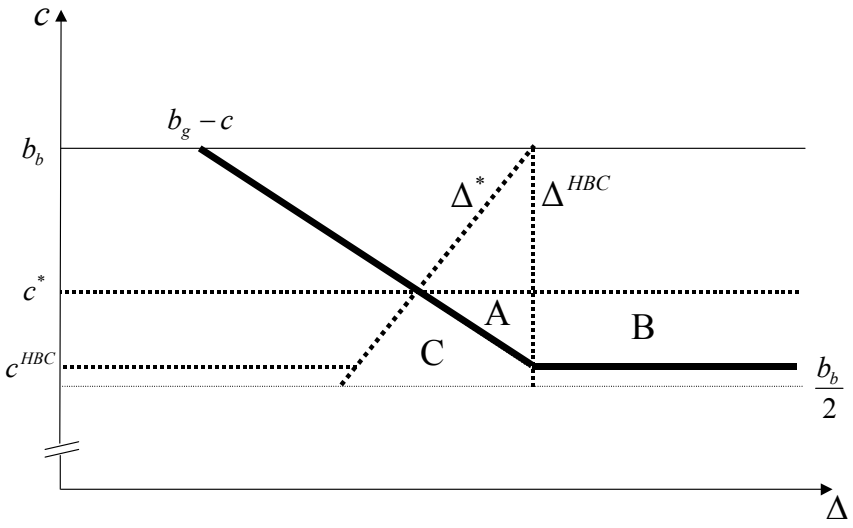

Figure 6: Inefficiencies under HBC

For the sake of graphical clarity, we draw this figure assuming that $c^{HBC} > \frac{b_b}{2}$. Again, this assumption does not change qualitatively our results. In regions A and B of the parameter space, investments are not made in equilibrium when it is efficient to do so. In region C of the parameter space, investments are made in equilibrium when it is efficient to do so, but high effort is supplied when it is efficient to supply low effort.

4.3 Hard or Soft Budget Constraint?

In this subsection, we use all previous results to analyze the choice of the central government in the first period. At $t = 0$, the CG decides whether to set a SBC or a HBC, comparing the expected present value of the sums of regional welfares. The main result is as follows:

Proposition 6. *At $t = 0$, the CG always chooses a regime that restores fully efficiency. But, depending on parameters, both HBC or SBC can be optimal.*

The last result confirms a interesting trade-off between hard and soft budget constraints. Under some parametric configurations, hard budget constraints help to overcome the externality effect created by bailouts. But, under other parametric configurations, soft budget constraints enable the central government to have some degree of flexibility, which creates an option value to wait until the type of the project is revealed. This Proposition is most easily understood using Figure 7.

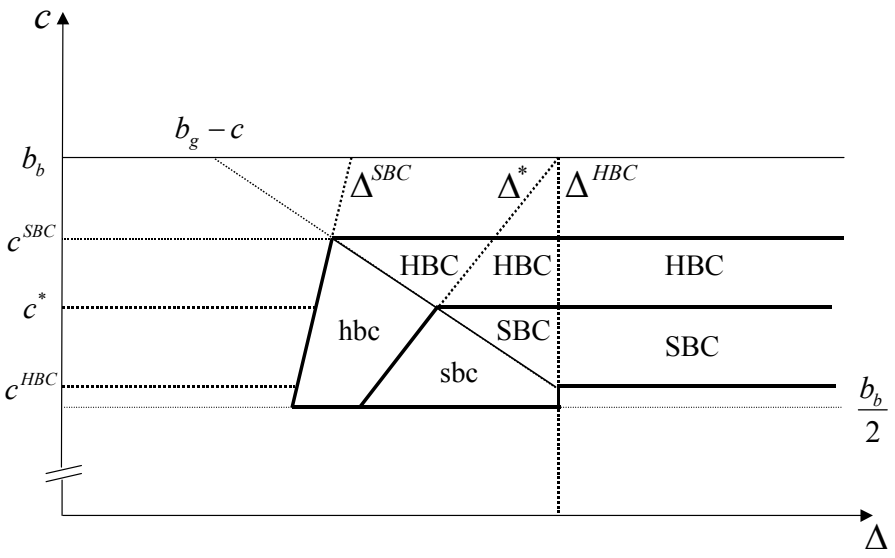

Figure 7: Comparisons of regimes

In the parametric areas without label, the central government is indifferent between imposing a hard or a soft budget constraint. This is not the case for the remaining areas, where the central government strictly prefers one regime.

