

# A Common Pool Theory of Deficit Bias

## Correction

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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. Along with Pigouvian taxes, a number of policy measures are examined and welfare-ranked: deficit ceilings, golden rules and delegation. In general, the combination of delegation and an optimally-set deficit ceiling deliver the social optimum, even if the deficit ceiling is not credible.

## 1 Introduction

Public debts have doubled on the average in the OECD area over the past three decades. This debt buildup, unprecedented in peace time, strongly suggests that industrial democracies suffer from a deficit bias. This bias has not gone

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unnoticed. Fiscal rules have been widely adopted in a number of countries and federated states. Chile and Brazil have adopted formal deficit targets. The UK has put in place a more informal Code for Fiscal Stability and Belgium has established a High Council of Finance. Denmark and the Netherlands have set up wisepersons' committees that inform the general public on the state of public finances. Perhaps the most prominent rule is the adoption in the European Union of the Stability and Growth Pact, which aims at limiting budget deficits.<sup>1</sup>

There are obvious analogies between fiscal discipline and price stability. Over the 1960s and 1970s, monetary policy also seemed to be generating a persistent "inflation bias". Following the works of Kydland and Prescott (1977) and Barro and Gordon (1980), the literature eventually converged on the view that monetary policy should aim at a medium to long term rule with some short term discretion, combined with institutional independence of the central bank. Wherever the inflation targeting strategy has been properly adopted, low inflation rates have subsequently been achieved.

In contrast with monetary rules, however, the case for fiscal rules has only started to be articulated. Von Hagen and Harden (1995), in a static model of a deficit bias due to political distortions, show that fiscal restraint is desirable and that delegation of the budget decision to a Finance Minister reduces the bias. Hallerberg and Von Hagen (1999) extends the previous paper by allowing for two periods; they show that giving agenda-setting power to the Finance Minister eliminates the bias. Beetsma and Uhlig (1999) show that a Stability and Growth Pact can be welfare improving in the presence of a deficit bias. Two other closely related papers, Beetsma and Debrun (2004, 2005) show that a Stability and Growth Pact may have the undesirable side effect of reducing public investments as well as unproductive spending, and then show how an optimal improvement

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<sup>1</sup>Following the recent revision, budgets must be "within a defined range between  $-1\%$  of GDP and balance or surplus, in cyclically adjusted terms, net of one-off and temporary measures."

of the Pact trades off fiscal discipline against productive spending through a golden-rule type of mechanism that displays some tolerance towards 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. While these papers show the particular welfare aspects of a Stability and Growth Pact type of arrangement and how delegation of the budgetary decision to a strong Finance minister reduces the bias, we still do not know whether these arrangements are optimal in the first place. The more general question of which types of fiscal restraints are socially desirable has not been posed, and we do not know which rules and/or institutions are likely to deliver these restraints. There also remains the question of when the deficit bias must be dealt with on the supranational level, such as the Stability and Growth Pact, and when the bias is more effectively dealt with on the national level. We address these questions here.

To do this, we need to formulate a general model of the deficit bias. The most influential theories are the common pool theory formalized by Von Hagen and Harden (1995), Hallerberg and Von Hagen (1999) and Velasco (1999, 2000), the time inconsistency of preferences theory formalized by Alesina and Tabellini (1990). and the agency problem as in Besley and Smart (2003).<sup>2</sup> The common pool problem results when there is more than one decision maker involved in setting the budget<sup>3</sup>. Thus, when the decision makers - spending ministers, lobby groups, parties in a coalition government - compete for their preferred public goods, they fail to internalize the cost of their choices on current and future cost in terms of higher taxes needed for debt service and repayment, which results in a deficit bias. The time inconsistency of preferences theory points out that

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<sup>2</sup> An excellent survey is Persson and Tabellini (2000), Chapter 9. The seminal contribution is Weingast et al. (1981).

<sup>3</sup> The delayed stabilizations case, developed by Alesina and Drazen (1991), can be seen as a case of common pool.

when governments are subject to elections, they do not fully internalize the cost of taking up debt as some of that debt will be serviced by future governments. Political-economic interpretations of the deficit bias among OECD countries 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). We hence adopt the common pool interpretation of the domestic part of the deficit bias. We do not account for time inconsistency of preferences to keep things simple. We note, however, that Krogstrup (2006) shows that with minor modifications in the modeling setup, the common pool externality can be interpreted as an externality due to time inconsistency. With some caution in interpretation, our model and the resulting policy implications hence extend to both types of the deficit bias.

We do not consider the role of parliament in amending and voting on the budget. The role of parliament, and its voting rules, is the object of an important literature that includes the seminal contribution by Baron and Ferejohn (1989). The more general issue of separation of power has been reviewed by Bendor et al. (2001) and an application to the budget process is Grossman and Helpman (2006). We do not ignore that the empirical evidence (e.g. Alesina and Perotti, 1999) is that the issues of separation of power and of parliament voting rules are relevant for the deficit bias, but we wish to focus on the underlying issue of conflicts of interests. One interpretation is that the government decides alone on the budget; another interpretation is that the game that we describe encompasses the government and the parliament, both of which are politically

captured and let the interest groups bargain on their own.

In principle, the deficit bias ought to be addressed where it arises, namely at the national level. Yet, we observe instances of interventions by an external agent, for example the IMF or Europe's Stability and Growth Pact. This is likely to be desirable in the presence of international externalities. Discussions of the Stability and Growth Pact have identified different externalities.<sup>4</sup> One channel is the interest rate. The assertion is that one country's deficit raises the interest rate and therefore the cost of debt service throughout the euro area. Alternatively, the prospect of a sharply contractionary fiscal policy may force the hand of an imperfectly independent central bank to raise the inflation rate<sup>5</sup>. Another channel is that the threat of debt default by one member country could affect the monetary union's common exchange rate depreciation and generate a risk premium if the common central bank would have to monetize some or all the debt. To eliminate this possibility, the Treaty includes a no-bailout clause. But this clause has not been tested yet and is sometimes considered as weak. The existence of a significant international externality remains a matter of debate, yet it figures prominently in policy discussions. Rather than modeling a particular mechanism, we simply assume that each country expects to be able to impose some of its debt service on other countries.

Our model is an extension of Velasco (2000). The advantage of this model is to focus on deficits while leaving levels of spending and taxes out. This neatly allows to separate the deficit bias from the issue of government size. We extend this model in several ways. First we allow for productive public spending in addition to unproductive public good provision. Without productive public spending, the optimal fiscal rule is trivially a zero deficit ceiling. Second, to

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<sup>4</sup>See the papers collected in Brunila, Buti and Franco (2001). See also Giuliadori and Beetsma (2004) for a discussion of the these channels.

<sup>5</sup>Beetsma and Uhlig (1999) model an international externality of debt in a Monetary Union along such lines.

simplify, we consider only two periods. Third, we consider two countries linked by a negative debt externality. The resulting model allows us to obtain intuitive analytical solutions. We use it to conduct a broad analysis of alternative policies, comparing fiscal rules and fiscal institutions that can be welfare-ranked.

The paper is structured as follows. The next section presents the model and characterizes the socially optimal equilibrium and the Nash and Stackelberg solutions in the presence of both domestic and international externalities. Section 3 determines the Pigouvian taxes that allow for the full internalization of both domestic and international externalities, and which hence take us to social optimum. We show that given the two sources of externalities, more than one tax is needed, and the taxes are highly impractical. This leads us to examine the properties of various often-discussed policies. In Section 4 we look at the institutional approach whereby deficits are delegated to a national social planner. In Section 5, we examine the properties of deficit ceilings or budget rules. Golden rules are then studied in Section 6. The welfare implications of these various solutions are brought together in Section 7 and the final section concludes.

