A Common Pool Theory of Supranational Deficit Ceilings*

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Abstract

The budget deficit bias is modeled as the result of a domestic common pool problem and of an international externality. Deficits can be used to

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finance both unproductive and productive public spending. An optimally set supranational deficit ceiling is examined and welfare is compared to the unconstrained outcome and to the case of nationally set deficit ceilings. The supranational deficit ceiling is found to be welfare improving relative to similar national arrangements, but does not fully eliminate the deficit bias unless combined with a domestic fiscal institution allowing for precommitment to productive public spending.

1. Introduction

Public debts have doubled relative to GDP in the OECD area over the past three decades. This debt buildup, unprecedented in peace time, is suggestive of a systematic deficit bias. One response has been the adoption of various fiscal rules. Chile and Brazil have set formal deficit targets. The UK operates an informal Code for Fiscal Stability. Belgium has established a High Council of Finance. Denmark, the Netherlands and Sweden rely on Wisepersons' committees to inform the general public. Perhaps the most prominent rule is the adoption by the European Union of the Stability and Growth Pact (SGP), which aims to put an upper limit to budget deficits.

The theoretical basis for fiscal rules is only starting to be articulated. Von

Hagen and Harden (1995) and Hallerberg and Von Hagen (1999) use political economy models of the deficit bias to show that fiscal restraints can be desirable and that delegation of the budget decision to a strong Finance Minister reduces the bias. Primo (2006) uses a distributive politics model to establish that budget ceilings reduce deficits. Beetsma and Uhlig (1999) show that a SGP can be welfare improving in the presence of a deficit bias, but Beetsma and Debrun (2004, 2005) argue that the pact may have the undesirable side effect of reducing productive as well as unproductive public spending. This observation provides support for a 'golden-rule' mechanism that shields productive spending. Blanchard and Giavazzi (2004) reach similar conclusions with a model that assumes that the return from productive public spending is underestimated by standard accounting rules.

This literature either analyses the welfare properties of specific national and state level arrangements or assumes that supranational restraints, such as the SGP, substitute for national measures. This leaves open the questions of when a supranational fiscal restraint is justified, and what are the welfare properties of international deficit ceilings more generally. Our paper aims to explore these issues.

To do this, we need a model of the deficit bias. The literature proposes several sources of a deficit bias. At the national level, the bias can be the result of a

common pool problem, as shown by Von Hagen and Harden (1995), Hallerberg and Von Hagen (1999) and Velasco (1999, 2000). It can also be a consequence of time inconsistent preferences, as formalized by Alesina and Tabellini (1990) and applied by Beetsma and Debrun (2004,2005) and Beetsma and Uhlig (1999).[1] A common pool problem arises when several decision makers - spending ministers, lobby groups, parties in a coalition government - compete for their preferred public goods. The bias is the result of an externality, the current and future general tax burden needed to pay for these preferred goods.[2] Time inconsistency leads to a deficit bias when current governments do not fully internalize the costs that future governments will bear when servicing the public debt. These interpretations of the deficit bias have been documented in a large number of papers. The evidence suggests that political fragmentation, i.e. common pool problems, play a role in the deficit bias (Persson et al. 2003; Fabrizio and Mody, 2006; Roubini and Sachs, 1989; von Hagen 1992; von Hagen and Harden, 1994). There is less support for the view that uncertainty of reelection causes deficits (Lambertini, 2003, finds zero support for this theory, while Roubini and Sachs, 1989, find some). Given the empirical evidence, we adopt the common pool interpretation of the domestic

[1] An excellent survey is Persson and Tabellini (2000), Chapter 9. The seminal contribution is Weingast et al. (1981).

[2] The delayed stabilizations case, developed by Alesina and Drazen (1991), can be seen as a case of common pool.

political distortions leading to a deficit bias.[3],[4]

The common pool problem and time inconsistency are domestic political failures. In principle, they ought to be addressed at the domestic level and not with supranational fiscal arrangements. Supranational fiscal arrangements or interventions, for example the IMF or Europe's SGP, can be justified as external agents of restraint when existing domestic political equilibria rule out domestic solutions. But this begs the question why the special interests, which make national solutions impossible, would allow for a supranational rule. This leads us to postulate the existence of an international externality, a *prima facie* rationale for an international intervention.

The existence of such an international debt externality within a monetary union reflects the debate that took place among the Founding Fathers of the EMU, who feared that, in a monetary union, "the inflationary fiscal policy of a single country would thus incur costs that would have to be shared by all member states" (Stark, 2001, p.79). The discussions that led to the adoption of the SGP have identified different possible international externalities of budget deficits or debt.[5]

[3] While, for simplicity, we do not account for time inconsistency, we note that Krogstrup (2006) shows that the common pool externality can be interpreted as an externality due to time inconsistency.

[4] Primo's (2006) distributive politics model used for analysis of US state deficit ceilings can also be interpreted as having a deficit bias driven by a common pool or pork barrel problem.

