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\* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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# Interdependence of Fiscal Debts in EMU\*

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## Abstract

We use an overlapping generations model to show that a bail-out is the optimal response to a fiscal crisis when the level of integration in a Monetary Union is high and the departure from Ricardian equivalence is significant. As it may not be optimal ex-post, the *no bail-out* rule is not credible ex-ante. To make it credible, one would have to look for arrangements that make the cost of one country defaulting sufficiently small, such that it does not impose a risk to the viability of the whole Monetary Union. One way to do that that we exploit is by reducing the relative size of the individual fiscal authority (from national to regional, for example).

Keywords: Debt Default, Monetary Union, Bail-Out

J.E.L. Classification: E62, F33

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# 1 Introduction

The fiscal crisis in Europe highlights the importance of evaluating cross country channels of interdependence when thinking about the institutional set-up of Monetary Unions. As international economic integration increases the level of interdependence between countries and regions, any individual economy becomes more sensitive to developments in others. And this is more true in Europe, where economic integration has been reinforced by the political motivation behind forming the Union.<sup>1</sup> The main worry then is whether the common good of greater interdependence is exploited by an "undisciplined" party, thereby shifting all, or part, of the cost of its behavior onto others.

The main concern behind those who drafted the Maastricht treaty was the possibility that EMU would produce an environment in which fiscal policy is used more than necessary, threatening the stability of Union as a whole. In theoretical terms, this worry would be equivalent to the governments having an incentive to violate the inter-temporal budget constraint, conducting a Ponzi game at the expense of their partners. Trying to prevent that, the Treaty imposed explicit limits on the use of fiscal policy, while article 104b explicitly forbade any bail-out operation, both between members countries as well as between the Central Bank and fiscal authorities. The so called *no bail-out* rule plays a similar role to that of a bankruptcy law but applied to sovereign states. But like any bankruptcy law, the efficiency of a punitive rule should be evaluated not only on its ex-ante ability to prevent undisciplined behavior, but also on its ex-post capacity to absorb the total cost of bankruptcy for all parties involved (see Eichengreen and Portes, 1995). The two concepts are intrinsically linked: if bankruptcy is too expensive ex-post, its threat cannot be credible and therefore efficient, ex-ante. Similarly in the case of a government default: if the cost of ex-post default is too high to the Union partners, then a *no bail-out* clause is simply not credible ex-ante. This automatically gives rise to the possibility of time-inconsistent behavior and the incentive to free-ride on others.

The need for institutional provisions to maintain fiscal discipline is often contrasted with the markets' ability to provide stability by themselves (see for example Buiter, Corsetti and Rubini, 1993). Confronted with an undisciplined government, such *market-based fiscal discipline* would initially take the form of a rising risk premium on the debt of the country running excessive deficits. If these deficits persist, the default risk premium would increase at an increasing rate until the offending country is denied additional credit. The increase of the cost of borrowing, along with the possibility of credit rationing, would then provide the incentive to correct irresponsible fiscal behavior. In this case punitive rules are redundant. However, Goldstein and Woglom (1992) argue that a market-based fiscal discipline can only work if

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<sup>1</sup>See Beetsma and Guilodori (2010) for a review of the literature.

certain conditions are satisfied, namely:

1. Capital is able to move freely;
2. full information on sovereign borrowers is available;
3. markets are convinced that there are neither implicit nor explicit outside guarantees on sovereign debt;
4. the financial system is strong enough to withstand the failure of the "large" borrower.

The experience of the first ten years of European Monetary Union shows that these conditions are not satisfied in full. While capital mobility is already virtually free, information problems are only theoretically solved, with increasing mutual control by member countries and financial institutions. The recent fiscal crisis has also shown that the failure of even a relatively small sovereign borrower can have a significant effect on the European financial system. Increasing market integration has increased the external effects of one nation's fiscal crisis, increasing at the same time the suitability of a bail-out operation, irrespective of the market's ability to form correct expectations. If this is foreseen by the markets, it would mean a looser government budget constraint at the national level and an increased risk premium imposed on the whole European debt. This is more so in the middle of fiscal crisis. Any rule that excludes the possibility of a bail-out when the private sector of each union country is hit, is not credible. Thus the possibility of a fiscal crisis produces a classical time-inconsistency problem in governments' optimal behavior, as noted by Diaz-Alejandro (1985) when analyzing the 1980's Latin American currency and financial crisis.

The objective of this paper is to analyze how increasing fiscal uncertainty changes the characteristics of interdependence between countries in a Monetary Union. We use a standard overlapping generations model (Weil, 1989) in which we allow two things: first, for countries to be interdependent through the cross-border holdings of government debt and second, for the possibility of a sovereign debtor defaulting. The connection between the fiscal positions arises through the private sector (the consumer) who is the owner of the debt issued<sup>2</sup>. The model shows that since one country's solvency crisis imposes costs on the other country's private sector, the possibility of a bail-out by the second country cannot be excluded. This implies two things: first, a *no bail-out* clause is not credible ex-ante, which generates incentives for fiscal "free-riding";<sup>3</sup> second, fiscal policy produces automatically an (again ex-ante) transfer

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<sup>2</sup>This is a schematic representation of a much more complex web of interdependence that has developed in the European Union in the last 10 years, especially in the banking and financial sectors (Bolton and Jeanne 2011).