First, we explain the CG's choice in the parametric areas characterized by capital letters. On the one hand, in "HBC", the central government alleviates the externality effect that emerges under a soft budget constraint and that makes more projects to be inefficiently financed. So, by choosing a hard budget constraint, the projects are efficiently not initiated. On the other hand, in "SBC", the central government prefers a soft budget constraint because this regime enables to continue bad projects for which this decision is socially efficient. So the projects are efficiently initiated.

Next we explain the CG's choice in the parametric areas characterized by small letters. In "hbc", the central government prefers a hard budget constraint. In spite of the fact that under both regimes the projects are efficiently initiated, under a hard budget constraint both regions exert effort (the socially efficient solution) and thus generate good projects. A similar reasoning applies in "sbc", where the central government prefers a soft budget constraint because under a hard budget constraint both regions exert effort, which is socially inefficient.

Remark: This trade-off between HBC and SBC only emerges when moral hazard yields to an uncertain outcome (i.e. $p > 0$). It is easy to verify that if $p \to 0$, then $c^* \to \frac{b_b}{2}$, $c^{SBC} \to \frac{2b_b}{3} > \frac{b_b}{2}$ and $c^{HBC} \to 0$. Therefore, under that circumstances (and recalling that we have assumed that $c > \frac{b_b}{2}$) HBC always restores fully efficiency and thus dominates.

4.4 Performance-Based Taxes for Regional Government

So far, we have assumed that the project outcome is unverifiable, so that the CG cannot directly reward or penalize RGs on the basis of project outcomes. If CG could do this, it could achieve the efficient outcome. Specifically, it could set a SBC combined with region-specific taxes τ_1, τ_2 at the end of period 2, where $\tau_i = c$ if the project in i turned out to be bad . This penalty would have the dual role of repaying the loan for refinancing the project, and incentivising RG to supply efficient effort. To put it another way, these taxes internalise the fiscal externalities that arise with uniform taxation. But, in practice, we do not observe such taxes. Indeed, tax rates set by central government are almost always uniform. One reason may be that project outcomes may be unverifiable (as we have assumed). Another may be that part of the role of the national tax system is to provide insurance. In any case, our main objective in this paper is to study the efficiency of the HBC *in an environment where the SBC is inefficient*: otherwise, there is no real interest in the HBC.

5 Institutional Solutions

5.1 Centralization

One possible solution is for the central government to assume all the functions of regional government i.e. project initiation and the supply of effort. In our model, the central government (given that it is benevolent, by assumption) behaves like the social planner. So, it would seem that centralization would solve the problem studied in this paper.

However, full centralization is not normally advocated as the solution to excessive sub-national borrowing, because it may entail other inefficiencies. In particular, an argument often made is that central government is less well-informed about regional preferences than regional governments. This could be introduced (for example), in our framework, by supposing at the initial investment stage, a fraction λ of potential projects are worthless (type A projects), and a fraction $1 - \lambda$ are as described above (type B projects), but only regional governments know which are which. In this case, centralization would involve a new inefficiency. In that case, depending on the parameter values, it may be better to have divided government than full centralization.

5.2 Decentralization

We define this form of government in the natural way as one where the regional government assumes all the functions of government i.e. project initiation and supply of effort, as well

as the continuation decision, and tax powers at the end of the second period. The regional government can now borrow, but must repay any borrowing out of an income tax levied only on its own residents. If this tax is lump-sum, efficiency is clearly restored as there is no fiscal externality, and thus no SBC. The decentralized government behaves just like the social planner.

However, it is often argued that decentralization leads to other inefficiencies though failure to internalize inter-jurisdictional spillovers (Oates (1972)). A key example would be tax externalities between regions, which generates inefficient tax competition under decentralization. More recently, it has been argued that the presence of tax competition, by raising the perceived marginal cost of public funds at the regional level can endogenously "harden" the government budget constraint (Qian and Roland (1998)).