[5] See the papers collected in Brunila, Buti and Franco (2001). See also Giuliodori and Beetsma

One proposed externality runs through a shared interest rate. The assertion is that one country's deficit raises the European (or international) interest rate and therefore the cost of debt service in other countries. Alternatively, the prospect of a sharply contractionary national fiscal policy as a response to high public debt may force the hand of an imperfectly independent central banker to raise the common inflation rate.[6] Yet another externality is that the threat of debt default by one member country could worry the financial markets and result in a union-wide risk premium, presumably because of fears that the common central bank will eventually monetize some or all of the debt.[7]

The current financial crisis has underlined the plausibility of such an externality. Facing high spreads for some national public debts, EMU finance ministers have made statements that they will not let individual EMU countries fall into financial distress. Our model indeed assumes that each country expects to be able to impose some of its debt service on other countries.

As modeling framework, we adopt and extend the domestic deficit bias model of Velasco (2000). The advantage of this model is that it focuses on deficits while

(2004) for a general discussion.

[6] Beetsma and Uhlig (1999) model an international externality of debt in a Monetary Union along such lines.

[7] To eliminate this possibility, the Treaty of the European Union includes a no-bailout clause. But this clause has not yet been tested and is sometimes considered as weak.

leaving levels of spending and taxes out. This neatly allows us to separate the deficit bias from the issue of government size. We extend this model in several ways. First, by allowing for productive public spending in addition to unproductive public transfers. Without productive public spending, the optimal fiscal rule is trivially a zero deficit ceiling. Second, to simplify, we consider only two periods. Third, we consider two countries linked by a negative debt externality. We retain Velasco's (2000) assumption that the budget is set single-handedly by the national government. We hence do not take the additional step of modeling the parliamentary amendment and approval process, in order to focus on the underlying issues of conflicts of interest and to keep the model and conclusions simple.[8] The resulting model allows us to obtain intuitive analytical solutions.

The paper is structured as follows. The next section presents the model. Section 3 characterizes the socially optimal solution while Section 4 describes the outcome in the presence of both domestic and international externalities. Section 5 looks at the role of the SGP, described as a deficit ceiling optimally set by a supranational agent. In Section 6, we consider the possibility that productive

[8]The role of parliament and its voting rules is the object of an important literature. The seminal contribution is Baron and Ferejohn (1989). The more general issue of separation of power has been reviewed by Bendor et al. (2001) and applications to the budget process are Ferejohn and Krehbiel (1987) and Grossman and Helpman (2006). Some supporting empirical evidence is provided, e.g. by Alesina and Perotti (1999)

public spending is shielded from the grab race that characterizes unproductive transfers. The last section summarizes our results and offers some concluding remarks.

2. The Model

The description of the domestic common pool problem follows Velasco (2000). In each country, there exist $n \geq 1$ interest groups, indexed by i, $i = 1, 2, ..., n$. We assume that all interest groups are of the same size, and that all citizens belong to one interest group. Each group can decide on the amount of net transfers, g_t^i, that it obtains in period $t = 1, 2$. Net transfers in the home (resp. foreign) country, $g_t^{h,i}$ (resp. $g_t^{f,i}$), are defined as gross transfers received less taxes paid. The gross transfers can be seen either as pure transfers or entitlement spending, or as the provision of public goods that are useful only for the receiving interest group. We think of these interest groups as spending ministries captured by special interest, or as parties representing different constituencies in a coalition government. Here we portray the extreme case where interest groups are in complete control of the net transfer part of the budget, creating a common pool problem leading to a deficit bias.

In addition to the domestic common pool problem, we allow for an interna-

tional debt externality. In our two-country model, we allow for each country to have a fraction α of its debt paid for by the other country. Hence, a portion α of domestic debt B^h can be passed on to the other country while the home government must serve a portion α of the foreign government debt B^f. This is a rough but simple way of capturing the international externality previously described.

Since some deficits may be socially desirable, we also allow for another budget item, productive spending, as in Beetsma and Debrun (2004, 2005). This spending is productive in the sense that it raises public revenues in the next period. We assume that it benefits all groups equally. Productive public spending (infrastructure, education, etc.) may in fact benefit some groups more than others. In order to simplify, we ignore this potential source of externality since it is already operating through transfers. Denote productive spending at home in period one as X^h. Spending X^h in period one raises tax revenues by $\theta(X^h)$ in period two. We assume $\theta' > 0$ and $\theta'' < 0$, i.e. these expenditures are subject to decreasing returns, which is needed for the second order condition to be satisfied.