## **2 The Deficit Bias**

### **2.1 The Model**

The domestic deficit bias is due to a common pool problem, where the common pool is the present and future deficits that can be run given the budget constraint. The domestic externality arises when interest groups seek to redistribute resources to their advantage through the public tax and transfer system. The corresponding 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 use the term interest groups, but these can

alternatively be interpreted as spending ministries represented by a minister or as parties in a coalition government. Another interpretation is that spending ministries are captured by interest groups. Yet another interpretation is that interest groups are represented by parties, which in turn are members of coalition governments. Here we portray the extreme case where interest groups are in complete control of the net transfer part of the budget.

As discussed above, there is no consensus on the source and strength of an international externality of public debt. We therefore postulate a general international externality: each country intends to have some of its debt paid for by the other country.

The domestic common pool problem follows Velasco (2000). In each country, there exist  $n \geq 1$  interest groups, indexed by  $i$ ,  $i = 1, 2, \dots, n$ . We assume that all interest groups are of the same size. 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 country,  $g_t^{h,i}$ , are defined as transfers received less taxes paid. The same applies to net transfers  $g_t^{f,i}$  in the foreign country.

Excessive deficits will arise when interest groups fail to internalize debt service. In addition, some deficits may be socially desirable because we allow for an other budget item, aggregate productive spending. This spending is productive in the sense that it raises public revenues in the next period. It is aggregate because it does not accrue to interest groups. One interpretation is that it covers infrastructure or effective reforms that will raise GDP and therefore taxable income. This is the interpretation given by Beetsma and Debrun (2004, 2005). Alternatively, we can think of efficient countercyclical fiscal policy that brings GDP back towards its potential level and thus reduces waste and inefficiencies. This second interpretation matches current debates in Europe over the discretionary use of fiscal policy. Denote productive spending at home in period 1 as

$X^h$ . Spending  $X^h$  in period 1 raises tax revenues by  $\theta(X^h)$  in period 2. 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.

We introduce a second actor, the Finance Minister, alongside the interest groups. The Finance Minister has no direct control over net transfers to interest groups, but she is in charge of setting productive spending which she does to maximize national welfare. Allowing for a benevolent Finance Minister, as von Hagen and Harden (1995) do, is not crucial to our results. Since national welfare is the sum of the interest groups (which represent the population as a whole) welfare, we could also let the interest groups select productive spending by consensus, or we could let the interest groups select a Finance minister amongst themselves with the aim of maximizing his own welfare, and the outcome would be the same<sup>6</sup>.

The government can borrow or lend internationally any amount that it wishes at the constant real interest rate  $r$  (i.e. the economy is small<sup>7</sup>), and it is bound by the intertemporal budget constraint. Importantly, 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:

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

where  $B^h$  is the debt acquired in period 1. For simplicity and without loss of generality, we assume that there is zero initial debt. Crucially, no other actors,

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<sup>6</sup>To see this, note that the only function of productive spending in this model is to affect the overall common pool. Setting  $X$  cannot be used to redistribute resources among interest groups nor to shift resources from one period to the other; hence the choice of  $X$  cannot be used strategically. It is therefore in all interest groups', as well as that of the benevolent Finance Ministers', interest to set  $X$  so as to maximize the common pool.

<sup>7</sup>The small country assumption, which allows us to treat the real interest rate as exogenous and constant, eliminates one of the sources of the international externality commonly mentioned. As will be made clear shortly, we allow for a direct international externality.

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:

$$\sum_{i=1}^n g_2^{h,i} + (1+r) [(1-\alpha)B^h + \alpha B^f] = \theta(X^h) \quad (2)$$

where  $\alpha$  represents the international externality. A portion  $\alpha$  of domestic debt  $B^h$  can be passed on to the other country while the home government must serve a portion  $\alpha$  of the foreign government deficit  $B^f$ . This is a rough but simple way of capturing various international externalities previously described, as long as they are zero-sum. It does not account for instance, for the possibility that one country's indiscipline could raise borrowing costs for all countries.

The home country's intertemporal budget constraint thus becomes

$$(1-\alpha) \left[ \sum_{i=1}^n g_1^{h,i} + X^h \right] + \alpha \left[ \sum_{i=1}^n g_1^{f,i} + X^f \right] + R \sum_{i=1}^n g_2^{h,i} = R\theta(X^h) \quad (3)$$

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, they all have the same preference over the own transfers that they can receive, represented by the following utility function:

$$U^{h,i} = \log(g_1^{h,i} + \bar{g}) + \beta \log(g_2^{h,i} + \bar{g}). \quad (4)$$

where  $\beta$  is the time preference factor. The term  $\bar{g}$  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  $-\bar{g} < 0$  for the net total transfers

received by each interest group.<sup>8</sup> It follows that the maximum net revenues that can be collected is  $\bar{G} = n\bar{g}$ .

The general case where  $\beta \neq R$  is presented in the Appendix. When  $\beta \neq R$  there exists a rationale for shifting income across periods and therefore for a budget deficit or surplus in period 1. This rationale is well understood and not pursued further here. For simplicity, therefore, from now on, we assume that  $\beta = R = 1$ . Again, the situation is identical in the foreign country.

Who are the interest groups? In a more complete model, these interest groups could coexist with citizens devoid of political influence. This would greatly complicate the situation. At this stage, we consider that all citizens belong to one interest group. One interpretation is that interest groups bring together citizens with shared interests, and that all citizens are somehow represented by an interest group. Another interpretation is that each citizen is an interest group of its own, in which case  $n$  is the size of population. What is important is that the Finance Minister and the social planners maximize the unweighted sum of the interest group utilities.

We first consider the socially optimal allocation of deficits between interest groups, Finance Ministers and across countries. Then we consider the free-for-all case when the interest groups effectively control the transfers and the national Finance Ministers decide on productive spending.

## 2.2 The International Social Planner

The international social planner decides on  $g_t^{k,i}$  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 (3) for both countries. Given the symmetry between all interest groups and countries, it is clear that  $g_t^{k,i} = g_t$ ,

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<sup>8</sup>This formulation, akin to that used in Velasco (1999), implies that  $U^{h,i} \rightarrow -\infty$  when  $g_t^{h,i} \rightarrow 0$ . The formulation differs from Velasco (2000) who assumes instead a bliss level for transfers and uses a quadratic loss function.

$\forall k, i$ , and  $X^h = X^f = X$ . Denoting aggregate transfers  $G_t = ng_t$ , the first order conditions are:

$$\theta'(X) = 1 \tag{5}$$

$$G_1 = G_2 \tag{6}$$

Condition (5) implies that the social planner chooses the level of productive spending  $\bar{X}$  that maximizes the surplus  $\theta(X) - X$ . Condition (6) means that the social planner equalizes transfers across periods (this is a consequence of the assumption  $R = \beta$ , see the Appendix for the general case).

Note that symmetry also implies that the intertemporal budget constraint (3) is the same for each country and simplifies to:

$$G_1 + G_2 = \theta(X) - X \tag{7}$$

The constraint being recognized *ex ante* by the international social planner, the international externality is fully internalized and (6) shows that the same applies to the domestic political distortions. Using definition (1), the socially optimal deficit is :

$$B^* = \frac{1}{2} [\theta(X^*) - X^*] + X^* \tag{8}$$

where asterisks denote socially optimal values. Period 1 and 2 net transfers are  $G_1^* = G_2^* = \frac{1}{2} [\theta(X^*) - X^*]$ .

The social optimum implies a deficit to the extent that productive public spending exists. In that case, the interest groups receive positive transfers in both periods, a share of the surplus created by productive spending. If there

is no such thing as productive spending, then we have  $X \equiv 0$  and the socially optimal debt is zero. This establishes the obvious point that not all deficits are bad; some deficit may be justified as optimal intertemporal smoothing of future returns to current productive spending.