We now show that this "hardening" of the budget constraint can indeed occur. However, in our model, it has the opposite welfare consequence to that found in Qian and Roland (1998). In that paper, hardening of the budget constraint though tax competition was unambiguously good, as it prevented wasteful lending to state enterprises. Here, if the hardening of the budget constraint has any effect on the equilibrium, it will be to *reduce* welfare, as it will cause inefficiently high effort to be supplied, with too few projects initiated as a consequence (from Proposition 4). Thus, decentralisation may be *less* efficient than divided government.

With fiscal decentralization, competition in income taxes can be introduced in a very simple and natural way in our model by allowing workers to be mobile between regions, thus generating a mobile tax base. This in turn raises the marginal cost of public funds when only one project is bad, as then only one region needs to set a positive tax, and perceives that in doing so, it will lose some of its tax base to the other region. This in turn makes project continuation possibly undesirable from the point of view of the single region, thus endogenously "hardening" the regional budget constraint.

The details are as follows. Any resident of region i can work either in region i itself, or (at a mobility cost m) can work in region j. The mobility cost is uniformly distributed on $[0,1]$. In each case, the resident of i can earn a wage (normalized to unity) in either region, minus any tax paid. Let $\tau_a, \tau_b \in [0,1]$ be the income tax rates. Moreover, for simplicity[12], we will assume that residents of i who work in region j still enjoy the benefits of consumption of private and public goods in region i, and their welfare is thus taken into account by the regional government of i.

Then, the payoff of a resident of region i in period 2, assuming that a bad project is refinanced, is

$$u_i(m) = b_b + \begin{cases} 1-\tau_i & \text{if } m \geq \tau_i - \tau_j \\ 1-\tau_j-m & \text{if } m < \tau_i - \tau_j \end{cases} \tag{14}$$

[12]Without this assumption, we introduce a "tax exporting" incentive for regional governments which will tend to lower the marginal cost of public funds, implying that in this case, decentralization cannot harden the budget constraint.

Assume w.l.o.g. that $\tau_i > \tau_j$. So, from (14), the sum of utilities of all residents in region i is

$$\begin{aligned}\int_0^1 u_i(m)dm &= b_b + [1-(\tau_i-\tau_j)](1-\tau_i) + \int_0^{\tau_i-\tau_j}(1-\tau_j-m)dm \\ &= b_b + [1-(\tau_i-\tau_j)](1-\tau_i) + (\tau_i-\tau_j)(1-\tau_j-\frac{(\tau_i-\tau_j)}{2})\end{aligned} \tag{15}$$

where $1-(\tau_i-\tau_j)$ is the fraction of the population who do not move, $(\tau_i-\tau_j)$ is the fraction who do, and $1-\tau_i$, $1-\tau_j-m$ are their respective wages net of taxes and any mobility costs.

The regional government budget constraint is therefore

$$r_i = \tau_i[1-(\tau_i-\tau_j)] \tag{16}$$

where r_i is any repayment to the banking sector. Note that $r_i = 0$ if the project is good, and $r_i = c$ with probability $1-p$ if the project is bad and is refinanced.

Now consider the refinancing decision. These decisions can now be interdependent as the tax that region i must set to cover the cost of refinancing depends on the tax that region j sets. For simplicity, assume that each region can observe not only whether its own project is good or bad, but also whether the project in the other region is good or bad.