The government can borrow or lend internationally any amount that it wishes at the constant real interest rate r (i.e. we assume that the economy is small), and it is bound by an intertemporal budget constraint. The budget constraint is understood and accepted by all interest groups. Thus, by assumption, we rule

out defaults, an extremely rare occurrence in developed economies. The budget constraint of the home country government in period one is:

$$\sum_{i=1}^{n} g_1^{h,i} + X^h = B^h, \tag{2.1}$$

where B^h is the debt acquired in period one. For simplicity and without loss of generality, we assume that there is zero initial debt. Crucially, no other actors, including the interest groups, can borrow or lend. This assumption ensures that the public debt is non-neutral, since the private sector cannot offset its intertemporal net transfer profile. The assumption does not change the common pool problem as a driver of deficits, but it is needed for realized deficits to have welfare implications.

The second period budget constraint for the home country is:

$$\sum_{i=1}^{n} g_2^{h,i} + (1+r)\left[(1-\alpha)B^h + \alpha B^f\right] = \theta(X^h), \tag{2.2}$$

where α represents the international externality.

The home country's intertemporal budget constraint thus becomes

$$(1-\alpha)\left[\sum_{i=1}^{n} g_1^{h,i} + X^h\right] + \alpha\left[\sum_{i=1}^{n} g_1^{f,i} + X^f\right] + R\sum_{i=1}^{n} g_2^{h,i} = R\theta(X^h), \tag{2.3}$$

where $R = (1+r)^{-1}$. The same constraints apply to the foreign country.

We assume that each interest group can implement its chosen level of net transfers in both periods. For simplicity, all interest groups have the same preferences over net transfers, represented by the following utility function:

$$U^{h,i} = \log\left(g_1^{h,i} + \overline{g}\right) + \beta \log\left(g_2^{h,i} + \overline{g}\right), \tag{2.4}$$

where β is the time preference factor. The term $\overline{g}$ represents the maximum amount of net taxes that each interest group is willing and able to pay. More precisely, we assume that there is a lower limit $-\overline{g} < 0$ for the net transfers received by each interest group.[9] It follows that the maximum net revenues that can be collected is $\overline{G} = n\overline{g}$.

When $\beta \neq R$ there exists a rationale for shifting income across periods and therefore for a budget deficit or surplus in period one. This rationale is well understood and not pursued further here. For simplicity, therefore, we assume that $\beta = R = 1$ and therefore, that the world interest rate is $r = 0$.[10] Again, the

[9] This formulation, akin to that used in Velasco (1999), implies that $U^{h,i} \longrightarrow -\infty$ when $g_t^{h,i} \longrightarrow 0$. The formulation differs from Velasco (2000) who assumes instead a bliss level for transfers and uses a quadratic loss function.

[10] The solution to the model in the case where $\beta \neq R$ can be obtained from the authors upon request.

situation is identical in the foreign country.

We first consider the socially optimal level of productive spending and allocation of deficits between interest groups and across countries. Then we consider the free-for-all case when the interest groups effectively control the transfers and level of public spending, before investigating the welfare implications of deficit ceilings.

3. The Social Optimum

The social optimum is found when all decisions are delegated to a supranational social planner. National social planners will not do because they will only internalize the domestic common pool problem, not the international externality. We briefly consider the case of national social planners at the end of Section 4 below.

The supranational social planner chooses $g_t^{k,i}$and X^k for $k = h, f$ to maximize $\sum_{i=1}^{n} U^{h,i} + \sum_{i=1}^{n} U^{f,i}$ subject to the budget constraints (2.3) for both countries. Given the symmetry between interest groups and across countries, it is clear that $g_t^{k,i} = g_t$, $\forall k, i$, and $X^h = X^f = X$. Denoting aggregate transfers $G_t = ng_t$, the two following conditions characterize the social optimum:

$$\theta'(X) = 1, \tag{3.1}$$

$$G_1 = G_2. \tag{3.2}$$

Condition (3.1) implies that the social planner chooses the level of productive spending $\overline{X}$ that maximizes the surplus $\theta(X) - X$. Condition (3.2) means that the social planner equalizes transfers across periods. Both results reflect the simplifying assumption $\beta = R = 1$.

Note that symmetry also implies the following intertemporal budget constraint (2.3), the same for both countries:

$$G_1 + G_2 = \theta(X) - X. \tag{3.3}$$

The constraint being recognized *ex ante* by the supranational social planner, the international externality is fully internalized and (3.2) shows that the same applies to the domestic political distortions. Using definition (2.1), the socially optimal deficit is

$$B^* = \frac{1}{2}\left[\theta(X^*) - X^*\right] + X^*, \tag{3.4}$$

where asterisks denote socially optimal values. Period one and two net transfers

are $G_1^* = G_2^* = \frac{1}{2}[\theta(X^*) - X^*]$.

When public spending is productive, i.e. when $\theta(X) - X > 0$, the planner allocates it to the interest groups in both periods. The first-period deficit is entirely paid off in period 2 with the remaining surplus. If public spending is not productive, then $X \equiv 0$ and the socially optimal debt is zero.