### 2.3 Autonomous Governments

We now look at the case where interest groups and Finance Ministers set their respective variables independently. The game is solved backwards. Once in period 2, the debt to be repaid is predetermined by the net transfers chosen in period one and by the surplus  $\theta(X) - X$  created by productive spending. As a result, there is no choice to be made at that stage. Each interest group simply recognizes that its net transfers will have to fit within the country's budget constraint (2). We assume that partition of the budget in period two is symmetric, in that each interest group gets (pays) an equal share<sup>9</sup>:

$$g_2^i = \frac{\theta(X^h) - [(1 - \alpha)B^h + \alpha B^f]}{n} \quad (9)$$

(9) shows the degree to which the cost of period one net transfers in terms of period two net transfers is not internalized by the individual interest group. Since  $B^h = \sum_{i=1}^n g_1^{h,i} + X^h$ , each interest group perceives that the second period cost of raising first period transfers by one unit is equal to  $(1 - \alpha)/n < 1$ . The strength of the deficit bias is captured by  $n/(1 - \alpha) \geq 1$ ; it logically 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

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<sup>9</sup> 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 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.

simultaneously, and the Finance Ministers in the two countries move simultaneously as well, thus abstracting from any asymmetry of the sequencing of moves within the types of actors in the first period. As a result, we only need to consider two cases in the first period game. The first possible setup is a Nash-Nash game, in which the interest groups play Nash against each other and against the two Finance Ministers and each Finance Minister plays Nash vis a vis the other one and the interest groups. The second setup is a two-stage game. In the first stage, the Finance Ministers of the two countries move as simultaneous Stackelberg leaders. In the second stage, the interest groups observe the move of the two Finance Ministers and then move simultaneously. The Nash-Nash setup turns out to be equivalent to the game in which the interest groups act as Stackelberg leaders since the Finance Ministers' decisions do not depend on the level of the interest groups' transfers.

### 2.3.1 Finance Ministers do not precommit (Nash-Nash)

In period one, the interest groups choose the transfers that they will receive taking into account the intertemporal budget constraint, i.e. the fact that they will have to collectively repay in period 2 the debt incurred in period 1. Taking as given what other interest groups do, they each have an incentive to raise their net transfer above the socially optimal level. Moreover, neither interest groups nor the Finance Ministers take into account the effect of their deficit decisions on the other country's second period budget constraint. The domestic common pool problem and the international externality of debt now combine to increase the deficit above the socially optimal level.

Formally, each interest group maximizes its utility function (4) subject to (9) and to its period 1 budget constraint (1),  $g_1^{h,i} = B^h - \sum_{j \neq i} g_1^{h,j} - X^h$ . The first-order condition is:

$$g_1^{h,i} = \frac{1}{2(1-\alpha)} \left[ (\alpha + n - 1)\bar{g} + \theta(X^h) - \alpha(X^f + \sum_{i=1}^n g_1^{f,i}) \right] - \frac{1}{2} \left[ X^h + \sum_{j \neq i} g_1^{h,j} \right] \quad (10)$$

Applying symmetry across interest groups (but not yet across countries) yields the aggregate interest group reaction function in Home:

$$G_1^h = \frac{n}{(2+n)(1-\alpha)} \left[ \frac{\alpha + n - 1}{n} \bar{G} + \theta(X^h) - (1-\alpha)X^h - \alpha(X^f + G_1^f) \right]$$

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

The Finance Ministers each have only one decision to make regarding the level of productive spending  $X^h$  and  $X^f$ , respectively at home and abroad. Their best choice is:

$$\theta'(X) = 1 - \alpha \quad (11)$$

Since  $\theta''(X) < 0$  this means that  $X > X^*$  i.e. productive spending exceeds the socially optimal level that maximizes the surplus  $\theta(X) - X$  as in (5). This is a consequence of the Nash game between governments as each one expects to pass a share  $\alpha$  of its debt to the other government. Importantly, the domestic political distortion only affects the interest groups, not the Finance Minister's choice of  $X$ . In fact, by maximizing the domestically available surplus from productive spending (the last three terms in (10)) Finance Ministers also increase the interest groups' welfare. That the distortion on  $X$  is only related to the international externality will matter for policy responses below.

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 each country is :

$$G_1 = \frac{n - (1 - \alpha)}{n + (1 - \alpha)} \bar{G} + \frac{n}{n + (1 - \alpha)} [\theta(X) - X] \quad (12)$$

which implies a deficit:

$$B = \frac{n - (1 - \alpha)}{n + (1 - \alpha)} \bar{G} + \frac{n}{n + (1 - \alpha)} [\theta(X) - X] + X \quad (13)$$

Note first that when  $n = 1$  and  $\alpha = 0$  we find the results of the international social planner: (11), (12) and (13) reduce to (5), (7) and (8), respectively. The first term in (13) shows how the potential domestic common pool, the maximum taxing possibility  $\bar{G}$ , is shared among interest groups. In addition to increasing with  $\alpha$ , this term increases with  $n$ . In the limit case where  $n \rightarrow \infty$ , this term is equal to  $\bar{G}$ , which means that infinitely small interest groups fully exhaust their future tax capacity. The role of productive public spending is captured by (11) and by the second and third terms in (13). Much as the competition to capture the common pool of current net transfers and feasible future budget surpluses, interest groups compete for the surplus  $\theta(X) - X$  created by productive spending. Again, in the limit case where  $n \rightarrow \infty$ , each of the infinitely small interest groups attempts to capture the whole surplus. The third term in (13) is simply the borrowing to finance productive public spending in period 1, which is larger than socially desirable.

The case of a single country corresponds to assuming  $\alpha = 0$ . In that case, the Finance Minister chooses the socially optimal productive spending as (11) reduces to (5), but the deficit bias is not eliminated since (13) becomes:

$$B = \frac{n - 1}{n + 1} \bar{G} + \frac{n}{n + 1} [\theta(X) - X] + X$$

In this case, the domestic common pool problem creates two deficit bias components. The first term 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 the productive spending. The last term corresponds to government borrowing to finance period 1 productive spending, which is socially optimal when there is no international externality.

### 2.3.2 Finance Ministers precommit (Stackelberg leaders)

We now let the Finance Ministers precommit to their chosen level of productive spending before the interest groups move. We still assume that the interest groups fully control their net transfers but now they know their respective Finance Ministers' selection of productive spending. This means that each Finance Minister acts as a Stackelberg leader vis a vis the interest groups, yet the Finance Ministers play Nash vis a vis each other.

The interest groups' decisions remain the same as in the previous section. Each group will act according to (10). The Finance Ministers realize this when they decide on  $X^h$  and  $X^f$ . They also recognize the symmetry of the situation, so they know that the interest groups will choose:

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

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

The home government now sets  $X^h$  to maximize  $\sum_{i=1}^n U^{h,i}$  subject to the two above conditions and to the interest groups intertemporal constraints, taking  $X^f$ , but not  $G_1^f$ , as given. Its first-order constraint is:

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

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:

$$\theta'(X) = 1 - \alpha - \frac{\alpha^2 n}{(1 - \alpha)(1 + n)} \quad (14)$$

Note that (14) stays positive as long as the international externality is not too large<sup>10</sup>. Finally, the model's symmetry implies that  $G_t^h = G_t^f = G_t$  and the deficit in each country remains given by (13). Thus, by precommitting, the Finance Ministers end up raising productive spending further above the socially optimal level. The  $n$  factor in the last term in (14) actually refers to the number of interest groups in the other country. This implies that this additional effect is entirely due to the international externality (it disappears when  $\alpha = 0$ ). Any increase in  $X^h$  is perceived by the foreign interest groups as a reduction in their domestic common pool since they expect to have to pay for a proportion  $\alpha$  of this increase. Accordingly, they reduce their own transfers  $G_1^f$ , which reduces, by a proportion  $\alpha$  again, the amount of foreign debt that will have to be financed by the home country in period 2. Home's available resources rise, which increases the Finance Minister's incentive to increase  $X^h$ . In comparison with the no pre-commitment case (the Nash-Nash case), transfers to interest groups in both periods are reduced because the surplus  $\theta(X) - X$  is lower in the symmetric equilibrium. The overall deficit is also larger with precommitment because the increase in productive spending  $X$  outweighs the reduction in transfers, which is spread over the two periods<sup>11</sup>. Thus, if the Finance Ministers are able to

<sup>10</sup>The exact condition for  $\theta'(X) > 0$  is  $\frac{1-\alpha}{\alpha} > \sqrt{\frac{n}{1+n}}$ , which is satisfied for  $\alpha \leq \frac{1}{2}$ .