There are then two cases. The first is where region i has a bad project, but region j has a good project. In that case, it is always optimal for j to set $\tau_j = 0$. Then, i anticipates that j will set $\tau_j = 0$, and thus the tax needed for refinancing is, from (16), $\tau_i = \overline{\tau} > c$, where $\overline{\tau}$ is the smaller root[13] of $c = \overline{\tau}(1-\overline{\tau})$. Then, from (15), welfare in region i is

$$b_b + (1-\overline{\tau})^2 + \overline{\tau}(1-\frac{\overline{\tau}}{2}) = b_b + 1 - \overline{\tau}(1-\overline{\tau}) - \frac{\overline{\tau}^2}{2} = b_b + 1 - (c + \frac{\overline{\tau}^2}{2})$$

This is to be compared to welfare of 1 without refinancing. So, the gain to refinancing the project is $b_b - (c + \frac{\overline{\tau}^2}{2})$, implying that the effective cost of refinancing is now $(c + \frac{\overline{\tau}^2}{2}) > c$. Thus, $\overline{\tau}^2/2$ is the *deadweight loss* of financing continuation of the project though a distortionary tax. More precisely, $\overline{\tau}^2/2$ measures the mobility costs incurred by workers seeking to avoid the higher tax in region i.

The second case is where both regions have bad projects. In this case, both have the option of refinancing (say R) or terminating the project (say T). Then, it is easily seen that the two regions play the following 2×2 matrix game, where region i chooses rows, and j chooses columns and the payoffs are regional utilities, ignoring the constant of 1 :

$i \backslash j$	R	T
R	$b_b - c,\ b_b - c$	$b_b - (c + \frac{\overline{\tau}^2}{2}), 0$
T	$0, b_b - (c + \frac{\overline{\tau}^2}{2})$	$0, 0$

(17)

[13] In fact, $\overline{\tau} = \frac{1-\sqrt{1-4c}}{2}$, so it must be the case that $c \leq \frac{1}{4}$. This reinforces the condition $c < 1$ that must hold, in order to be viable the bad project's refinancing. If $c > \frac{1}{4}$, refinancing is impossible if only one region has a bad project. But the analysis of this case is similar to the one we perform below and thus omitted from the model.

The explanation of the payoffs is as follows. If both refinance i.e. (R, R), both will set the same tax i.e. some tax $\tau_i = \tau_j = \tau$, so from (15), regional welfare is $b_b + 1 - \tau$, and from (16), $\tau = c$. If only one region choose to refinance, it must set a tax $\overline{\tau}$ as before, which gives a payoff of $b_b - (c + \frac{\overline{\tau}^2}{2})$.

As $b_b > c$, $\overline{\tau} > 0$, if $b_b \geq (c + \frac{\overline{\tau}^2}{2})$ the only weakly undominated Nash equilibrium of this game is for both regions to continue financing. On the other hand, if $b_b < (c + \frac{\overline{\tau}^2}{2})$, (R, R) and (T, T) are *both* Nash equilibria. Note that (R, R) Pareto-dominates (T, T), so if players could coordinate, they would play (R, R). However, there is no consensus in the game-theory literature that such coordination is possible, so we will consider both outcomes.

First, if $b_b \geq (c + \frac{\overline{\tau}^2}{2})$, bad projects are always refinanced, so it is clear that the outcome is efficient and thus as described as in Proposition 1. Now consider the case where when[14] $b_b < (c + \frac{\overline{\tau}^2}{2})$. Suppose first that the "bad" equilibrium (T, T) prevails when both regions have bad projects. In this case, there is an *endogenous* HBC[15] with probability 1; that is, if a region has a bad project, it will always terminate it in equilibrium, whether the other region has a bad project or not. Thus, the outcome is *exactly* as in the case with an exogenously imposed hard budget constraint i.e. as described in Proposition 4. Thus, by Proposition 5, decentralisation can be inefficient, and moreover, by the discussion in Section 4.3, decentralisation can be less efficient than divided government with a soft budget constraint.

Now suppose that the "good" equilibrium (R, R) prevails when both regions have bad projects. Then, there is an endogenous HBC in the event that one region has a bad project and the other a good project. In this case, existing propositions do not apply, and some more analysis is needed to characterise the equilibrium. First, if both regions exert low effort, this now gives an expected continuation payoff of

$$u_i(0, 0) = pb_g + (1 - p)p0 + (1 - p)^2(b_b - c)$$

This is because with probability $(1 - p)p$, only one region has a bad project, in which case cost of continuation is $\overline{\tau}$, and thus it terminates this project; on the other hand, if both regions have bad projects, there is no termination, as the "good" equilibrium (R, R) entails that projects are refinanced. On the other hand, $u_i(0, \Delta) = pb_g$ because in this case, the cost of continuation is $\overline{\tau}$ with probability 1. Finally, $u_i(\Delta, \Delta) = u_i(\Delta, 0) = b_g$ because if the project is good, region i does not need to levy a tax and thus has no interaction with the other region.