4. Captured Governments

We now look at the case where both externalities are at work. The international externality arises because each national government ignores the other one when it makes its decisions. The national externality occurs because we assume that captured governments allow each interest group to independently select its own net transfers. The level of productive spending is decided by consensus (or majority vote - the outcome would be the same). The game is solved backwards. Once in period two, the debt to be repaid is predetermined by period one decisions and the country's budget constraint (2.2), so there is no further decision to be made at that stage. We assume that in period two each interest group receives (pays) an equal share of transfers:[11]

[11] A slightly more complex bargaining process in period two, for example along the lines of the Baron and Ferejohn (1989) model, would also be possible, and would not change the central

$$g_2^i = \frac{\theta(X^h) - \left[(1-\alpha)B^h + \alpha B^f\right]}{n}. \tag{4.1}$$

Period two transfers are paid for by the return from productive spending less debt repayment. (4.1) shows how the combination of the two externalities creates a deficit bias. Repayment of a portion of the foreign debt reduces transfers but this is not an externality since domestic interest groups cannot do anything about it in period one. The externalities operate through the domestic debt $B^h = \sum_{i=1}^{n} g_1^{h,i} + X^h$. Each interest group perceives that it will have to repay a fraction $(1-\alpha)/n < 1$ of the debt and, therefore, of its own period one transfers. The strength of the deficit bias increases with the number of interest groups and with the size of the international externality.

In period one, we assume that the interest groups in the two countries move simultaneously in choosing their net transfers, and that the interest groups move simultaneously across countries in selecting their level of productive spending. We thus abstract from any asymmetry in the sequencing of moves. Still, there remain at least two possible ways of describing the situation: one with and one without

common pool mechanism or our conclusions. But it would introduce uncertainty between the two periods from the point of view of the individual interest group, and it would therefore complicate the derivations correspondingly. Primo (2006) is an example of a model analyzing the effect of budget ceilings with an explicit bargaining process of the legislature.

precommitment concerning productive spending. We discuss the precommitment case in Section 6 below. Here we consider the no-precommitment case, which takes the form of a one-stage Nash-Nash game. The interest groups play Nash against each other and against the interest groups of the other country in their choice of net transfers and in selecting productive spending.[12]

When deciding on its net transfers in period one, interest group i will take as given the level of productive spending and the actions of other interest groups. Formally, it maximizes its utility function (2.4) subject to (4.1) and to its period one budget constraint (2.1), $g_1^{h,i} = B^h - \sum_{j \neq i} g_1^{h,j} - X^h$. The first-order condition is

$$\begin{aligned} g_1^{h,i} &= \frac{1}{2\,(1-\alpha)} \left[(\alpha + n - 1)\,\overline{g} + \theta(X^h) - \alpha(X^f + \sum_{i=1}^{n} g_1^{f,i}) \right] \\ &\quad -\frac{1}{2} \left[X^h + \sum_{j \neq i} g_1^{h,j} \right]. \end{aligned} \tag{4.2}$$

Applying symmetry across interest groups (but not yet across countries) yields

[12] The one-stage Nash-Nash setup turns out to be equivalent to a game in which the interest groups choose their net transfers before productive spending, since - as will become clear below - the choice of productive spending does not depend on the level of the interest groups' transfers.

the aggregate reaction function for net transfers in Home

$$G_1^h = \frac{n}{(1+n)(1-\alpha)}\left[\frac{n-(1-\alpha)}{n}\bar{G} + \theta\left(X^h\right) - (1-\alpha)X^h - \alpha\left(X^f + G_1^f\right)\right], \tag{4.3}$$

where $G_1^h = \sum_{i=1}^{n} g_1^{h,i}$. The same condition and reaction function apply abroad.

The optimal choice of productive spending is very simple and all interest groups agree. The surplus perceived by the interest groups is $\theta(X) - (1-\alpha)X$, since a fraction α of first period spending is paid for by the other country. The greater is the surplus from productive spending, the larger is the domestic common pool from which net transfers can be distributed. In addition, no one can use productive spending to increase his or her own net transfer at the expense of the other interest groups. It follows that the interest groups maximize the domestic surplus from productive spending by selecting X such that

$$\theta'(X) = 1 - \alpha. \tag{4.4}$$

Since $\theta''(X) < 0$ this means that $X > X^*$ i.e. productive spending exceeds the socially optimal level that maximizes $\theta(X) - X$ as in (3.1). This is a consequence of the international externality.

