Deficit targeting: mechanism design and the control of sub-national governments' fiscal deficits*

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1. Introduction

The traditional debate on fiscal federalism focuses on the trade-off between allocative efficiency and distributive concerns. From the point of view of the *allocation* of public resources, it is well known that local governments are better suited to accommodate in an efficient way differing preferences among agents. This view suggests that the best fiscal policies are decided at a decentralized local-government level. However, from the point of view of the *distribution* of wealth, the central government has a clear role in designing revenue-sharing rules to achieve a more equitable redistribution of income among different regions of a country with heterogeneous levels of development. This second view suggests a higher level of centralization in a government's fiscal policy decisions.[1] Therefore, the optimal level of decentralization in a federation must reflect the right balance between those two opposing views.

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A study of the recent experience of selected developing countries shows a somehow erratic process in the level of centralization of the fiscal federalist system. The case of Brazil, for example, is noteworthy: since 1965 the share of the federal government in terms of total revenue has increased from 54.9% to 61.3% in 1988 and then decreased again to 51.4% in 1991.[2] As it was the case with Brazil, when democracy takes roots in a country, there is a natural movement towards fiscal decentralization.[3] A consequence of this trend is the emergence of a third important issue in the definition of the optimal level of fiscal decentralization: sub-national governments' expenditure levels may come to play a significant role in the *macroeconomic management* of the country. Indeed, as a higher proportion of total expenditure is done at the decentralized level, a serious effort made in order to control the federal fiscal deficit maybe totally offset by a less disciplined fiscal policy at the lower levels of government. Due to a *free rider* type of problem, local governments may not consider macroeconomic management as one of their priorities; therefore they may find in their best interest to accumulate important deficits which will generate a Pareto sub-optimal equilibrium for the whole economy.[4]

The present article studies the incentives faced by local governments[5] with respect to fiscal discipline in a federalist system where revenue-sharing transfers are important sources of income for those states. The study is based on a model of state expenditure policy first introduced in Werneck (1995). Following that model, it is shown here that the central government can use the transfers as a powerful mechanism to induce the states into choosing lower levels of fiscal deficit. This is accomplished by making the transfers contingent on an optimally chosen "deficit targeting" rule, in such a way that the farther the state realized deficit from the targeted level, the lower the transfers from the central government.

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[1] See, for example, Wagner (1983).
[2] Net of transfers to local governments; see Afonso (1994).
[3] In Argentina during the 80's the federal government's expenditure corresponded on average, to 68% of total public expenditures. In 1991 this percentage decreased to 60% and in 1996 that percentage was 55%. The corresponding numbers for the "provincias" (states) are 27%, 33% and 38%, respectively, according to Murphy and Moskovits (1997).
[4] See, e.g., Werlang and Fraga Neto (1995).

Although desirable, such a contingency may be difficult to implement, as unconditional transfers are often seem as a necessary condition for state autonomy. In the case of Brazil, for example, there is a constitutional requirement that the transfers of the "States Participation Fund" (Fundo de Participação dos Estados-FPE, the must important source of transfers to the states) must the unconditional. In order to study the central government's options when this type of contingency cannot be imposed upon the states, a fundamental friction of the federative system in many developing countries is analyzed. The friction is that less financially responsible sub-national governments usually have to pay higher interests on their debt than a sounder central government. Therefore, the states have an incentive to renegotiate their debt stocks to the private sector into debt to the central government. As the state's interest rate becomes significantly higher than the federal government's one, a strong political pressure ensues, compelling the central government into a costly renegotiation process.

The present study shows that, when the renegotiation is done without care, it can generate a very adverse behavior from the state: facing a looser budget constraint, due to the lower interest payments, a typical state will want indeed to increase its deficit. However, if the federal government implements a proper renegotiation procedure, it will induce the states into accepting a special type of transfer contract in order to obtain a lower interest rate. As a result, the expenditure level of the state will be significantly reduced.

The rest of the paper is organized as follows. Section 2 introduces the basic Werneck (1995) model and derives the optimal expenditure rule for a typical state in the presence of unconditional transfers from the central government. Section 3 shows that the state's deficit will be considerably reduced when the federal government is able to condition the transfers on a measure of fiscal responsibility of the state. The structure introduced is called here a "deficit-targeting" model due to its resemblance with the traditional "inflation-targeting" models used in the monetary policy literature. Section 4 shows that, when transfers are unconditional and the state renegotiates with the federal government in order to obtain lower

[5] This article uses the expressions "state", "local government" and "sub-national government" for the lower level of government and the expressions "nation", "central government" and "federal

interest rates on the stock of its debt, then the state will choose a deficit level higher than before renegotiation. Finally, section 5 shows that a well chosen renegotiation process may be devised so that the state will find in its best interest to sign a deficit targeting contract in order to obtain the lower interest rate after renegotiation. In that case a lower deficit level will be the solution to the state expenditure problem. Some concluding remarks are presented in section 6.