<sup>3</sup>See Beetsma et (2009) for a similar argument.

of consumer wealth from the lower to the higher indebted countries. In a world of forward looking agents the possibility of bail-out will be immediately discounted by the private sector at the Union level. An excessive fiscal impulse, a confidence crisis or a worsening of the credit position in one country will then spill over into the expected fiscal position of other member countries. This would happen through affecting the future tax liabilities of consumers in other member countries, which would in turn lead to a net transfer of wealth and consumption. We show that this problem worsens when the level of integration in the Monetary Union is high and the departure from Ricardian equivalent is significant. Last, we discuss what kind of institutional arrangements could provide for a credible *no bail-out* clause. We base our analysis on the principle that credibility can only be ensured through the reduction of the ex-post costs for the whole Union if one country defaults. We argue that a reduction of the relative size of the individual fiscal unit, vis-à-vis the whole Union, (from nations to regions, for example) may be such an arrangement.

## 2 The Model

We introduce a model of a two-country Monetary Union. Two fiscal authorities (domestic and foreign indicated by a star) provide services and levy income taxes over two different national groups. The supply side of either economy is represented by an exogenous income.

### A The Private Sector

We model the private sector following Weil (1987, 1989) where both debt and tax policies play a role. The two economies are populated by infinitely lived agents, but their aggregate population grows at the constant rate,  $n$ . Assuming an exogenous interest rate,  $r$ , the individual of generation  $v$  at time  $t$  maximizes his inter-temporal consumption,  $c$ , discounted by  $\beta$ :<sup>4</sup>

$$U_t^v = E_t \left\{ \sum_{s=t}^{\infty} \beta^{s-t} \log c_s^v \right\}, \quad (1)$$

subject to his inter-temporal budget constraint:

$$E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1}{1+r} \right)^{s-t} c_s^v \right\} = (1+r) b_t^v + E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1}{1+r} \right)^{s-t} [(1-\tau_s) y_s^v] \right\}, \quad (2)$$

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<sup>4</sup>The exogeneity of interest rates is naturally a strong assumption. We do not analyze the issue of determination of interest rates because we concentrate our attention in the strategic choices faced by the national governments and not market responses. If bailing-out the domestic economy is the optimal choice for the foreign government (which indeed will be the case sometimes, as we will show further down), then the interest rate on the domestic debt is not a good reflection of its risk to default. In fact, it would reflect the willingness/ability of the foreign country to bail out the domestic country, not the true state of its economy.

where  $b_t^v$  is the beginning of the period stock of assets of vintage  $v$ ,  $\tau_s$  is the income tax rate imposed by the government and  $y_s^v$  the per capita income of generation  $v$ . Maximization of (1) subject to (2) gives the individual's consumption function:

$$c_s^v = (1 - \beta) \left\{ (1 + r) b_t^v + E_t \sum_{s=t}^{\infty} \left( \frac{1}{1 + r} \right)^{s-t} [(1 - \tau_s) y_s^v] \right\}. \quad (3)$$

The model at the individual level is a straightforward infinitely-lived agent model. At the aggregate level, the growth rate  $n$  of populations in the two countries ( $N_t$  and  $N_t^*$ ) is assumed to be strictly lower than the real interest rate, i.e.  $n < r$ , in order to avoid any dynamic inefficiency. Therefore,  $N_t = (1 + n)N_{t-1}$  and at time  $t = 0$  population  $N_0$  is normalized to be one in both countries. This together with the assumption that a newly born generation has no assets ( $b_v^v = 0$ ), allows us to derive the aggregate variables at time  $t$ .<sup>5</sup>

$$C_{t,s} = (1 - \beta) \left\{ (1 + r) B_t + E_t \sum_{s=t}^{\infty} \left( \frac{1}{1 + r} \right)^{s-t} [(1 - \tau_s) Y_{t,s}] \right\}, \quad (4)$$

where  $Y_{t,s}$  is the stream of income expected by generations living at time  $t$ . The same relations govern the behavior of the foreign private sector leading to a similar consumption function shown in (5).

$$C_{t,s}^* = (1 - \beta) \left\{ (1 + r) B_t^* + E_t \sum_{s=t}^{\infty} \left( \frac{1}{1 + r} \right)^{s-t} [(1 - \tau_s^*) Y_{t,s}^*] \right\}. \quad (5)$$

Finally, in order to capture financial integration in the most stylized fashion, we assume that at time  $t$  a portfolio of public debt issued by the two governments represents the total financial assets of the private sector in the two countries. A fraction  $\alpha$  ( $0 < \alpha < 1$ ) of domestic public debt is held by the domestic private sector, and the rest,  $(1 - \alpha)$ , is held by the foreign private sector. Similarly foreign public debt is distributed between the two private sectors, with  $\phi$  being the proportion held in its own hands and  $(1 - \phi)$  being held by the other country's (i.e. domestic) private sector. Non-human wealth in period  $t$  in the two economies is therefore defined as follows:

$$B_t = \alpha D_t + (1 - \phi) D_t^* \quad (6)$$

$$B_t^* = (1 - \alpha) D_t + \phi D_t^*. \quad (7)$$

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<sup>5</sup>The aggregate variables are defined as:  $X_t = x_t^0 + n x_t^1 + n(1 + n)x_t^2 + \dots + n(1 + n)^{t-1} x_t^t$  and refer to the generations present at time  $t$ .