In equilibrium, we have $g_t^{k,i} = g_t \forall t, k, i$, $G_t^h = G_t^f$ and $X^h = X^f = X$, and the

solution for aggregate net transfers for each country is

$$G_1 = \frac{n-(1-\alpha)}{n+(1-\alpha)}\overline{G} + \frac{n}{n+(1-\alpha)}\left[\theta(X) - X\right], \tag{4.5}$$

which implies the deficit

$$B = \frac{n-(1-\alpha)}{n+(1-\alpha)}\overline{G} + \frac{n}{n+(1-\alpha)}\left[\theta(X) - X\right] + X. \tag{4.6}$$

Note that when $n = 1$ and $\alpha = 0$ there is no externality and we obtain social optimum ((4.4), (4.5) and (4.6) reduce to (3.1), (3.3) and (3.4), respectively). The first term in (4.6) shows how the extraction of maximum taxing capacity in the second period, $\bar{G}$, is shared among interest groups in the form of deficits in the first period. This extraction increases in both α and n. In the limit case where $n \longrightarrow \infty$, the term is equal to $\overline{G}$, which means that infinitely small interest groups fully exhaust their future tax capacity today. The role of productive public spending is captured by (4.4) and by the second term in (4.6). Interest groups compete for the surplus $\theta(X) - X$ created by productive spending. Again, in the limit case where $n \longrightarrow \infty$, each of the infinitely small interest groups attempts to capture the whole surplus. The third term in (4.6) correspond to the financing of productive public spending in period 1, which is larger than socially desirable.

Note also that the case where $n = 1$ and $\alpha > 1$ corresponds to the case where two national social planners select domestic transfers, productive spending and deficit levels. Moreover, the case of a single country, or alternatively, the case of a country outside a monetary union, corresponds to assuming $\alpha = 0$. In that case, the interest groups choose the socially optimal level of productive spending, as (4.4) reduces to (3.1), but the deficit bias is not eliminated since (4.6) becomes

$$B = \frac{n-1}{n+1}\overline{G} + \frac{n}{n+1}\left[\theta(X) - X\right] + X. \tag{4.7}$$

In this case, the domestic common pool problem creates two sources of a deficit bias. The first term in (4.7) reflects the grab for transfers in the absence of productive spending. The second term shows how the interest groups capture part of the surplus generated by productive spending.

5. Deficit (or Debt) Ceilings

The SGP's answer to the deficit bias is a mandatory deficit and a debt ceiling, although the latter has been set aside *de facto*.[13] In our two-period model, there

[13]The Stability and Growth Pact includes a preventive arm and a corrective arm. The preventive arm prescribes a deficit ceiling set in cyclically adjusted terms. Under the interpretation that X represents a keynesian expansion, it is only "productive" during periods of slowdown. In normal times, fiscal policy is not needed and could be counter productive (e.g. $\theta(X) \leq X$)

is no distinction between deficit and debt, and we therefore consider only one ceiling.[14] We assume that the deficit ceiling is optimally set by a supranational authority that we call the fiscal agency. The sequencing of the game is the following. The fiscal agency moves first and sets the deficit ceiling. In a second stage, the interest groups set their net transfers. Finally, productive spending is residually chosen so that the deficit ceiling binds. This sequencing assumes that the deficit ceiling is accepted by the interest groups, which can be interpreted as a sign that it is credible. We briefly return to the issue of credibility below.

In deciding on net transfers, the interest groups recognize that productive spending, and the associated surplus $\theta(X) - X$, will be constrained. In this situation their budget constraints (2.1) and (2.2) become

$$\sum_{i=1}^{n} g_1^{h,i} + X^h = \hat{B}, \tag{5.1}$$

$$\sum_{i=1}^{n} g_2^{h,i} + \left[(1-\alpha)\hat{B} + \alpha\hat{B}\right] = \sum_{i=1}^{n} g_2^{h,i} + \hat{B} = \theta(X^h), \tag{5.2}$$

where $\hat{B}$ denotes the deficit ceiling. Because the two countries are assumed to be

and indeed the optimum solution is $X = 0$. During periods of slowdown, on the other hand, it is desirable to choose $X = \overline{X} > 0$.

[14] Wyplosz (2005) emphasizes the distinction and argues that the public debt is the correct variable to be targeted. Ribeiro et.al (2008) investigate the welfare implications of deficit vs. debt constraints formally.

identical, the optimal ceiling is the same. It follows that the same constraint binds both countries' deficits, which eliminates the international externality. Only the domestic externality remains. The symmetry of interest groups implies that their optimal choice for period one and two transfers is characterized by

$$G_1 = \left[\frac{n - \theta'(X)}{\theta'(X)}\right] \bar{G} + \frac{n}{\theta'(X)} \left[\theta(X) - \hat{B}\right], \tag{5.3}$$

$$G_2 = \theta(X) - \hat{B}. \tag{5.4}$$

This implies that productive spending is:

$$X = \hat{B} - G_1. \tag{5.5}$$

The fiscal agency chooses the deficit ceiling $\hat{B}$ to maximize international welfare. Given (5.3), by setting $\hat{B}$ the fiscal agency in effect sets X. The agency's optimal decision is characterized by

$$\theta'(X) = \frac{n}{1 + (n-1)\dfrac{dX}{d\hat{B}}}, \tag{5.6}$$

where

$$\frac{dX}{d\hat{B}} = \frac{n + \theta'(X)}{(1+n)\theta'(X) - (G_1 + \bar{G})\theta''(X)}. \tag{5.7}$$