<sup>11</sup>Formally, call  $B^P$  and  $B^{NP}$  the deficit with and without precommitment, respectively, and correspondingly  $X^P$  and  $X^{NP}$ . We have:

precommit to productive spending, the result is a larger deficit bias and lower welfare.<sup>12, 13</sup>

Note that if we look at the single country version of the model by setting  $\alpha = 0$ , there is no difference any more between the no-precommitment and precommitment cases.

### 3 Policy Responses: Pigouvian Taxes

Whenever externalities create a wedge between the optimal and actual production of some good, correctly devised and imposed Pigouvian taxes can correct the distortions. Assume for the purposes of this section that an international tax authority exists with the sole purpose of imposing Pigouvian taxes to eliminate the distortions due to the domestic and international externalities of transfers. The tax authority has complete information.

#### 3.1 Internalizing the International Externality

Internalizing the international externality with a Pigouvian tax is straightforward. The international externality concerns the aggregate debt level,  $X + G$ . The international tax authority hence wants to impose a Pigouvian tax,  $\tau^I$ , on the debt in period one such that the total debt level to be repaid in period two

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

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

<sup>12</sup>Since the interest groups first order condition implies  $G_2 + \bar{G} = \frac{1 - \alpha}{n}(G_1 + \bar{G})$ , welfare is  $2 \log(G_1 + \bar{G}) + \log\left(\frac{1 - \alpha}{n}\right)$ .

<sup>13</sup>This result depends on the assumption that Finance Ministers take into account the reaction function of the foreign interest groups. The alternative assumption that Finance Ministers 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.

is equal to the full amount,  $X + G$ . Formally, the tax must fulfill:

$$\begin{aligned}(X + G) &= (1 + \tau)(1 - \alpha)(X + G) \\ \Rightarrow \tau^I &= \frac{\alpha}{1 - \alpha}\end{aligned}$$

The proceeds from this tax are then paid to the other country:

$$\tau^I (X + G) = \frac{\alpha}{1 - \alpha} (X + G) \quad (15)$$

which implies that the new second period budget constraint becomes

$$\sum_{i=1}^n g_2^{h,i} + ((1 - \alpha)(1 + \tau)(X + G) + \alpha(1 + \tau)(X^f + G^f) - \tau(X^f + G^f)) = \theta(X^h)$$

which reduces to the old budget constraint once (15) is inserted. With this tax on the total debt level of each country, the international externality is internalized.

### 3.2 Internalizing the Domestic Externality

Assuming that the Pigouvian tax for the international externality derived above is applied, the model is reduced to the one country case, with only a domestic common pool problem. Since the interest groups do not fully internalize the effect of their choice of transfers on the overall budget, a Pigouvian tax should address the cost of transfers in the first period in terms of the associated loss of period two transfers for the individual interest group. There is an added complication here. The revenues from this tax must be channeled back to the country in question without being manipulable by the interest groups. Tax revenue collected from interest group  $i$  should be channeled back to the other interest groups *excluding* interest group  $i$ . But the whole common pool problem per definition does not allow to distinguish between the budgets of the individual

interest groups in this way, so assuming that such a design for a Pigouvian tax is possible would amount to assuming away the domestic common pool problem. We hence proceed by looking only at Pigouvian taxes that apply to the whole budget and do not distinguish between interest groups.

We solve the problem by assuming that the international tax authority makes a lump sum transfers to the Finance Minister at the beginning of period one, which has the effect of increasing the overall common pool by an amount  $T$  in the first period, and that this lump sum transfer is equal to the tax revenues from the domestic Pigouvian tax ex post. Thus, a Pigouvian deficit tax of  $\tau^D$  is levied on the part of the deficit comprised of transfers to interest groups,  $G$ . Since the international externality is neutralized, and taking into account the lump sum transfer from the international tax authority, the intertemporal budget constraint becomes:

$$(1 + \tau^D) \sum_{i=1}^n g_1^i + X + \sum_{i=1}^n g_2^i = \theta(X) + T$$

To ensure revenue neutrality of the tax, the international tax authority commits ex ante to paying  $T$  such that ex post, we have:

$$T = \tau^D \sum_{i=1}^n \hat{g}_1^i \tag{16}$$

where  $\hat{g}_1^i$  is the optimally chosen transfer of interest group  $i$  given  $\hat{T}$  and  $\tau^D$ . (Note that for the international tax authority to be able to know  $\hat{T}$  with certainty, we rely on the assumptions of no uncertainty and complete information). Solving backwards yields the interest groups' response to the taxing scheme<sup>14</sup>:

<sup>14</sup>Noting that  $\theta'(X) = 1$  and using the budget constraint, the second period deficit can be written as a function of first period deficits:

$$g_2^i = \frac{1}{n}[\theta(X^h) - X^h] + \frac{1}{n}[T - (1 + \tau^D) \sum_{i=1}^n g_1^{h,i}]$$

$$\widehat{G}_1(T, \tau^D) = \frac{n(T + \theta(X) - X)}{(1+n)(1+\tau^D)} + \frac{n - (1 + \tau^D)}{(1+n)(1+\tau^D)} \overline{G}$$

Since the international tax authority chooses  $T$  such that (16) is satisfied ex post, we have

$$\widehat{G}_1(\tau^D) = \frac{n(\theta(X) - X)}{(1+n)(1+\tau^D) - n\tau^D} + \frac{n - (1 + \tau^D)}{(1+n)(1+\tau^D) - n\tau^D} \overline{G}$$

The international tax authority now selects the domestic Pigouvian tax,  $\tau^D$ , that induces the socially optimal transfers to the interest groups, which yields

$$\tau^D = n - 1$$

This in turn implies that the initial transfer from the international tax authority to the two countries becomes:

$$\widehat{T} = \frac{n-1}{2} (\theta(X) - X)$$

where  $X$  is given by the socially optimal level.

In conclusion, if a tax on the overall deficit of  $\tau^I$  and a tax on only the transfers part of the deficit of  $\tau^D$  are levied on the two countries, and moreover,  $\widehat{T}$  is transferred to each of the two countries from the international tax authority prior to the game (or in period one as the game has started, provided the international tax authority can commit credibly to transferring  $\widehat{T}$ ), the Nash solution to the game is socially optimal<sup>15</sup>.

Pigouvian taxes can internalize externalities but their implementation is doubtful in the absence of an international authority who can tax sovereign

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<sup>15</sup>Note that the transfers of tax revenues from the international pigouvian tax  $\tau^I$  between the two countries in the second period do not actually have to take place, as the same is symmetric and the bilateral transfers hence cancel each other out.

governments. The international social planner is a convenient analytical construct but it does not have a real-life existence. Pigouvian taxes could be raised nationally but this presumes that the interest groups that are powerful enough to capture the government will let their influence vanish; this amounts to assuming the problem away.

## 4 Delegation to National Social Planners

Given our assumption that national governments are fragmented, a natural policy response is to delegate fiscal policy to a benevolent national social planner. This can take the form of formal delegation to a fiscal council, as advocated by Wyplosz (2005), or - since there is no issue of time inconsistency of preferences of government in this model - a Finance Minister who is given broad powers, as recommended by von Hagen and Harden (1994)<sup>16</sup>. The social planner can make decisions on  $X^k$  and  $g_t^{k,i}$  for all  $i$ 's in each country, but does not coordinate with the social planner in the other country. In effect, we consider a Nash game where both social planners act simultaneously, taking the other social planner's decision as given. The symmetry of the situation implies that  $g_t^{h,i} = g_t^{f,i} = g_t^i$  and  $X^h = X^f = X$ .