## B The Government, Income Uncertainty and Default Risk

In each country the government at time  $t$  inherits a stock of debt from the previous period and, given the expectation of future income, determines the tax rate that satisfies the inter-temporal budget constraint. Given population growth, which in the model represents the degree of departure from Ricardian equivalence, the relevant inter-temporal budget constraint for the two countries are defined as:

$$(1+r)D_t = E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1+n}{1+r} \right)^{s-t} (\tau_s Y_{t,s}) - \sum_{s=t}^{\infty} \left( \frac{1+n}{1+r} \right)^{s-t} (G_{t,s}) \right\}, \quad (8)$$

for the domestic country and,

$$(1+r)D_t^* = E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1+n}{1+r} \right)^{s-t} (\tau_s^* Y_{t,s}^*) - \sum_{s=t}^{\infty} \left( \frac{1+n}{1+r} \right)^{s-t} (G_{t,s}^*) \right\}, \quad (9)$$

for the foreign country.  $G_{t,s}$  and  $G_{t,s}^*$  represent government expenditures in the two countries, respectively. Without capital accumulation and with an exogenous stream of expenditure and income, the government's problem is reduced to fixing the tax rate that satisfies the inter-temporal budget constraint. In order to determine the tax rate, we need to specify the income process. In doing so, we introduce the possibility of partial default on domestic debt. For simplicity we assume that domestic per capita income is subject to two states: good ( $g$ ) and bad ( $b$ ), which occur with probability  $p$  and  $1-p$  respectively. We examine what this implies for the foreign country. Without any loss of generality we assume that foreign per capita income is not subject to uncertainty but is kept constant at the level  $y^*$ . Formally, domestic per capita income for any generation present and future follows the following distribution:

$$y_s^v = \begin{cases} y^g & \text{with probability } p \\ y^b & \text{with probability } (1-p) \end{cases} \quad \forall s = t \dots \infty. \quad (10)$$

The uncertainty about the stream of income introduces uncertainty also in the government budget constraint as taxes are also subject to this uncertainty. We can now rewrite the ex-ante budget constraint (8) as follows:<sup>6</sup>

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<sup>6</sup>In the budget constraint above, we implicitly assume that differential bond default risks are not reflected in differential bond prices. This assumption is made in order to avoid the complex dynamics that a differentiated term structure of interest rates would introduce. At the same time it reflects the uncertainty about the exact meaning of a risk premium. Moreover, the price of a bond reflects the expected future revenue stream from the borrowing country's bonds. The market will price different bonds such that the expected future revenue streams from each of them should be equal. While the difference in price is important in analyzing the dynamics of debt (see for example Hughes Hallett and McAdam, 1996), the difference in prices is irrelevant after default, because a market for that bond would no longer exist. Given that our analysis deals with the appropriate reaction to a fiscal default, assuming away the difference in prices is not problematic. Moreover if



$$(1+r)D_t = p \sum_{s=t}^{\infty} \left(\frac{1+n}{1+r}\right)^{s-t} (\tau^g Y^g) + (1-p) \sum_{s=t}^{\infty} \left(\frac{1+n}{1+r}\right)^{s-t} (\tau^b Y^b) - \sum_{s=t}^{\infty} \left(\frac{1+n}{1+r}\right)^{s-t} (G_{t,s}). \quad (11)$$

where  $Y^g$  and  $Y^b$  are the aggregate incomes of generations alive at time ( $t$ ), in the good ( $g$ ) and bad ( $b$ ) state of nature respectively. In this formulation, all variables (the level of income, the tax rate and government expenditure) are now constants, which implies that we can simplify (11) as follows:

$$(1+r)D_t = \frac{1+r}{r-n} [p(\tau^g Y^g) + (1-p)(\tau^b Y^b)] - \frac{1+r}{r-n} G. \quad (12)$$

The ex-ante tax rate that satisfies the domestic government's budget constraint is equal to:

$$\tau = (r-n) \frac{D_t}{p(Y^g) + (1-p)(Y^b)} + \frac{G}{p(Y^g) + (1-p)(Y^b)}. \quad (13)$$

Satisfying the inter-temporal budget constraint ex-ante is not a sufficient condition for the sustainability of the fiscal position ex-post. In fact, the default risk persists because government plans are subject to an uncertain income realization. Ex-post, when uncertainty is resolved, the domestic country can be faced with two possible scenarios:

In the good state of nature, i.e.  $y_s^v = y^g$ , the tax rate (from 13) that will satisfy the budget constraint (12) is:

$$\tau^g = (r-n) \frac{D_t}{Y^g} + \frac{G}{Y^g}. \quad (14)$$

In the bad state of nature, when  $y_s^v = y^b$ , the same level of debt and permanent expenditure require an higher level of tax rate, ( $\tau^b > \tau^g$ ):

$$\tau^b = (r-n) \frac{D_t}{Y^b} + \frac{G}{Y^b}. \quad (15)$$

Equations (14) and (15) together give the ex-post tax rates required to satisfy the budget constraint in either states of the world. Having fixed the tax rate at the beginning of period  $t$ , the domestic government faces two possible outcomes. If the realization of income falls in the good state,  $Y^g$ , the domestic government fulfils its plans and can reduce the tax rate to  $\tau^g$ . If instead  $Y^b$  occurs, then the tax rate  $\tau^b$  required to meet the budget constraint is higher than the maximum permissible tax rate  $T$ . The government is left with a part of the debt that is