Substituting (5.5) into (5.3) gives the level of transfers

$$G_1 = \left[\frac{n - \theta'(X)}{\theta'(X) + n}\right] \bar{G} + \frac{n}{\theta'(X) + n} \left[\theta(X) - X\right]. \tag{5.8}$$

Since $\theta''(X) < 0$, (5.6) and (5.7) imply $\theta' > 1$ i.e. $X < X^*$. Productive spending is now less than optimal. This, in turn, reduces the available surplus $\theta(X) - X$ and thus indirectly constrains transfers G_1. Intuitively, the ceiling reduces both productive spending and unproductive transfers since the fiscal agency cannot choose how the effect of the ceiling is distributed across the two spending items. In order to reduce transfers, the agency must accept to squeeze productive spending below its efficient level. Note that $\theta' > 1$ implies $\dfrac{dX}{d\hat{B}} < 1$, which in turn implies that when $\hat{B}$ is reduced, X falls by less than $\hat{B}$. In order to reduce unproductive transfers G_1, the fiscal agency must shrink the surplus $\theta(X) - X$. Note also that, $\dfrac{\partial \theta'(X)}{\partial n} > 0$.[15] This means that when the domestic externality rises, i.e. when n increases, the fiscal agency reduces $\hat{B}$, which increasingly constrains X and G_1.

[15] $\dfrac{\partial \theta'(X)}{dn} = \dfrac{1}{\left[1 + (n-1)\dfrac{dX}{d\hat{B}}\right]^2}(1 - \dfrac{dX}{d\hat{B}}) > 0.$

For n large enough, productive spending is driven to zero; it is fully crowded out by net transfers. In this limit case, the fiscal agency does not face a trade-off between squeezing the deficit and reducing the surplus $\theta(X) - X$ and it sets $\hat{B} = 0$.

The upshot is that an optimally set (and credible) deficit ceiling cannot deliver the social optimum in the presence of a domestic common pool problem when some expenditures are productive. The deficit distortion created by the international externality, however, is removed by the internationally set deficit ceiling. The supranational fiscal agency thus has a useful role to play in setting the deficit ceiling if an international externality indeed exists, since welfare rises relative to the unconstrained Nash equilibrium (this must be the case since the fiscal agency can always set a deficit ceiling that reproduces the Nash outcome).

This does not yet make the case for a supranational fiscal agency. We still need to consider the case in which the deficit ceiling is set at the domestic level in each country. The relevant comparison is with two national fiscal agencies that simultaneously set their national debt ceilings in the first stage. Since they do not internalize the international externality, the national fiscal agencies have an incentive to set their ceilings higher than that chosen by the supranational fiscal agency. In equilibrium, the ceilings are nevertheless set at the same level across

to two countries due to the symmetry assumption.[16] We hence know that welfare cannot be higher with national fiscal agencies, as the supranational fiscal agency can always reproduce the national agencies' decisions, but chooses to set the ceiling lower. The two cases deliver the same outcome when $\alpha = 0$. In other words, a supranational fiscal agency is only justified relative to nationally set ceilings when an international externality of debt exists.

The above reasoning assumes that the decisions of the fiscal agency are recognized *ex ante* by national authorities. If this is not the case, the ceiling is not fully credible. This case can be captured by assuming that the supranational fiscal agency sets the ceiling after the interest groups have decided on the part of the budget allocated to transfers. As before, productive spending is the residual and symmetry between countries implies that the deficit ceiling eliminates the international externality. The main difference is that productive spending is at the optimal level X^*, because the fiscal agency cannot directly affect transfers. Since it does not face any trade-off, it takes transfers as given and sets the ceiling such that productive spending is optimal. The larger surplus $\theta(X) - X$ is captured by interest groups to increase transfers further in the first period, implying

[16] It bears emphasizing that this result holds because we assume that the two countries are identical.

that transfers as well as the deficit are higher, and welfare is lower. Still, because productive spending is optimally set, the situation is improved relative to the unconstrained Nash outcome because the international externality is internalized. If there is no international externality (when $\alpha = 0$), a non-credible ceiling coincides with the Nash outcome because the fiscal agency cannot constrain transfers.

6. Precommitment to Productive Spending

A deficit ceiling optimally set by a supranational fiscal agency does not fully eliminate the deficit bias because it is too coarse. Unable to distinguish between productive and unproductive spending, the fiscal agency must constrain both in order to limit the latter. A natural question is whether shielding productive spending can substitute for the ceilings or make them more effective. In this section, we consider the case when captured governments, i.e. the interest groups, decide first on the level of productive spending X and then choose the individual net transfers. This means that the interest groups act as Stackelberg leaders in their choice of X *vis-a-vis* their subsequent choice of net transfers. But each interest group still plays Nash against the other interest groups and against the other country. In practice, this means that the budget process involves two stages. A first budgetary law decides on spending items deemed productive and a second

law sets the other items, which we call transfers.[17]