The home social planner chooses  $g_t^{h,i}$  and  $X^h$  to maximize (4) subject to (3). The first-order conditions are:

$$\theta'(X) = 1 - \alpha \tag{17}$$

$$G_1 = \frac{\alpha}{2 - \alpha} \bar{G} + \frac{1}{2 - \alpha} [\theta(X) - X] \tag{18}$$

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<sup>16</sup>The underlying mechanism behind the domestic externality - common pool or time inconsistency of preferences - becomes important in the interpretation of the national social planner. If we assume time inconsistency of preferences of government, the delegation to the a Finance Minister will not internalize the domestic source of the deficit bias as the Finance Minister is still subject to elections.

with the corresponding deficit  $B = G_1 + X$  :

$$B = \frac{\alpha}{2-\alpha}\bar{G} + \frac{1}{2-\alpha}[\theta(X) - X] + X \quad (19)$$

The national social planners eliminate the domestic externality but the international externality remains because each national planner expects to pass a portion  $\alpha$  of its debt to the other planner. Indeed, (18) and (19) correspond to (12) and (13) in the Nash case with  $n = 1$ . Exactly as in the Nash case (11), productive spending is set higher than  $X^*$ , the level that maximizes the national surplus  $\theta(X) - X$  (compare (5) and (17)). Although  $\theta(X) - X$ , the surplus available to each country is reduced, the deficit in (19) is higher than in (8) since  $\frac{\partial B}{\partial X} > 0$ : the international externality creates a deficit bias in both countries. Note that the first term in (18) shows that the international externality is also an incentive for the social planner to raise transfers to its own interest groups.

If the international externality is small ( $\alpha \simeq 0$ ), then (17) reduces to (5) and (18) reduces to (7). Trivially, a national social planner achieves the social optimum in a one-country model.

## 5 Deficit (or Debt) Ceilings

An alternative policy response is a mandatory cap on the deficit or on the debt. Deficit ceilings have been adopted in the case of sub-federal level governments as well as at the national level in Chile or Brazil. The Stability and Growth Pact rests on both a deficit and a debt ceiling, although the latter has been set aside *de facto*.<sup>17</sup> In our model, there is no distinction between deficit and

<sup>17</sup>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.

debt, so we leave this important distinction out.<sup>18</sup> We assume that the deficit ceiling is optimally set by an outside authority that we call the international social planner.

A key question is which category of spending is affected by the deficit ceiling. Recall that we assume that the Finance Ministers do not control the transfers to their interest groups. If they cannot precommit, the ceiling only constrains productive spending  $X$ .<sup>19</sup> While it is obviously better to constrain unproductive transfers than productive spending, restraining only the latter may still be welfare-improving. Indeed, we know from (11) that, in the absence of any corrective measure, productive spending is excessive ( $X > X^*$ ). Yet, the risk is that the constraint be so tight that it leads to insufficient productive spending ( $X < X^*$ ). Conversely, if the Finance Ministers can precommit, it is the transfers to interest groups that are constrained. Thus we need to consider the two cases of precommitment and no-precommitment by the Finance Minister.

In addition, it matters whether the deficit ceiling chosen by the social planner is credible or not. If the social planner cannot precommit and can change the chosen ceiling once action by either interest groups or Finance Ministers has been taken, the deficit ceiling is not credible; knowing this, the interest groups and the Finance Minister will make different decisions than if the ceilings are seen as carved in stone. If neither the Finance Ministers nor the interest groups internalize the ceiling (i.e. the game in which social planner moves last) we are back to the unconstrained outcomes previously studied. It therefore also matters whether the ceiling is credible. We consider each case and examine four different cases combining commitment and credibility.

Commitment and credibility are modeled by specifying the order in which  $\theta(X) \leq X$  and indeed the optimum solution is  $X = 0$ . During periods of slowdown, on the other hand, it is desirable to choose  $X = \bar{X} > 0$ .

<sup>18</sup>Wyplosz (2005) emphasizes the distinction and argues that the public debt is the correct variable to be targeted.

<sup>19</sup>In Section 6 below we look at golden rules that separate out the two budget components.

decisions are made. For the credit ceiling to be credible, it must be set at the outset of the game and taken as given by the Finance Ministers and by the interest groups in both countries. Conversely, when the credit ceiling is set in second stage, it is effective and binds the third stage movers, but non-credible because it will respond to the deficit choices of the first stage movers. We call pre-commitment the Stackelberg case where the Finance Minister moves before the interest groups; this will be stage two of the game when the ceiling is credible and stage one when the ceiling is set in the second stage. Obviously, there is no commitment when it is the interest groups that move ahead of the Finance Minister.

## 5.1 Deficit Ceiling When the Finance Minister Can Pre-commit

We first consider the case where the Finance Minister can precommit to the level of productive spending before the interest groups choose their net transfers.

### 5.1.1 The deficit ceiling is credible

Take first the case in which the deficit ceiling is seen as credible by the Finance Ministers and the interest groups in both countries. The sequencing of the game in the first period is as follows. In the first stage, the international social planner selects the deficit ceiling, denoted by  $\hat{B}$ . Given  $\hat{B}$ , in the second stage of the game, the Finance Ministers then set  $X$  at the level  $\hat{X}$  that maximizes national welfare  $\sum_{i=1}^n U^{k,i}$  for  $k = h, f$ . Given the deficit ceiling, the interest groups have no choice but to accept  $G_1(\hat{X}) = \hat{B} - \hat{X}$  in the third stage. It is thus the transfers to interest groups that become the residual item under the budget ceiling. The social planner credibly controls  $\hat{B}$ , not its breakdown between  $G_1$  and  $X$ , but it knows that the Finance Ministers move first. By

setting the ceiling at the socially optimal level of debt,  $\hat{B} = X^* + \frac{\theta(X^*) - X^*}{2}$ , the international social planner leads the Finance Minister to choose  $X = X^*$  and, therefore,  $G_1 = \frac{\theta(X^*) - X^*}{2}$ , which delivers the social optimum.

The combination of the domestic fiscal institution which allows precommitment of the Finance Minister, and a credible deficit ceiling, eliminates the deficit bias. The reason is clear: government precommitment eliminates the domestic externality once the debt ceiling has eliminated the international externality. Note that when there is no international externality, the optimal deficit ceiling can just as well be selected by a national social planner.

### 5.1.2 The deficit ceiling is not credible to the Finance Minister

Now assume that the deficit ceiling is not credible to the first movers in the game, in this case the Finance Ministers. The sequence of the game is the following. The Finance Ministers set the levels of productive spending in the two countries in the first stage, after which the international social planner sets the deficit ceiling. Transfers to interest groups are then set in the third stage. Given Finance Ministers' choice of  $X$ , the social planner now directly controls net transfers, which she will set at the optimal level given productive spending: she will choose  $\hat{B}$  such that  $G_1 = G_2 = \frac{\theta(X) - X}{2}$  (see (8)). Since the deficit ceiling is symmetric across the two countries, the international externality is eliminated and the Finance Ministers select the socially optimal level of productive spending, i.e.  $X = X^*$ , knowing that the international social planner will make sure in the second stage that the surplus to productive spending will be optimally distributed across the two time periods. As in the case of a credible fiscal rule, we find that when the national Finance Ministers move first, i.e. can precommit, a mandatory deficit ceiling delivers the social optimum. Credibility of the ceiling, as we define it here, does not matter. The reason is that forcing

the interest groups to act as residual claimants eliminates the domestic externality while the international externality disappears because the same deficit ceiling applies to both countries.

## 5.2 The Finance Minister cannot precommit

We now consider the properties of a deficit ceiling when the Finance Ministers cannot precommit to the level of productive spending before the interest groups select their net transfers. In our model, this is the case in which the interest groups move before the Finance Ministers.