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the optimal reaction to a default is to bail out, then the expected future stream of revenues is not affected by the probability of default, and the difference in prices would not appear anyway.

not covered by the stream of future income and is forced to default. Formally:

$$\text{if } Y_{t,s} = Y^b \quad \forall \quad s = t + 1, \dots, \infty, \quad \text{then } \tau_s = T < \tau^b,$$

and

$$D_{t+1} = (1 + r) D_t - \underbrace{\frac{1 + r}{r - n} [\tau^b - T] Y^b}_{\text{income shortage}}. \quad (16)$$

As not all domestic debt is in its own private sector's hands, the domestic government's default imposes a negative externality on the foreign private sector, by reducing the value of its wealth. By the same token, the actual cost of default for the domestic private sector is lower than it would have been without financial integration. This implies that the foreign government, which aims to maximize its own private sector's wealth, is forced to take into consideration the possibility of the domestic country defaulting. How it responds to this will be decided from the point of view of the present generation. The ex-post cost of domestic default for the foreign private sector should be compared with the cost of alternative policies. In the next section we consider these alternative policies and what they would imply for the foreign country, its fiscal position and its private sector.

### 3 Default or Fiscal Bail-Out?

The fiscal crisis in the domestic country described above can generate three different responses by the foreign government: (i) let the domestic country default on its debt, thus letting the present generation of foreign citizens pay the cost of a risky investment; (ii) buy out the domestic debt held by the foreign private sector or, (iii) bail-out the domestic debt directly. The choice faced by the foreign government is then one between letting the cost of the fiscal crisis be felt only by the present generation, i.e. letting the domestic country default on its debt, or smoothing the cost of fiscally adjusting the domestic government across generations, via rescue and tax policies. Evaluating these policies involves looking at their effects on the two components of foreign private consumption, (5), non-human wealth:

$$B_t^* = (1 - \alpha) D_t + \phi D_t^*, \quad (17)$$

and human wealth:

$$H^* = \sum_{s=t}^{\infty} \left( \frac{1}{1 + r} \right)^{s-t} [(1 - \tau_s^*) Y^*]. \quad (18)$$

Since income is assumed to be constant, so is the tax rate  $\tau^*$ . We can therefore re-write

(18) as:

$$H^* = \left( \frac{1+r}{r} \right) (1 - \tau^*) Y^*. \quad (19)$$

## A Domestic country defaults

The effect of a domestic country default on the foreign private wealth is equal to the capital losses sustained on the domestic debt held in their portfolio. The part of the debt that the domestic country cannot service is shown in (16). Net losses on its non-human wealth (17) are then (*ceteris paribus*):

$$\Delta B_{t+1}^* = - (1 - \alpha) \frac{1+r}{r-n} [\tau^b - T] Y^b. \quad (20)$$

This shows the change (reduction) in the value of domestic debt  $D_t$ , as incurred by the foreign private sector.

## B Bail-in: buy out of foreign held domestic debt

The second strategy available to the foreign government is to buy back the domestic debt held by foreign citizens. In this case the non-human wealth of the foreign private sector is not affected, as the domestic debt is simply replaced by their own country's (foreign) debt. On the other hand, foreign human wealth will be affected because of the increase in future taxes in their own country that this operation implies. We start from the foreign government's budget constraint, (9), and re-write it for constant values:

$$(1+r) D_t^* = \frac{1+r}{r-n} \tau^* Y^* - \frac{1+r}{r-n} G^*. \quad (21)$$

However, buying the domestic debt implies an extra expense. The foreign income will therefore need to cover the following three outflows such that the budget constraint is:

$$\frac{1+r}{r-n} \hat{\tau}^* Y^* = (1+r) D_t^* + (1-\alpha) \frac{1+r}{r-n} [\tau^b - T] Y^b + \frac{1+r}{r-n} G^*. \quad (22)$$

To finance that the sustainable tax rate becomes:

$$\hat{\tau}^* = (r-n) \frac{D_t^*}{Y^*} + (1-\alpha) [\tau^b - T] \frac{Y^b}{Y^*} + \frac{G^*}{Y^*}. \quad (23)$$

Equation (23) shows the tax increase required to cover the bail-in policy. This increase in

taxation will affect the private sector's human wealth as follows:

$$\Delta H_t^* = -(1 - \alpha) \frac{1 + r}{r} [\tau^b - T] Y^b. \quad (24)$$

Equation (24) shows the cost of increasing taxation, paid by the present generation. This is lower than the overall bail-in cost because part of the cost is transferred to future generations (not yet born). Comparing now equation (24) with equation (20), we see that an ex-post buy-out of the foreign private sector owned domestic debt shifts the cost of the fiscal crisis towards future generations in the foreign country. Given the overlapping generations structure of the model, the present generation would certainly prefer the second strategy to the first. The buying out of this part of domestic debt does not avoid domestic fiscal default; what it does do is to insulate the current generation of the foreign private sector from the cost of default.