2. Local governments' optimal expenditure rule

A typical state's expenditure decision is modeled after Werneck (1995). The state is assumed to solve the following maximization problem.

$$\begin{aligned} &\underset{D_S}{Max}\ U_S(E_S) \\ &st.\ E_S + r_S B_S = D_S + T_S \end{aligned} \qquad (1)$$

In the above problem U_S is the state utility, a continuously differentiable, strictly increasing function. The restriction is the usual budget constraint, which establishes that total expenditure must be equal to total revenue. The elements of expenditure and revenue are detailed below. All variables refer to a typical state *S*. On the expenditure side, E_S denotes the fiscal expenditure of the state. The total payment of interest on the stock of debt, B_S, is $r_S B_S$, where it is assumed that each state faces its own interest rate r_S. On the revenue side, D_S is the state's deficit and T_S is its total tax revenue.

Therefore, the model assumes that a typical state derives utility from increasing its expenditure levels, constrained by the accounting restriction (1). The variables above are interdependent and related to their federal level counterpart as follows.

A typical state's interest rate r_S is given by:

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government" for the higher level of government in the federation.

$$r_S = r_F + r\left(D_S, \frac{T_S}{B_S}\right) \tag{2}$$

Here r_F is the interest rate the federal government pays on its own debt and r is a *spread* the state has to endure given its own financial structure[6]. The spread r is assumed to be increasing on the state's deficit D_S and decreasing on the traditional measure of its solvency T_S/B_S: $\frac{\partial r}{\partial D_S} > 0$; $\frac{\partial r}{\partial \frac{T_S}{B_S}} < 0$.

Finally, the state's revenue T_S has two components: the revenue obtained by its own tax effort, T_O, and the amount of transfers obtained from the central government, δT_F, a fixed proportion δ of the Federal tax effort.[7]

$$T_S = T_O + \delta T_F \tag{3}$$

Plugging in expressions (2) and (3) into the budget constraint (1) and then substituting the resulting expression for E_S into the utility function of the state one obtain the following unrestricted maximization problem.

$$\underset{D_S}{Max}\ U_S\left(D_S - r_F B_S - r\left(D_S, \frac{T_O + \delta T_F}{B_S}\right)B_S + T_O + \delta T_F\right)$$

The solution to the above problem is the unique value of D_S that satisfies the identity below.

[6] In theory it could be the case that r takes negative values. This would happen if the State is fiscally sounder then the federal government. However, there seems to have been the case in developing countries that local governments tend to act less responsibly than central governments. See on this regard Saiegh and Tommasi (1999).

[7] In Brazil, for instance, the National Congress defines explicitly the coefficient $\delta = \delta_S$ for each state S.

$$\frac{\partial r}{\partial D_S}\left(D_S, \frac{T_O + \delta T_F}{B_S}\right) B_S = 1 \qquad (4)$$

Condition (4), first presented in Werneck (1995), establishes the optimal deficit level of the local government, D_S^W. The left-hand side represents the additional cost to the state when it increases its deficit by one unit: the corresponding additional increase in the spread of the state interest rate *r*, which applies to the stock of the debt B_S. The right-hand side represents the extra benefit of an increase of one unit of deficit.[8]

The optimal deficit level D_S^W of a typical state does not take into consideration the effect of its expenditure on the overall macroeconomic management of the country. In fact, the free rider problem suggests that the socially optimal deficit level, when the whole country is taken into account, may require a much lower deficit level (Werlang and Fraga Neto (1995)). The next section shows that a new type of transfer rule may be used in order to induce the state to choose a lower level of deficit.

3. Deficit targeting: a second best approach

The budget constraint (1) as well as the discussion on the trend towards decentralization suggests that revenue sharing may be an important source of income for the local governments, which affects the state's optimal fiscal policy. Various studies show that the natural consequence of revenue-sharing rules is that the state chooses a looser fiscal policy. Ribeiro (1998), for example, shows that revenue sharing in Brazil tends to reduce the states' own tax effort. Werneck (1995) shows that an increase in the federal government tax effort T_F may induce the states into a higher level of expenditure.