### 5.2.1 The deficit ceiling is credible

When the deficit ceiling is credible to all actors, the sequencing of the game is the following. The international social planner sets the deficit ceiling in stage one, after which the interest groups set their net transfers in the second stage. In the third stage, the Finance Ministers simply carry productive spending up to the ceiling, which is assumed to be binding. As they move first, the interest groups recognize that the surplus  $\theta(X) - X$  from productive spending will be constrained. In this situation their budget constraints (1) and (2) become:

$$\sum_{i=1}^n g_1^{h,i} + X^h = \hat{B} \quad (20)$$

$$\sum_{i=1}^n g_2^{h,i} + \left[ (1 - \alpha)\hat{B} + \alpha\hat{B} \right] = \sum_{i=1}^n g_2^{h,i} + \hat{B} = \theta(X^h) \quad (21)$$

The fact that the same constraint binds both countries' deficits eliminates the international externality, but the domestic externality now remains. In addition, the interest groups understand that when they decide on the transfers, they effectively set the level of productive spending  $X^h = \hat{B} - \sum_{i=1}^n g_1^{h,i}$ . The symmetry of the situation implies that the optimal choice of the interest groups

is:

$$G_1 = \left[ \frac{n - \theta'(X)}{\theta'(X)} \right] \bar{G} + \frac{n}{\theta'(X)} [\theta(X) - \hat{B}] \quad (22)$$

$$G_2 = \theta(X) - \hat{B} \quad (23)$$

Then the Finance Minister spends whatever is left under the ceiling:

$$X = \hat{B} - G_1 \quad (24)$$

The international social planner optimally chooses  $\hat{B}$  to maximize welfare. Given  $G_1$ , by setting  $\hat{B}$  the social planner in effect sets  $X$ . Its first order condition implies:

$$\theta'(X) = \frac{n}{1 + (n-1) \frac{dX}{d\hat{B}}} \quad (25)$$

where:

$$\frac{dX}{d\hat{B}} = \frac{n + \theta'(X)}{(1+n)\theta'(X) - (G_1 + \bar{G})\theta''(X)} \quad (26)$$

Note that substituting (24) into (22) gives the level of transfers:

$$G_1 = \frac{n}{\theta'(X) + n} [\theta(X) - X] - \left[ \frac{\theta'(X) - n}{\theta'(X) + n} \right] \bar{G} \quad (27)$$

Since  $\theta''(X) < 0$ , (25) and (26) 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  $G_1$ . Note that  $\theta' > 1$  implies  $\frac{dX}{d\hat{B}} < 1$ : when  $\hat{B}$  is reduced,  $X$  falls by less, which means that  $G_1$  is indirectly constrained

as well since the surplus  $\theta(X) - X$  shrinks. As a consequence,  $\frac{\partial \theta'(X)}{\partial n} > 0$ :<sup>20</sup> when the domestic externality rises, the social planner reduces  $\hat{B}$ , which increasingly constrains  $X$  and  $G_1$ . For  $n$  large enough, productive spending is driven to zero. When this happens, the social planner does not face any more 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 limit cannot deliver the social optimum when national governments cannot precommit. This is unrelated to the international externality (which is removed) but due to the domestic political distortion. Indeed, in the absence of the domestic externality, i.e. when  $n = 1$ , (25) implies that public spending is at the socially optimal level. Then (27) implies that the social planner uses its choice of  $\hat{B}$  in such a way that  $G_1$  is also socially optimal, see (8). But the deficit ceiling must improve upon the Nash equilibrium; otherwise the social planner would set the ceiling such that the Nash outcome would prevail.

### 5.2.2 The ceiling is not credible to interest groups

The interest groups now select net transfers in the first stage and the deficit ceiling is set in the second stage. The Finance Ministers implement  $X = \hat{B} - G_1$  in the third stage. Knowing this, the best that the international social planner can do in the second stage is to ensure that  $\theta'(X) = 1$  i.e. the socially optimal level of productive spending  $X = X^*$ . Knowing this optimal action of the social planner, the interest groups choose  $G_1$  taking into account  $X^*$  and  $\hat{B}$ :

$$G_1 = \frac{n}{n+1} [\theta(X^*) - X^*] + \frac{n-1}{n+1} \bar{G} \quad (28)$$

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

Now, transfers are higher than in the case of a credible social planner when interest groups move first<sup>21</sup>. The deficit ceiling becomes:

$$\hat{B} = \frac{n\theta(X^*) + X^*}{n+1} + \frac{n-1}{n+1}\bar{G} \quad (29)$$

Since both transfers and productive spending are higher than in the case where the social planner is credible, the deficit ceiling is also higher here. The deficit bias remains because the domestic externality still applies and affects the transfers to interest groups.

The situation is improved relative to the unconstrained Nash case since the outcome corresponds to the Nash outcome in the case of a zero international externality. The deficit is correspondingly smaller and welfare is correspondingly higher. But the situation is worse than when the social planner is credible as in Section (5.2). If this were not the case, the social planner would have chosen the debt ceiling given by (29) when acting as a Stackelberg leader in section (5.2). Since she chooses a tighter ceiling under commitment, it must be the case that this tighter ceiling leads to higher welfare.

### 5.3 Conclusions on Ceilings

Three conclusions emerge from the treatment of deficit ceilings. First, the combination of a domestic fiscal institution allowing precommitment on productive spending and of a mandatory deficit ceiling delivers the social optimum. This conclusion does not depend on whether the Finance Minister considers the deficit ceiling credible or not. The reason for this is that the deficit ceiling is the same in both countries, which eliminates the international externality. In the absence of an international externality, the precommitted Finance Ministers always se-

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<sup>21</sup>To see this, note that:  $\frac{n}{n+1}(\theta(X) - X) + \frac{n-1}{n+1}\bar{G} > \frac{n}{n+\theta'(X)}(\theta(X) - X) + \frac{n-\theta'(X)}{n+\theta'(X)}\bar{G}$ .

lect the socially optimal level of productive spending. The deficit ceiling is then set by the social planner to constrain the transfers to the interest groups to their socially optimal level.

The second point is that when there is no domestic fiscal institution allowing the Finance Ministers to precommit, a deficit ceiling never delivers the social optimum, irrespective of whether the ceiling is seen by the interest groups as credible or not. The reason is that the domestic common pool externality leads the interest groups to always select a level of transfers that exceeds the optimal level.

The third conclusion concerns the debate on rules versus discretion in economic policy. When domestic fiscal institutions are poor, a credible fiscal rule yields a higher level of welfare compared to the non-credible case in which the rule can be changed after interest groups have set net transfers. This result is just one more instance of the general result that it is desirable to build credible institutions.

## 6 Golden Rules

So far we have considered the case of a ceiling that applies to the overall deficit. It has been proposed to leave productive spending out of the ceiling.<sup>22</sup> In the present model, a golden rule would set a limit on  $G_1$  while leaving the Finance Minister free to choose  $X$ . Let  $\hat{G}$  be the limit.

If the ceiling is credible, the interest groups have no decision left.  $G_1 = \hat{G}$  and the domestic externality is eliminated. Irrespective of whether they can precommit or not, the Finance Ministers choose  $X$  to maximize the available surplus. As they fail to internalize the international externality, they set  $X$

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<sup>22</sup>This is the traditional German "Golden Rule", adopted in the British Rule for Fiscal Conduct. See Blanchard and Giavazzi (2004) and Beetsma and Debrun (2004, 2005) for an analytical justification.

according to (11) so  $X > X^*$ . The social planner chooses  $\hat{G}$  to maximize  $\sum_{i=1}^n U^{h,i} + \sum_{i=1}^n U^{f,i}$  subject to the budget constraints  $\hat{G}^h + G_2^h = \hat{G}^f + G_2^f = \theta(X) - X$ . Not surprisingly, the social planner sets  $\hat{G}$  so that the transfers are optimal given the surplus  $\theta(X) - X$ :

$$G_1 = \hat{G} = \frac{\theta(X) - X}{2} \quad (30)$$

The debt level is now higher than socially optimal due to the suboptimally high levels of productive spending, but lower than the deficit in the Nash outcome since the domestic political distortions are reined in. In short, even if it were possible to distinguish between productive spending and transfers to interest groups, a golden rule is not enough to eliminate the deficit bias in the presence of an international externality. Obviously, if  $\alpha = 0$ , the golden rule delivers the social optimum.

If the ceiling is not credible and if the Finance Ministers cannot precommit, the interest groups move first and we are back to the Nash case. If they can precommit, the Finance Ministers move first and still choose  $X$  according to (11) because they do not internalize the international externality. Then the social planner sets  $\hat{G}$  according to (30). Thus, the effect of a golden rule crucially depends on whether it is credible, but does not depend on whether the Finance Ministers can precommit or not.