## C Bail-out

The third option available to the foreign government is to apply a direct fiscal transfer to the domestic government that would avoid the default altogether. Such an operation has two different effects. The first effect is on its non-human wealth which sees an increase of foreign debt equal to the part of domestic debt "rescued", i.e. :

$$\Delta D_{t+1}^* = \frac{1 + r}{r - n} [\tau^b - T] Y^b > 0. \quad (25)$$

The effect of this type of fiscal bail-out depends on the distribution of the new debt issued by the foreign government across borders. Assuming that the increase in foreign debt is absorbed by the two private sectors by factors  $1 - \phi$  and  $\phi$ , as assumed in equations (6) and (7), the policy will produce an increase in foreign private sector stock of bonds (and non-human wealth) equal to:

$$\Delta B_{t+1}^* = \phi \frac{1 + r}{r - n} [\tau^b - T] Y^b. \quad (26)$$

The second effect is the reduction of human wealth caused by the increase in taxation, necessary to satisfy the inter-temporal government budget constraint. Similar to (22), we re-write the foreign governments budget constraint:

$$\frac{1 + r}{r - n} \tilde{\tau}^* Y^* = (1 + r) D_t^* + \frac{1 + r}{r - n} [\tau^b - T] Y^b + \frac{1 + r}{r - n} G^*, \quad (27)$$

according to which the amount of taxes required for the balance to bind is:

$$\tilde{\tau}^* = (r - n) \frac{D_t^*}{Y^*} + [\tau^b - T] \frac{Y^b}{Y^*} + \frac{G^*}{Y^*}. \quad (28)$$

The increase in taxes required will therefore affect the private sector's human wealth as follows:

$$\Delta H_{t+1}^* = -\frac{1+r}{r} [\tau^b - T] Y^b. \quad (29)$$

The total cost of bailing out in terms of private wealth of the present generation in the foreign country<sup>7</sup> is given by the sum of the two effects,  $\Delta B_{t+1}^*$ ,  $\Delta H_{t+1}^*$ , i.e.:

$$\Delta W_{t+1}^* = \phi \frac{1+r}{r-n} [\tau^b - T] Y^b - \frac{1+r}{r} [\tau^b - T] Y^b. \quad (30)$$

**Conjecture 1** *A fiscal bail-out is the foreign country's optimal response, from the point of view of its present generations, to the domestic fiscal crisis if the total cost of bailing out, (30) is lower than the cost of allowing the domestic country to default, (20). In other words:*

$$\phi \frac{1+r}{r-n} [\tau^b - T] Y^b - \frac{1+r}{r} [\tau^b - T] Y^b < -(1-\alpha) \frac{1+r}{r-n} [\tau^b - T] Y^b, \quad (31)$$

or, rearranging and simplifying:

$$\frac{\phi}{r-n} - \frac{1}{r} < -\frac{(1-\alpha)}{r-n}. \quad (32)$$

## D Graphical comparison

We describe next how these three alternative strategies compare with each other. Figures 1 and 2 plot the three conditions (20), (24) and (30) for alternative values of  $\alpha$ . In figure 1 we assume a very low population growth  $\{n = 0.003\}$  so that the model has a very low departure from Ricardian equivalence and a relatively high level of cross border holdings of foreign public debt, ( $\phi = 0.7$ ).

The graph illustrates that bailing out is preferable, from the point of view of the present generation, only if the level of integration is large enough (low values of  $\alpha$ ) to justify the permanent increase in future taxes. At the same time, a bail-in is always better than default without any intervention.

The result depends crucially on the degree of departure from Ricardian equivalence. If the value of  $n$  is changed, forcing it towards a more generous interpretation than trend in income growth, say assuming a value of  $\{n = 0.02\}$ , the results are more dramatic, seen in figure 2.

In this case, bailing out is always better than either default or bail-in and it actually represents a net increase of foreign private wealth. This improvement arises as the increase

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<sup>7</sup>As the model departs from Ricardian Equivalence for positive population growth, the operation of bailing out can produce an increase in private wealth in period  $t$ . The operation of bailing out domestic debt becomes a cost in terms of foreign private wealth only if parameter  $\phi$  is small, implying a high degree of integration between the two economies.

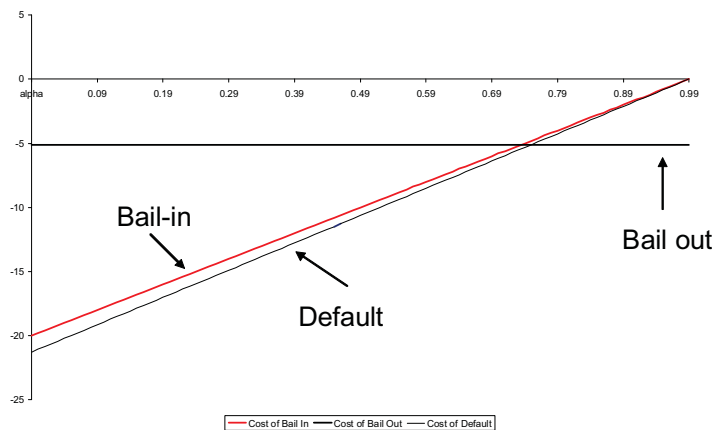


Figure 1: Costs to Foreign country :  $n = 0.003$ ,  $\phi = 0.7$ .