[8] The marginal costs and benefits above have to be multiplied by $U_E'(E_S)$ in order to obtain this interpretation in terms of the State's utility. The marginal utility term is not used here to avoid the unnecessary heavy notation.

Revenue sharing may, however, become a strong source of control on local government deficits if a rule of transfer contingent on certain goals is introduced. Suppose, then, that the federal government wishes to induce the state into choosing a deficit level D_S^*. This optimal level of deficit typically depends on the overall state of the economy; here it is taken as an exogenous decision of the federal government that could be zero or even negative. For the sake of simplicity and realism the present article assumes that the optimal deficit level is lower than the deficit that would be chosen in the original model of Werneck: $D_S^* < D_S^W$, so that the federal government would like to induce the state into reducing its deficit.[9]

Suppose now the old sharing rule δT_F is replaced by the new rule $f(D_S)T_F$, where f is a single peaked, continuously differentiable function defined on the real line, attaining its maximum at $D_S=D_S^*$. To illustrate, a possible choice of f could be:

$$f(D_S) = \gamma - \frac{(D_S^* - D_S)^2}{K} \tag{5}$$

In the above expression the state will be able to receive its total expected transfer only if it chooses $D_S=D_S^*$. Otherwise the state will be "punished" by receiving a lower transfer. The farther D_S is from D_S^*, the lower the transfer the state will receive. The parameter K determines the power of the punishment: the lower K, the more severe is the punishment for deviation from the target D_S^*. The parameter γ represents the opportunity cost of not complying to the targeted deficit and could be set equal to δ, for example.

The revenue-sharing rule f is called here a "deficit targeting" rule and it has some resemblance with the traditional "inflation targeting" rule. However, whereas the literature on inflation targeting generally assumes the existence of a Phillips curve, all that is assumed here is that the state has control over its deficit level.

Under the above condition, a typical state's maximization problem becomes:

[9] However, there would be no significant change in the model had the goal been to induce the state

$$\underset{D_S}{Max}\ U_S(E_S)$$

$$st.\ E_S = D_S - r_F B_S - r\left(D_S, \frac{T_O + f(D_S)T_F}{B_S}\right)B_S + T_O + f(D_S)T_S \qquad (6)$$

Plugging in the new budget constraint into the objective function and calculating the first order condition one obtains the following equality for the optimal deficit level of the local government under the *deficit targeting* rule f :

$$\frac{\partial r}{\partial D_S}\left(D_S, \frac{T_O + \delta T_F}{B_S}\right)B_S = 1 - \alpha \qquad (7)$$

where,

$$\alpha = \left[-f'(D_S)T_F\right]\left[1 - \frac{\partial r}{\partial \frac{T_S}{B_S}}\left(D_S, \frac{T_O + \delta T_F}{B_S}\right)\right] > 0$$

Expression (7) determines the new optimal deficit policy for the state. Compared to expression (4), it reduces by α the marginal benefit of increasing the deficit. The term α has a very simple interpretation: on one hand, by increasing the deficit of one unit, the total transfer to the state is reduced by $-f'(D_S)T_F$; on the other hand, the transfer reduction affects the solvency of the state (T_S/B_S) which, in turns, induces an increase in the spread of the interest rate, r, of $\partial r/\partial(T_S/B_S)$, and further reduces the amount of the transfer available for expenditure.

Note that the reduction in the left-hand side of (7) compared to (4) implies a choice of a lower level of deficit D_S. Therefore, the *deficit-targeting* rule induces the state into a more responsible fiscal policy. The actual effect of this constraint depends on several exogenous and endogenous variables. First, the rule will be more effective the more the state depends on the central government's transfers; indeed, if the transfers when the state chooses $D_S=D_S^*$ are too low compared to the states own tax effort T_O, then the *power* of the incentive scheme will be very limited. Second, the effectiveness of the rule depends crucially on the choice of the function f and,

into increasing expenditure.

more particularly, on the absolute value of the derivative $f'(D_S)$: the higher that absolute value, the more powerful the incentives.

It is noteworthy that, although the federal government may be able to reduce a state's deficit, in general it may not be able to actually induce the desired deficit level D_S^*. In that sense the *deficit-targeting* rule may be viewed as a *second best* mechanism.