6.1. No Deficit Ceiling

We first examine the unconstrained case and compare the results with those of Section 4. The only difference concerns period one. In a second stage of the first period, the interest groups choose net transfers taking productive spending as given in the two countries. Each interest group acts according to (4.2), which by symmetry gives the aggregate reaction function for interest groups in home (4.3) and correspondingly in foreign

$$G_1^f = \frac{n}{(1+n)(1-\alpha)}\left[\frac{\alpha+n-1}{n}\overline{G} + \theta(X^f) - (1-\alpha)X^f - \alpha(X^h + G_1^h)\right]. \tag{6.1}$$

In the first stage, the home interest groups set X^h to maximize $\sum_{i=1}^{n} U^{h,i}$ subject to the two reaction conditions (4.3) and (6.1), and to the interest groups' intertemporal constraints, taking X^f, but not G_1^f, as given. The first-order condition is

[17] We do not attempt to develop the institutional setup that would make this procedure operational. Shielding productive spending is remindful of the German golden rule while the two-step procedure borrows a leaf from the Italian practice. We are also well-aware that the distinction between productive and unproductive spending is not clear cut and could well be manipulated by interest groups.

$$\frac{1}{G_1^h + \overline{G}} \frac{dG_1^h}{dX^h} + \frac{1}{G_2^h + \overline{G}} \frac{dG_2^h}{dX^h} = 0.$$

By the envelope theorem, this amounts to setting X^h such that $\frac{dG_1^h}{dX^h} = 0$. The equilibrium is symmetric ($X^h = X^f = X$) such that[18]

$$\theta'(X) = 1 - \alpha - \frac{\alpha^2 n}{(1-\alpha)(1+n)}, \tag{6.2}$$

and $G_t^h = G_t^f = G_t$. The deficit in each country remains given by (4.6). The last term in (6.2) shows the effect of precommitment. Productive spending, which is already above the socially optimal level without precommitment, is even higher with precommitment. This is entirely due to the international externality (it disappears when $\alpha = 0$, not when $n = 1$). To see why, suppose X^h increases. Foreign interest groups see it as a reduction in their domestic common pool since they will pay for a proportion α of this additional spending. Accordingly, they reduce their own transfers G_1^f, which reduces the debt burden in the home country and hence increases the foreign common pool through the international externality. This increases home interest groups' incentive to further raise X^h. Yet, transfers

[18]Note that $\theta'(X) > 0$ when $\frac{1-\alpha}{\alpha} > \sqrt{\frac{n}{1+n}}$, which is satisfied for $\alpha \leq \frac{1}{2}$ i.e. when the international externality is not too large.

to interest groups in both periods are reduced because the surplus $\theta(X) - X$ is lower. It can be shown that the increase in productive spending X outweighs the reduction in transfers, so the deficit is larger.[19] As a result, welfare is lower.[20],[21] Protecting productive spending when it is already above its optimum level backfires. Domestic budgetary reform of this particular kind is not welfare improving on its own in the presence of an international debt externality.

6.2. Deficit ceiling

We now consider the effect of a credible supranational deficit ceiling to precommitment. The sequencing of the game in the first period is as follows. In the first stage, the fiscal agency selects the deficit ceiling, denoted by $\hat{B}$. In the second stage, the interest groups set X at the level $\hat{X}$ that maximizes national

[19] Formally, call B^P and B^{NP} the deficit with and without precommitment, respectively, and correspondingly X^P and X^{NP}. We have:

$$\frac{B^P - B^{NP}}{X^P - X^{NP}} = \frac{n}{n + (1-\alpha)} \frac{\theta(X^P) - \theta(X^{NP})}{X^P - X^{NP}} + \frac{1-\alpha}{n + (1-\alpha)} > 0$$

Since $\theta'(X) > 0$ and $X^P > X^{NP}$, it follows that $B^P > B^{NP}$.

[20] Since the interest groups' first order condition implies $G_2 + \overline{G} = \frac{1-\alpha}{n}(G_1 + \overline{G})$, welfare is $2\log(G_1 + \overline{G}) + \log(\frac{1-\alpha}{n})$.

[21] This result depends on the assumption that interest groups take into account the reaction function of the foreign interest groups. The alternative assumption that they only take into account domestic interest groups' reaction function (i.e. $E\left\{ \frac{\partial G_1^f}{\partial X^h} \right\} = 0$) would yield the Nash outcome.

welfare $\sum_{i=1}^{n} U^{k,i}$ for $k = h, f$, given $\hat{B}$. In the third stage of the game, the interest groups recognize that the transfers will be set residually, i.e. $G_1\left(\hat{X}\right) = \hat{B} - \hat{X}$. Note that the fiscal agency controls the deficit $\hat{B}$, but not its breakdown between G_1 and X. However, the agency knows that the interest groups select productive spending first. By setting the ceiling at the socially optimal level of debt, $\hat{B} = X^* + \frac{\theta(X^*) - X^*}{2}$, the fiscal agency leads the interest groups to choose $X = X^*$ and, therefore, $G_1 = \frac{\theta(X^*) - X^*}{2}$, which delivers the social optimum.