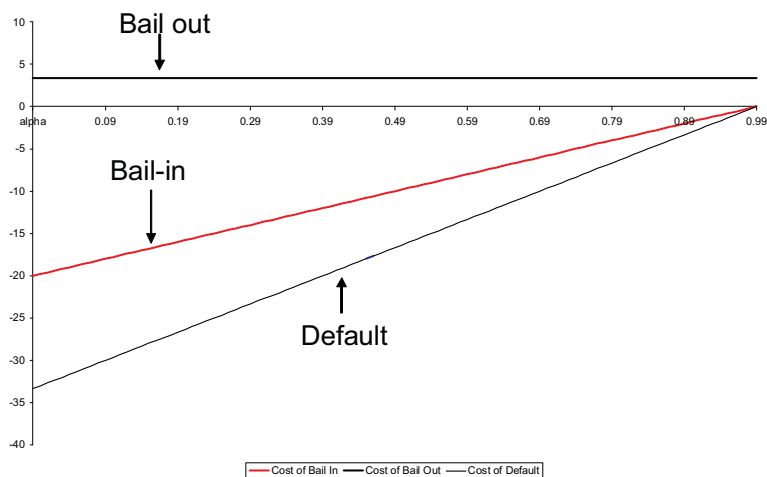


Figure 2: Costs to Foreign country :  $n = 0.02$ ,  $\phi = 0.7$ .

in foreign debt following the bail-out is de-facto paid mainly by future generations. Current generations in the foreign country are therefore net beneficiaries.

## 4 Endogenous Fiscal Federalism

The analysis so far shows that countries' fiscal positions are not independent from each other and that fiscal crises are contagious. This is true both in the case of bailing in the foreign private sector as well as in the case of direct transfers between the governments. We examine next what condition (32) would imply for the ex-ante form of the government budget constraint.

From the domestic country's point of view, the government budget constraint (12) needs to be modified to consider the expected value of a bail-out intervention from the foreign partner.

Formally, for the present value of the stock of debt to be sustainable the following must hold:

$$(1+r)D_t = \frac{1+r}{r-n} [p(\tau^g Y^g) + (1-p)TY^b + (1-p)(\tau^b - T)Y^b] - \frac{1+r}{r-n}G, \quad (33)$$

where the last term in the square brackets is the expected value of a possible bail-out by the foreign country. By the same token, the foreign country needs to account for the possibility of having to rescue its partner's debt when calculating the expected value of future liabilities of the public sector (and hence the amount of future taxes anticipated). The tax rate satisfying the inter-temporal budget constraint for the foreign country is then derived from the following budget constraint:

$$\bar{\tau}^* Y^* = (r-n)D_t^* + G^* + (1-p)[\tau_b - T]Y^b, \quad (34)$$

where the last term is the expected cost of bailing out the domestic country. Assuming the foreign government wants to maintain a flat tax rate (ex-ante), the present tax rate will therefore be:

$$\bar{\tau}^* = (r-n)\frac{D_t^*}{Y^*} + \frac{G^*}{Y^*} + (1-p)[\tau_b - T]\frac{Y^b}{Y^*}. \quad (35)$$

Equation (35) shows that the foreign country will need to run a budget surplus to cover for the implicit guarantee it gives to the domestic economy. This accounts for the following inter-temporal budget constraint:

$$(1+r)D_t^* = \frac{1+r}{r-n}\bar{\tau}^* Y^* - (1-p)\frac{1+r}{r-n}[\tau_b - T]Y^b - \frac{1+r}{r-n}G^*. \quad (36)$$

This shows how the foreign country adjusts its constraint to incorporate the risk of the domestic country defaulting. Condition (36) therefore shows explicitly how interrelated fiscal positions are in a highly integrated economic area. The difference between equations (36) and (33) - the inter-temporal budget constraints for the two countries - is in the way uncertainty is accounted for. While uncertainty in equation (33) is in the future income realization, uncertainty in equation (36) is introduced by the uncertain future level of taxes, conditioned by the expected income realization in the domestic country. Note also that the foreign country is forced to run an *inter-temporal* budget surplus in order to cover the risk of the domestic country defaulting.

The main implication of the analysis so far is that it is not always appropriate to consider the government budget constraints separately from the private sector optimization. Recall the two government budget constraints, (33) and (36). It is clear that the two equations are not



independent. Adding (33) and (36), we obtain the aggregate inter-temporal budget constraint:

$$(1+r)(D_t + D_t^*) = \frac{1+r}{r-n} [p(\tau^g Y^g) + (1-p)(TY^b) + \bar{\tau}^* Y^*] - \frac{1+r}{r-n} (G + G^*). \quad (37)$$

The rationale behind (37) is that domestic public debt can become a future tax liability for the foreign private sector, when there is a positive probability of default.<sup>8</sup> At the same time, it redefines the transversality condition for the government and the private sector problems. So long as the private sector assigns a positive probability to one member country defaulting, making decisions based on the aggregate inter-temporal budget constraint (37) is justified. And if that country is big enough, it can potentially threaten the stability of the Union as a whole.