The approach presented here, however limited, requires a strong central government, that has to be able to impose a change of transfer rules that may not be in the best interest of local governments. Therefore, the political challenges involved may be very important. In the case of Brazil, for example, the Federal Constitution establishes the *States Participation Fund* (Fundo de Participação dos Estados) for direct and unconditional transfers to the states in the form of a revenue-sharing rule δT_F as in (3).

In fact, history seems to move in an opposite direction. Indeed, it has often been the case in developing countries that a local government, when faced with extremely high interest rate, asks for the central government's financial support. The usual procedure is for the central government to take responsibility for the state's debt, while becoming the state's new creditor. The interest rate the state will pay to the central government on the transferred debt is decided during the debt renegotiation process and this decision typically has a strong political bias. Usually the renegotiation concludes with an indirect subsidy from the central to the local government: the central government pays the state's debt according to the state's market rate r_S, whereas the state pays the federal government back according to the lower interest rate r_F. The next section analyses the effect on the local government' expenditure decision when, as a result of the renegotiation process, the state has to pay the same interest rate as the central government, r_F.

4. Unconstrained renegotiation

Suppose that a state faces a high spread r in its own interest rate, due to the application of fiscal rule (4). In that case, the state would have a significant gain if it

could switch from the high r_F+r interest rate to the lower r_F rate paid by the federal government. Therefore, the incentives are set for a debt renegotiation between the local and the federal governments.

This section studies the case where the renegotiation is such that the federal government takes responsibility for the local government's debt and becomes the state's creditor. Moreover, the state now has access to the subsidized interest rate r_F, the one faced by the central government.

In this case, the state government fiscal problem becomes:

$$\underset{D_S}{Max} U_S\left(D_S - r_F B_S + T_O + \delta T_F\right)$$

Observe that now the interest rate faced by the state does not depend on its own fiscal policy. Therefore, the above problem has no solution: since there is no cost associated with increasing expenditure, the state wants to spend as much as possible and accumulate an infinite amount of debt.[10] That is, the renegotiation process generates an *adverse incentive* (moral hazard), stimulating the state to increase its expenditure above the level selected before renegotiation, which is exactly what the central government would like to avoid. Unfortunately, there seems to be evidence that this very behavior has occurred in Brazil's states debt renegotiation processes.[11]

However, this type of inefficient renegotiation process does not have to be the institution chosen by the federal government. Indeed, as it has been shown in section 3, central government transfers constitute a powerful instrument that can be used in order to discipline a state's fiscal behavior. The following section analyses what can be done by the federal government when the institutional framework of the

[10] This conclusion is not complete in the sense that it does not take into consideration the dynamic aspect of the debt accumulation process. Indeed, after renegotiation, the state will have an incentive to accumulate new debt through the market, so that the spread rate *r* will reappear on the stock of the new debt. As a consequence, the state's deficit will have a new upper bound, similar to the one obtained in the previous model, but higher, given the reduction obtained in the payment of the debt existing before the renegotiation. This new fiscal policy will then remain stable until a new renegotiation takes place.

[11] See, for example, Santos (1999).

country does not allow for a radical change in the transfer rule as the one proposed in section 3, but the states still need financial support from the federal government.

5. Individually rational renegotiation contracts: a third best approach

Suppose now that a state cannot be forced into a contract of the *deficit targeting* type, so that it can always choose to keep the legal fixed transfers δT_F. What can the federal government do in order to induce the local government into reducing its deficit level? Because the renegotiation of a state debt, with the resulting reduction in its interest rate, implies a relaxation of that state's budget constraint, the federal government can take advantage of the process to create the conditions for a reduction of the sub-national government's fiscal deficit.

The argument is as follow. A typical state can choose not to sign a renegotiation contract with the central government. In that case the state keeps its unconditional transfers δT_F, but faces its own high interest rate $r_S=r_F+r$. On the other hand, the state may choose to renegotiate its debt in order to have access to the lower interest rate r_F, but has to accept the *deficit targeting* transfer rule *f*.

Since the state may choose not to renegotiate with the central government, if renegotiation occurs the state must be at least as well off as without negotiation. Recall that D_S^W denotes the optimal deficit level when the state faces its own interest rate, and let $E_S^W = D_S^W - r_S B_S + T_S$ be the corresponding total expenditure. Then the central government's problem can be described as:

$$\underset{f,\,D_S}{Min}\ (D_S^* - D_S)^2$$

$$st.\ E_S = D_S - r_F B_S + T_O + f(D_S)T_F \tag{8}$$

$$E_S \geq E_S^W \tag{9}$$

Equation (8) is the budget constraint, when the state accepts the *deficit-targeting* contract, as before. The novelty here is equation (9), the *individual rationality* or *participation constraint*, which requires that the state receive at least as much utility when it accepts the new contract as it would have gotten had it chosen not to renegotiate its debt.