It is worthwhile noting that a golden rule raises many practical questions. Someone must decide which budget items are productive, which is likely to be a politically delicate step. The alternative is to draw up a list of productive items, but the likely outcome is creative accounting.<sup>23</sup>

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<sup>23</sup>On the issue of creative accounting, see Milesi-Ferretti (2003), Canova and Pappa (2004), and Buti et al. (2006).

## 7 Welfare Implications

When both the international and the domestic sources of the deficit bias are present, the welfare ranking of the various policies under consideration is as follows:

$$U^* = \hat{U}^{C,PC} = \hat{U}^{NC,PC} > \left( \begin{array}{c} U^{GR} > U^{NSP} \\ \hat{U}^{C,NPC} > \hat{U}^{NC,NPC} \end{array} \right) > U^N > U^{PC}$$

where  $U^*$  is the social optimum, and subscripts  $C$  and  $NC$  refer to a credible and a not credible deficit ceiling, respectively,  $NSP$  to national social planners,  $PC$  to precommitment by the Finance Minister and  $NPC$  to the opposite situation of no precommitment,  $GR$  to a golden rule,  $N$  to Nash and a hat represents a ceiling. We cannot generally rank all solutions. The relative welfare ranking of  $U^{GR}$ ,  $U^{NSP}$ ,  $\hat{U}^{C,NPC}$  and  $\hat{U}^{NC,NPC}$  depends on the relative strength of the domestic and international externality (i.e. on the relative sizes of  $\alpha$  and  $n$ ).

Except for an improbable international social planner, the social optimum can be reached when the Finance Minister can precommit. This is a necessary but not a sufficient condition, though. Precommitment must be accompanied by an optimally-set deficit (or debt) ceiling. It does not matter whether the ceiling is credible, as long as it is optimally set, constrains net transfers and is imposed. This result is independent of the source of the deficit bias, i.e. the relative strength of the domestic common pool problem and the international externality of debt.

Another way of stating this conclusion is that a deficit ceiling, even optimally set, cannot deliver in and by itself the social optimum. It has to be combined with appropriate domestic budget institutions. Specifically, the domestic budgeting process has to make it possible to precommit the desirable or productive part of spending (productive in the sense that it raises output) in advance of

the wasteful part of the budget. A golden rule, which also attempts to separate productive spending from transfers, does not deliver the social optimum because it does not address the international externality.

Excluding the international externality, we deal in effect with a one-country case and (with  $\alpha = 0$  and  $n > 1$ ) the welfare ranking becomes:

$$U^* = \hat{U}^{C,PC} = \hat{U}^{NC,PC} = U^{GR} = U^{NSP} > \hat{U}^{C,NPC} > \hat{U}^{NC,NPC} > U^N > U^{PC}$$

The menu of options that deliver the social optimum is now wider. A golden rule or a national social planner, which can deal with the domestic externality, now deliver the social optimum.

Ignoring instead the domestic externality, with  $\alpha > 0$  and  $n = 1$ , the welfare ranking is:

$$U^* = \hat{U}^{C,PC} = \hat{U}^{NC,PC} = \hat{U}^{C,NPC} = \hat{U}^{NC,NPC} > U^{GR} > U^{NSP} > U^N > U^{PC}$$

Precommitment by the Finance Minister is no longer important. A credit ceiling is now sufficient to achieve the social optimum, but this is not a general result. It relies on the assumption that the two countries are identical so that the deficit ceiling is the same for both countries and that it is binding. Once the deficit is the same, there is no possibility to shift the debt burden and the international externality disappears.

Finally, note that the existence of a binding ceiling, the same for the two identical countries, implies that the international externality is internalized. The situation would be different if the ceilings were different across the two countries, or if the ceiling were not binding in at least one country. This kind of asymmetry - which greatly complicates the calculations - is not examined in the present paper. Note also that when the deficit ceiling is not credible, a zero

deficit rule can never be an equilibrium outcome, irrespective of whether the Finance Ministers can precommit or not. To see this, note that a non-credible deficit ceiling can never bind the actors who move in the first stage of the game. That means that, when it is set, the ceiling has to allow for the unconstrained deficit decisions of the actors who move first. We know that the first movers always select strictly positive deficits: interest groups will always choose strictly positive transfers when unconstrained, due to the deficit bias, and the Finance Ministers will always choose the socially optimal - strictly positive - level of productive spending when the overall deficit is capped because the international externality is internalized.

## 8 Conclusions

This paper is a theoretical exploration of optimal fiscal rules and institutions in the presence of a deficit bias. The bias is the result of two distortions: internally, a common pool problem occurs as interest groups compete for transfers (or spending that they favor); externally, the two countries each expect to pass some of its debt onto the other one. The paper seeks to compare the role of rules (a credit ceiling, a golden rule) and institutions (the ability of the Finance Minister to precommit) in containing, and possibly eliminating, the bias.

Except in the extreme and unrealistic case when the only source of the deficit bias is an international externality, the key result is that the combination of precommitment and a deficit/debt ceiling can deliver the social optimum. This conclusion is independent of the relative strength of the domestic common pool problem and the international externality. But the nature of the institution needed to deliver this combination of fiscal restraints depends on the nature of the deficit bias. If the domestic distortion is negligible, a supra-national fiscal authority is needed to set the ceiling, while the precommitment part can be

carried out on the national level. If the international externality is negligible, domestic fiscal institutions are sufficient. The question is what, in practice, are the arrangements that can mimic these solutions?

The institution of precommitment must make it possible for the government to isolate in the budget law some spending items that are of general interest, in contrast with spending that favor special interests. Precommitment also requires the government to decide on these items irrespective of the rest of the budget. What is crucial is that the interest groups know *ex ante* that taxation and spending on general-interest public goods will not be affected by the amount of transfers or special-interest public goods that they capture.<sup>24</sup> In practice, however, it is not always possible to draw a line between "productive" and "unproductive" public goods. The implication is that some value judgment is required. Finance Ministers are usually those who are best placed to pass such a judgment, even if they too are likely to be partially captured. Under this view, precommitment means that the Finance Minister - or the Prime Minister - is given a dominating role in the budget process. Von Hagen and Harden (1994) provide a detailed discussion and evaluation of existing arrangements. They also show that the performance of these arrangements are intimately linked to the structure of government, i.e. whether it is constituted by a single party or involves a coalition.

More delicate is the question of who is the social planner who sets the deficit (or debt) ceilings. A mandatory ceiling fixed by law, for example a zero-budget rule or the Stability and Growth Pact's 3% limit will not do. The reason is 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. This reminds us of rules vs. discretion issue: rules can deliver better

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<sup>24</sup>This must affect the complete budget process, from the preparation and adoption of the budget law by the government to its passage by the parliament.

or worse outcomes than discretion depending on the nature of the disturbances. We cannot pursue this issue further here since we do not allow for uncertainty. In real life, however, the optimal ceiling is likely to vary over time in response to various disturbances, so that any permanently set number is not, possibly never, optimal.

If we interpret our model as describing one of many recurring but always different situations, the social planner must fix a new ceiling for each annual budget. The role of the social planner must be delegated to a fairly sophisticated and non-partisan agent. One possibility would be to delegate this task to the Finance Minister, in addition to the decision on productive spending. This institutional arrangement can work under two main conditions: that the Finance Minister is independent from interest groups and that it is not caught in a conflict of interest between its own spending decisions and the choice of the ceiling.