## 5 A Europe of Nations Vs A Europe of Regions

As mentioned at the start, the main objective of the Maastricht fiscal rules was to provide a framework for a stable and disciplined Monetary Union, in which every member is the sole responsible to the market for their actions. It had done this by imposing strict rules on the use of the fiscal instrument, thereby aiming to reduce the probability of default, as well as increasing the “political” cost of bailing out a country with fiscal problems. Although correct in the sense of aiming in the right direction, such rules, by themselves, offer no guarantee against “time inconsistent” behavior on the part of the governments. But strict rules cannot account for all conceivable states of nature, and our analysis suggests that a no-bail-out rule is not optimal ex-post and therefore, also not credible ex-ante. The risk of using the fiscal instrument excessively in a strategic manner remains therefore very real. To cope with this form of “over-expansionary bias”, our analysis implies that European institutions should be designed to reduce the external economic cost of default, therefore reducing the incentive to bail-out that produces the strategic dilemma illustrated. As recent experiences in the world financial markets demonstrate,<sup>9</sup> without an institutional structure robust to all possible states of nature, the possibility of bail-out cannot (and should not) be ruled out. A rule that makes

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<sup>8</sup>Condition (37) is similar to the case of fiscal bail out presented in Woodford (1996) and Bergin (1997). Their analysis shows that respecting an inter-temporal aggregate budget constraint like (37) is a sufficient condition to maintain price stability in monetary union. On the other hand, requiring a constant transfer of wealth from one member to the other is not an equilibrium condition, because every government would follow the same expansionary policy. In our analysis, instead, condition (37) is independent of the actual behavior of the fiscal authorities but is the result of their expected optimal behavior in occasion of default. See also Leeper (2010).

<sup>9</sup>Recurrent financial and economic crises around the world in the last 20 years remind us of the very real possibility of a fiscal default. More importantly, they highlight the time inconsistency nature of a no-bail out commitment (either towards a country or a strategically important private actor), if not supported by institutions that minimize the external costs of a crisis.

this inevitable bail-out very costly is simply counterproductive.

But our analysis also suggests a possible institutional solution to this "time inconsistency" problem. What drives the results is not only the level of integration (represented by parameters  $\alpha$  and  $\phi$ ), but also the size of the country in fiscal distress in relation to the Union as a whole. We can see this if we consider the case of a Union of  $m$  number of countries, perfectly identical in terms of preferences and initial conditions. The total amount of government debt in this enlarged Union is now given by:

$$D_t^{emu} = \sum_{i=1}^m D_t^i. \quad (38)$$

Similar to above, the private sector has a preference for national assets and is indifferent between the various foreign assets. Therefore, the domestic resident will hold a fraction  $\alpha$  of domestic debt, while the other countries will absorb the rest. Each of these countries will hold  $\frac{(1-\alpha)}{m-1}$  of the remaining debt. Given the assumption of perfect symmetry among countries, the aggregate wealth in country  $i$  at time  $t$  will thus be composed by a portfolio of debt issued in all countries, i.e.:

$$B_t^i = \alpha D_t^i + \frac{(1-\alpha)}{m-1} \sum_{j=1}^{m-1} D_t^j, \quad j \neq i. \quad (39)$$

Assume that a (generic) country  $i$  experiences fiscal distress and therefore faces the possibility of default in a similar way as we have described in the two-country setting. This would imply a cost for its own private sector equal to:

$$\Delta W_{def.}^i = -(\alpha) \frac{1}{r-n} [\tau^b - T] Y^b. \quad (40)$$

At the same time such a default would impose a cost on the other member countries' private sector, equal to:

$$\Delta W_{def.}^{j \neq i} = -\frac{(1-\alpha)}{(m-1)(r-n)} [\tau^b - T] Y^b. \quad (41)$$

Equation (41) shows that the cost of default is inversely related to the number of Union members ( $m$ ) (or the relative weight of any local authority issuing debt with respect to the Union). Moreover the enlargement (or fragmentation) of the Union only affects the external cost of default but not, as shown by (40) the cost for the country in crisis.

Furthermore, enlargement in our set-up does not affect the cost of bail-out. This would not have been the case if member countries considered a coordinated action to rescue country

$i$ .<sup>10</sup> In an enlarged Union, the cost of bail-out would again be equal to:

$$\Delta W_{bo}^j = \frac{\alpha}{r - n} [\tau^b - T] Y^b - \frac{1}{r} [\tau^b - T] Y^b. \quad (42)$$

We graph equations (41) and (42), the costs of such strategies, in figure 3 against the number of countries in the Union. We show these for two different values of  $\alpha$ , and assuming  $r = 0.05$  and  $n = 0.02$ . The horizontal lines are the cost of bail-out, and are invariant to  $m$ . Furthermore a positive value represents an increase in country  $j$ 's private wealth following a bail-out operation of country  $i$ , independent of the number of country-members of the Union.