From these expressions, it is easily calculated that

$$\begin{aligned} u_i(\Delta, \Delta) - u_i(0, \Delta) &= (1 - p)b_g = \Delta^{HBC} \\ u_i(\Delta, 0) - u_i(0, 0) &= (1 - p)b_g - (1 - p)^2(b_b - c) = \hat{\Delta} \end{aligned}$$

[14] As $c \leq \frac{1}{4}$, $c + \frac{\overline{\tau}^2}{2} = c + \frac{1}{2}\left(\frac{1-\sqrt{1-4c}}{2}\right)^2 \leq \frac{3}{8}$. So this case can happen provided $b_b < \frac{3}{8}$.

[15] We say that the HBC is endogenous here because it is not due to explicit precommitment not to borrow, but because borrowing is too expensive in equilibrium, because of the deadweight loss of repayment due to tax competition.

Note that $\hat{\Delta} < \Delta^{HBC}$. So, if $\Delta < \hat{\Delta}$, there is a unique equilibrium where both regions set $e = \Delta$, and if $\Delta > \Delta^{HBC}$, there is a unique equilibrium where both regions set $e = 0$. If $\hat{\Delta} \leq \Delta \leq \Delta^{HBC}$, there are two symmetric equilibria (Δ, Δ) and $(0, 0)$.

Now, turn to the initial investment decision. If $\Delta \leq \hat{\Delta}$, the government of region i anticipates that both regions will exert effort if investment has occurred. So

$$v_i(1,1) = v_i(1,0) = b_g - \Delta, \; v_i(0,1) = v_i(0,0) = c$$

Therefore, for either region is a dominant strategy to invest if $\Delta \leq b_g - c$. When $\Delta > \Delta^{HBC}$, the government of region i anticipates that both regions will exert low effort. So,

$$\begin{aligned} v_i(1,1) &= v_i(1,0) = pb_g + (1-p)p0 + (1-p)^2(b_b - c) \\ v_i(0,1) &= v_i(0,0) = c \end{aligned}$$

Therefore, for either region it is a dominant strategy to invest if $c \leq \frac{pb_g + (1-p)^2 b_b}{1+(1-p)^2} = \hat{c}$.

Finally, suppose that $\hat{\Delta} \leq \Delta \leq \Delta^{HBC}$. Suppose first that regions anticipate supplying high effort. Then, by the argument just given, each will invest if $\Delta \leq b_g - c$. On the other hand, if regions anticipate supplying low effort, each is again willing to invest if $c \leq \hat{c}$. So, we have established the following characterization of the equilibrium with an endogenous HBC under decentralization when the good equilibrium (R, R) prevails in (17)

Proposition 7. *If $\Delta \leq \min\{\hat{\Delta}, b_g - c\}$, investment occurs and high effort is supplied in both regions. If $\Delta \geq \Delta^{HBC}$ and $c \leq \hat{c}$, investment occurs and low effort is supplied in both regions. If $\Delta \in (\hat{\Delta}, \Delta^{HBC})$ and $c \leq \hat{c}$, multiple equilibria are possible. On the one hand, there is an equilibrium where investment occurs, and low effort is supplied in both regions. On the other hand, there is an equilibrium where investment occurs and high effort is supplied in both regions, provided $\Delta \leq b_g - c$. Otherwise, no investments are made in equilibrium.*

Clearly, multiple equilibria are possible here. Nevertheless, comparing with Proposition 1, the inefficiency of the outcome under decentralization is clear, as $\hat{\Delta} > \Delta^*$: if the outcome is inefficient, it will involve either (i) too high effort, or (ii) project not initiated when it is efficient to do so.