An attractive alternative is to delegate the social planner's task to someone outside of the political arena. This is what lies behind the proposal of fiscal councils composed of independent wisepersons. Note that the social optimum is achieved whether the ceiling is *ex ante* credible or not in the eyes of the governments as long as the government can pre-commit. Institutionally, this means that the fiscal council can intervene either at the beginning or at the end of the budget process. What matters is that it be given the power to make a final and mandatory decision on the actual budget balance.<sup>25</sup>

The model presented here, and the policy implications, rests on a number of assumptions that are not all innocuous. The most obvious one is that the countries are identical. This assumption brings considerable simplification but

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<sup>25</sup>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 can be interpreted as implicitly changing the ceiling in response to particular circumstances. In this interpretation, the Commission acts as social planner.

at cost. Any asymmetry - country size and structure, but also the prevailing economic conditions - will make it more difficult to deal with the international externality. The assumption that the debt ceiling is identical and simultaneously binding, for instance, solves the international externality. Without symmetry, it will not be generally possible to set ceilings that simultaneously deal with the domestic and international externalities. If, however, the international externality is of second order of importance, the symmetry assumption is not too restrictive.

Another limitation is that we only look at *net* spending. Our model explicitly ignores the level of public spending and the taxation burden. These are important issues, not wholly unrelated to the deficit bias. However, the common pool interpretation of the deficit bias assumes that all parties involved recognize that spending must be tax financed, either immediately or later on. Separating spending and taxation decision, in effect allowing for two separate games linked by the budget constraint, would greatly complicate matters without, we believe, delivering much additional intuition.

A final limitation is that the model ignores the issue of separation of powers. The fact that parliament must vote on the budget raises a host of issues, which have been mentioned in the introductory section. A complete study of the implied interactions is far beyond the scope of the present paper.

Finally comes the question of whether the optimal solution that combines precommitment and a deficit/debt ceiling can be politically supported. In this model, all involved parties benefit from achieving the social optimum. In particular, rational interest groups understand that the grab race inherent in the common pool problem is hurting them individually. They should welcome, therefore, an impartial referee that would eliminate an inefficiency. Of course, they must be convinced that the referee will be impartial, which brings us back

to the institution issue.

## Appendix

We present here the general case when the interest rate  $r$  and the rate of time preference  $\delta$ , which appear in (3) and (4) as  $R = (1 + r)^{-1}$  and  $\beta = (1 + \delta)^{-1}$  are not nil.

### Social optimum

The first-order conditions are:

$$\theta'(X^*) = \frac{1}{R}$$

$$G_2 + \bar{G} = \frac{\beta}{R}(G_1 + \bar{G}) \quad (31)$$

The solution is:

$$G_1 = \frac{R - \beta}{1 + \beta} \bar{G} + \frac{(R\theta(X^*) - X^*)}{1 + \beta}$$

Note that when  $R \neq \beta$  there is a rationale for shifting income intertemporally, hence the first term in the budget deficit equation. The corresponding welfare is:

$$U^* = (1 + \beta) \log(G_1 + \bar{G}) + \beta \log\left(\frac{\beta}{R}\right)$$

### National social planners

The first-order conditions are:

$$\theta'(X) = \frac{1 - \alpha}{R} \quad (32)$$

$$G_2 + \bar{G} = (1 - \alpha) \frac{\beta}{R} (G_1 + \bar{G}) \quad (33)$$

The solution is:

$$G_1 = \frac{R - (1 - \alpha)\beta}{1 + (1 - \alpha)\beta} \bar{G} + \frac{1}{1 + (1 - \alpha)\beta} (R\theta(X) - X)$$

and welfare:

$$U^{NSP} = (1 + \beta) \log(G_1 + \bar{G}) + \beta \log \left( (1 - \alpha) \frac{\beta}{R} \right)$$

### Nash-Nash

The first-order conditions are:

$$\theta'(X) = \frac{1 - \alpha}{R} \quad (34)$$

$$G_2 + \bar{G} = \frac{1 - \alpha}{n} \frac{\beta}{R} (G_1 + \bar{G})$$

So:

$$G_1 = \frac{nR - (1 - \alpha)\beta}{n + (1 - \alpha)\beta} \bar{G} + \frac{n}{n + (1 - \alpha)\beta} [R\theta(X) - X] \quad (35)$$

The corresponding welfare is:

$$\begin{aligned} U^N = & (1 + \beta) \log \left( \frac{n}{n + (1 - \alpha)\beta} \right) - \beta \log n \\ & + (1 + \beta) \log \left( (1 + R) \bar{G} + R\theta(X) - X \right) + \beta \log \left[ \frac{(1 - \alpha)\beta}{R} \right] \end{aligned} \quad (36)$$

Note that, as required:

$$\frac{dU}{dn} = -\frac{\beta}{n} \frac{n - (1 - \alpha)}{n + (1 - \alpha)\beta} < 0$$

## .1 Finance Ministers as Stackelberg leaders

$$R\theta'(X) = 1 - \alpha - \frac{\alpha^2 n}{(1 - \alpha)(n + \beta)} \quad (37)$$

$G_1$  is the same as (35) but the choice of  $X$  is given by (37).

$$G_2 + \bar{G} = \frac{1 - \alpha}{n} \frac{\beta}{R} (G_1 + \bar{G})$$

$$G_1 + \bar{G} = \frac{n}{n + (1 - \alpha)\beta} [(1 + R)\bar{G} + [R\theta(X) - X]]$$

Welfare,  $U^{PC}$ , is the same as (36) but with the higher  $X$  (given by (37)),  $R\theta(X) - X$  is now lower, so welfare is lower than in the Nash-Nash case.

## Policy responses

### Pigouvian taxes

The taxes on period 1 debt  $\tau^I = \frac{\alpha}{1 - \alpha}$  and on transfers to interest groups  $\tau^D = n - 1$  remain unchanged. The international tax becomes:

$$\hat{T} = \frac{n - 1}{\beta + 1} [R\theta(X) - X + (R - \beta)\bar{G}]$$

### Credible deficit ceiling

**Finance Minister cannot precommit** The first-order conditions are:

$$R\theta'(X) = \frac{n}{1 + (n - 1) \frac{dX}{d\bar{B}}}$$

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

$$\beta\theta'(X) = Rn \frac{G_2 + \bar{G}}{G_1 + \bar{G}}$$

Note that  $R\theta'(X) > 1$  if  $\frac{dX}{d\hat{B}} < 1$ . Then observe that  $\theta''(X) < 0$  implies  $\frac{dX}{d\hat{B}} < \frac{n + R\theta'(X)}{(1+n)R\theta'(X)} < 1$  when  $R\theta'(X) > 1$ .

The outcome is:

$$G_1 = \frac{n - \beta\theta'(X)}{\beta\theta'(X)} \bar{G} + \frac{n}{\beta\theta'(X)} [\theta(X) - X]$$

**Non-credible deficit ceiling**

**Finance Minister cannot precommit**

$$\theta'(\hat{X}) = \frac{1}{R}$$

$$G_1 = \frac{n \left( R\theta(\hat{X}) - \hat{X} \right)}{(\beta + n)} + \frac{Rn - \beta}{\beta + n} \bar{G}$$

**Zero deficit ceiling** When  $X = G_1 = -RG_2 = \hat{B} = 0$  we have:

$$\hat{U}' = (1 + \beta) \log(\bar{G})$$

When  $R = \beta = 1$

$$\hat{U}' = 2 \log(\bar{G})$$

$$U^N - \hat{U}' = 2 \log \left( \frac{n}{n + (1 - \alpha)} \right) - \log n + 2 \log (2\bar{G} + \theta(X) - X) + \log(1 - \alpha) - 2 \log(\bar{G})$$

When  $n = 1$ , we cannot sign  $U^N - \hat{U}'$ . When  $n \rightarrow \infty$  or when  $\alpha \rightarrow 1$   $U^N - \hat{U}' \rightarrow -\infty$ .

### Golden Rule

The first-order conditions are given by (32) for the choice of  $X$  and (31) for the interest groups. The cap on the net transfers to interest groups in period one is:

$$\hat{G} = \frac{R - \beta}{1 + \beta} \bar{G} + \frac{R\theta(X) - X}{1 + \beta}$$

With  $G_1 = \hat{G}$  The resulting welfare is:

$$U^{GR} = (1 + \beta) \log(\hat{G} + \bar{G}) + \beta \log \left( \frac{\beta}{R} \right)$$

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