Since the federal government wants to induce the state to choose a deficit level lower than D_S^W **,** the optimal contract will be designed in such a way that the additional income available to the state because of the reduction in the its interest rate payment will be totally directed towards a reduction of its deficit. This can be obtained by heavily penalizing the state when $D_S > D_S^W$.

Therefore, the optimal choice of *f* will be such that equation (9) is met with equality: $E_S = E_S^W$. Composing (9) with (8) it follows that:

$$D_S^W - D_S = r\left(D_S, \frac{T_O + \delta T_F}{B_S}\right)B_S - (\delta - f(D_S))T_F \qquad (10)$$

This expression shows the maximum gain for the central government in terms of the reduction of the state's fiscal deficit, $D_S^W - D_S$, in an institutional framework where the state is able to choose not to renegotiate. The first term on the right-hand side corresponds to the resources the state obtains given the reduction in the interest payment on the stock of its debt. The second term corresponds to the reduction in the transfers from the federal government when the contract is signed. Therefore, the right-hand side corresponds to the net revenue the state receives when signing the *deficit-targeting* contract. The left-hand side shows that all the net gains the state receives from this new arrangement is directed towards the reduction of its deficit.

To conclude, note that the participation constraint (9) puts a limit on the ability of the central government to control the state's fiscal deficit, since the state must be assured an expenditure level at least as high as it would choose without renegotiation. For that reason this mechanism could be classified as a *third best*

approach to the deficit control problem. However, equation (10) shows that there is still a potential gain for the federal government if it chooses a suitable renegotiation mechanism. It is important to mention that, due to political pressures or other considerations, the federal governments may be forced to renegotiate states' debts anyway[12]. The main point of the present study is to show that debt renegotiation, instead of being a burden to the nation, can be used by the central government as a tool in order to induce a more responsible fiscal behavior in the part of the sub-national governments.

6. Conclusion

The present article considers the fiscal federalist relationship between a higher-level central government and a local level state government, from the point of view of the control of the state's fiscal deficits. The first result proven here is that the usual revenue-sharing rules between federal and local levels of government are powerful instruments that can be used by the central authority in order to induce the local decision makers to reduce their deficit level. The sharing rules that implement such a responsible fiscal policy at the state level were called *deficit-targeting* rules, because of their resemblance with the traditional *inflation targeting* rules in the monetary policy literature.

The second main result concerns the case when a deficit-targeting rule cannot be imposed upon a state against its will. In this situation, the federal government can still devise an individually rational deficit targeting contract that will be accepted by the state when it faces a higher interest rate than the federal government one, and needs the central government financial support in order to reduce interest payments.

The models developed here are based on a framework first introduced in Werneck (1995) in order to study the effects of an increase in the tax effort of the

[12] During the period 1987-1997 there have been state debt renegotiations in Brazil every two years (Santos 1999).

central government into the expenditure policy of local governments. Those models constitute a first attempt at using mechanism design to deal with the issue of disciplining the fiscal behavior of local governments. They can be extended in many different ways in order to better reflect some aspects of the reality, without changing its essence. For instance, when a renegotiation occurs it is assumed here that the state faces the federal government interest rate r_F. In fact, Brazilian recent history has shown that often the states are faced with interest rates lower than the one faced by the federal government, an extra subsidy to the local governments. The introduction of such lower interest rate, say r_A (for "after" renegotiation) would only increase the control of the federal government over the state government deficits or, equivalently, loosen the individual rationality constraint (9).

Other more fundamental and important extensions may also be of interest. First, although the choice of the optimum expenditure policy of a state is essentially a dynamic issue, it is modeled here in a static framework. A more complete model must consider the effects of accumulation of debt in the future decisions of a state. This approach would generate a more precise solution to the state's problem in section 4, for example. Second, although the renegotiation of a state's debt is essentially a political issue, no model of the bargaining process is included in this model. Some concepts of positive political economy might greatly enrich the appeal of those models. In particular, in the federal government's minimization problem studied in section 5 the subsidy cost to the nation of this renegotiation process is not considered. Finally, this article takes parametrically the optimal state deficit level D_S^*; a more comprehensive model would take into account how the federal government determines this optimal level of deficit.

The expansion of the basic models to include the above frictions is left as a suggestion for further research.

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