The combination of a domestic fiscal institution which allows for precommitment, and an internationally set deficit ceiling, fully eliminates the deficit bias. The reason is clear: forcing the interest groups to act as residual claimants eliminates the domestic externality while the international externality disappears because the same deficit ceiling *ex ante* applies to both countries.[22]

7. Summary and Conclusions

This paper is a theoretical exploration of the rationale for supranational fiscal restraints, and more generally, an exploration of the welfare properties of deficit ceilings, motivated by Europe's Stability and Growth Pact and other similar

[22] The result holds when the deficit ceiling is not fully credible, for exactly the same reason.

arrangements. Deficit ceilings are meant to correct a deficit bias. In our two-country two-period model, the bias is created by two debt externalities: a domestic common pool problem, which arises because interest groups disagree on the distribution of transfers, and an international externality. We model the international externality as a partial international transfer of debt burdens. This is meant to describe in a simple way the fear, expressed when the SGP was adopted, that high-debt countries might seek relief through the inflation tax, which would be levied on all monetary union members. Deficits are used to finance both unproductive transfers to interest groups, and productive spending which increases government tax revenues in the second period. This setup allows us to examine the welfare properties of optimally set deficit or - equivalently here - debt ceilings.

We find that if the main rationale for the SGP is the presence of an international debt externality, such an externally-set deficit ceiling is indeed welfare improving, both relative to the unconstrained Nash outcome and relative to nationally set deficit ceilings. While faring better than national arrangements, however, an externally-set ceiling cannot fully eliminate the deficit bias in the presence of productive spending. The reason is that the ceiling constrains total borrowing, but not its breakdown into what finances productive spending and what finances

unproductive net transfers.[23] As a consequence, there is a trade-off in setting the international deficit ceiling. The lower is the ceiling, the closer are the transfers to their optimal level but the further productive spending falls below its efficient level. We then show that to reach social optimum, we need to complement the external deficit restraint with a national-level institutional arrangement. Furthermore, the specific institutional arrangement of allowing for precommitment to productive spending before unproductive transfers are determined will deliver social optimum in the presence of an optimally set external debt restraint.

The findings raise the question of how such a precommitment can be set up in practice. The model suggests a two-step budgetary procedure whereby productive spending is identified and committed to before other types of expenditures are determined, but it remains to be seen how such a procedure could be implemented. It is not always possible to draw a line between productive and unproductive public spending, so some value judgment would be required.[24] Finance Ministers are usually those assumed to be best placed to pass such judgment. Under this view, precommitment means that the Finance Minister - or the Prime Minister -

[23] Intuitively, the Tinbergen principle suggests that, faced with two policy objectives, we need two 'instruments'.

[24] Drawing up lists of productive items is likely to produce creative accounting, however. On the issue of creative accounting, see Milesi-Ferretti (2003), Canova and Pappa (2004), and Buti et al. (2006).

is given a dominating role in the budget process. Von Hagen and Harden (1994) provide a detailed discussion and evaluation of existing arrangements and show that the performance of these arrangements are intimately linked to the structure of government (single party or coalition). However, if a proper institution can be set up to shield productive spending from interest groups, one can ask why the equivalent of a national social planner could not be instituted as well.

The findings raise the further question of who is the agent setting the deficit (or debt) ceiling and what it means to set the ceiling optimally. A mandatory ceiling fixed by law, for example a zero-budget rule or the SGP's three percent limit will not do. Recall that, in our model, the ceiling is optimally chosen and not set at an arbitrary level through a fixed rule. This is a crucial condition for achieving the social optimum. Of course, the ceiling can be interpreted as a fixed rule, but only if economic conditions remain invariant. If we interpret our model as a snapshot of constantly changing situations, the fiscal agency must fix a new ceiling for each annual budget. This is not how the SGP operates, although the 2005 reform has sought to introduce some flexibility by allowing for special circumstances to weigh in when judging both commitments and adherence to commitments.[25] The need

[25] In the European Monetary Union, the Commission intervenes to pass judgement on the reasons why a country might not abide by the deficit ceiling. This could be interpreted as the Commission implicitly changing the ceiling in response to particular circumstances.

for constantly determining the optimal ceiling implies that the role of the fiscal agency must be delegated to a fairly sophisticated and non-partisan agent.

Finally, our analysis is subject to the usual caveat regarding limitations inherent to all modeling exercises. The model and policy implications rest on a number of simplifying assumptions that should be kept in mind when interpreting the results. Probably the most important limitation is that we have assumed symmetry of the countries linked by an international debt externality. Symmetry brings considerable analytical simplification and tractability, but at a cost. The assumption that the debt ceiling is identical across countries and universally binding is crucial. Any asymmetry - country size and structure, but also the prevailing economic conditions - would result in different optimal ceilings for each country and it would be much more difficult to deal with the international externality.

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