6 Related Literature and Conclusions

6.1 Related Literature

Related literature is as follows. First, the concept of the SBC was introduced by Kornai (1980, 1986) and mainly applied to state-owned enterprises in socialist economies. The subsequent literature tried to analyze, in different contexts, the reasons for the emergence of such a problem: paternalism, political intervention, asymmetric information and lack of commitment, corrupt influences, etc. Dewatripont and Maskin (1995) were the first to provide

an explanation for the SBC based on asymmetric information and lack of commitment (i.e. without reference to any exogenous factors).

This basic model has been extended in a number of directions, and the current literature is surveyed by Kornai, Maskin and Roland (2004). However, the focus of the literature is on various mechanisms that can help harden the budget constraint: there is no model currently in the literature (to our knowledge) that explicitly makes the point that HBCs may be suboptimal. An example of the literature on "hardening" the budget constraint that is most closely related to what we do here is Qian and Roland (1998). Their contribution is to show that decentralization of tax powers raises the marginal cost of public funds to sub-central government, and thus makes it more costly for these governments to bail out enterprises[16]. This effect is reinforced by monetary centralization.

Other work (e.g. Wildasin (1997) and Goodspeed (2002)) take a more traditional public finance approach to the problem of SBC for RGs. They do not explicitly model the agency problem between RG and central government (i.e. in terms of asymmetric information), but generate a soft budget constraint by assuming a particular timing in the model: i.e. that central government chooses grants to the regions *after* having observed regional decisions on the provision of regional public goods. The models differ substantially in detail: in Wildasin (1997), the SBC is due to the fact that CG has an ex post incentive to increase expenditure on local public goods because they generate spillovers that are ignored by RGs. In Goodspeed (1998), CG may increase the second-period grant to a particular RG when it increases its borrowing. In both models, however, if the CG could commit to a HBC, efficiency could be restored. In Inman (2003), a model of interaction between CG and a RG is presented that explicitly includes a dynamic commitment problem as in Kornai, Maskin and Roland (2004). However, it is a very stylized model, and again, the imposition of a HBC restores efficiency.

Last, our paper is also related to Sanguinetti and Tommasi (2004). In their article, regions derive utility from the consumption of a private good and a national public good. Each region is endowed with an exogenous random level of output. The federal government has an exogenous level of resources to finance the national public good and to set transfers to the regions, without knowing the realization of their level of output. Two regimes are considered. In the first, the federal government commits ex ante to a transfer to each region. In the second, the regional governments simultaneously choose transfers subject to the federal government budget constraint i.e. the federal government fully accommodates to the requests for transfers that each region makes. Sanguinetti and Tommasi find the conditions for which either one of the regimes dominate. The second regime has the advantage of offering full insurance, but at the cost of a common pool problem where the national public good is underprovided. The first regime has no common pool problem, but offers no insurance. It can be thought of as a kind of HBC regime, but it is not a HBC in the usual sense of the term i.e. a precommitment ex ante not to provide resources, as there is no dynamic

[16] This formal result has been adopted by the (political science) supporters of the idea that "federalism preserves markets". See Weingast (1995), Montinola, Qian and Weingast (1995) and Qian and Weingast (1997). Although Rodden and Rose-Ackerman (1997) also argue against the predictions of Montinola, Qian and Weingast (1995), they do not criticize neither the logic nor the results of this model *per se* (as we do) but rather the fact that the assumptions are unrealistic.

precommitment problem in their paper.

6.2 Conclusions

This paper has shown that, in the context of a model of fiscal federalism where central government has a dynamic commitment problem, a HBC does not necessarily "solve" this problem. Our argument was the following. First, by definition, a HBC necessarily implies that "bad" investment projects will be terminated, when ex post, it would be desirable to continue them though additional financing. Now suppose that by exerting some effort, RGs can lower the probability that projects are "bad". Then, with a HBC, RGs are over-incentivised to provide effort, as payoff to them in the event of a bad project is excessively low. Thus, effort exerted may be inefficient. More importantly, when this is the case, some projects will not be initiated in the first place, even when it is efficient to do so. So, a HBC may lead to underinvestment. The argument developed in this paper is quite general, and may apply to areas other than fiscal federalism. That is a topic for future research.

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