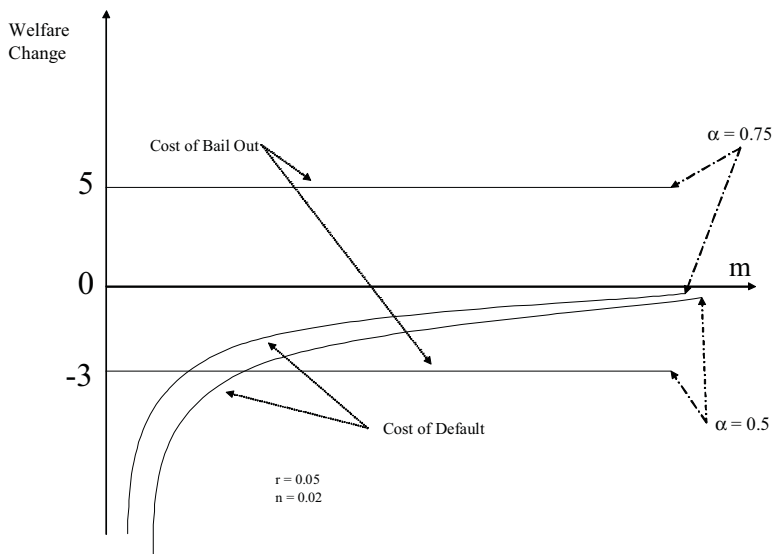


Figure 3: Fiscal strategies and enlargement

As argued earlier, the cost of bailing out one country increases, the greater the amount of national debt held abroad ( $\alpha$  smaller) and the lower the degree of departure from Ricardian equivalence. Bail-out is the optimal response to a fiscal crisis only if the Union is composed by a relatively small number of countries and the degree of cross-border transactions of public bonds is small. On the one hand therefore, the increase in openness increases the cost of default but on the other, the increase in the number of Union members softens the problem, reducing the possibility of the single member determining the outcome for the whole Union.

We suggest therefore, that while integration deepens, European countries have to make sure that it also widens at the same time, or otherwise reduce the size of the building blocks of the Union from the country to the local or regional level. The two processes reinforce each other, because reducing the external cost of default reduces the incentive to resort to

<sup>10</sup>We abstract from analyzing this case, not because it has no relevance, but because, given the fact that increasing the number of players decreases the cost of default, the incentive to cooperate in order to reduce the cost of bailing out decreases as well.

default (or the threat of it) therefore imposing discipline not through external enforcement but through self-interest. A sort of perfectly competitive Monetary Union, in other words.

## 6 Conclusions

We have examined how economic integration increases the possibility of excessive use of the fiscal instrument. We show that a country can use strategically its default risk to force a fiscal bail-out from other member states, especially if the country in question is big enough with respect to the whole Union. Although this is a theoretical possibility common to any integrated economic space, in a Monetary Union fiscal bail-out becomes more likely and this affects the ability of the markets to assess specific country risks. By implication, our model shows that the optimality of a fiscal bail-out produces interdependence of national fiscal positions; a fiscal federalism by default.

Is then the *no bail-out* clause the institutional solution to this possible strategic use of fiscal default risk? Since the costs of one country defaulting are incurred also by other countries' consumers, we have argued that the *no bail-out* is not a good solution if this external cost of default is greater than the cost of a fiscal bail-out. For solutions to be credible we require commitment mechanisms that go beyond what is found in the Maastricht Treaty. We argue that the relative dimension of the players is the single determining factor of the strategic problem analyzed. Therefore a transfer of the power of issuing debt to a lower institutional level could reduce the cost of default, making a commitment mechanism like the *no bail-out* rule easier to implement.

## References

- [1] Bayoumi, Tamim and Paul Masson, (1998), "Liability-Creating versus Non-liability-Creating Fiscal Stabilisation Policies: Ricardian Equivalence, Fiscal Stabilisation, and EMU", *Economic Journal*, Vol. 108(449), 1026-45.
- [2] Beetsma, Roel and Massimo Giuliodori, (2010), "The Macroeconomic Costs and Benefits of the EMU and other Monetary Unions: An Overview of Recent Research", *Journal of Economic Literature*, Vol. 48(3), 603-641.
- [3] Beetsma Roel, Massimo Giuliodori and Peter Wierdsma, (2009), "Planning to cheat: EU fiscal policy in real time", *Economic Policy*, Vol. 24, 753-804.
- [4] Bergin, Paul, (2000), "Fiscal Solvency and Price Level Determination in a Monetary Union", *Journal of Monetary Economics* 44, 37-53.
- [5] Bolton, Patrick and Olivier Jeanne, (2011), "Sovereign default Risk and Bank Fragility in Financially Integrated economies", CEPR Discussion Paper No. 8358.
- [6] Buiter, Willem, Giancarlo Corsetti and Nouriel Roubini, (1993), "Excessive Deficits: Sense and Nonsense in the Treaty of Maastricht", *Economic Policy*, 16, 59-99.
- [7] Diaz-Alejandro, Carlos, (1985), "Good-bye Financial Repression, Hello Financial Crash" *Journal of Development Economics*, 19, 1-24
- [8] Eichengreen Barry and Richard Portes, (1995), "Crisis? What Crisis? Orderly Workouts for Sovereign Debtors", CEPR, London.
- [9] Goldstein, Morris and Geoffrey Woglom, (1992), "Market-based Fiscal Discipline in Monetary Unions: Evidence from the US Municipal Bond Market", in *Establishing a Central Bank: Issues in Europe and Lessons from the US* , ed. Matthew Canzoneri, Vittorio Grilli, and Paul Masson, Cambridge University Press, Cambridge.
- [10] Leeper, Eric, (2010), "Monetary Science, Fiscal Alchemy", Kansas City Fed, August.
- [11] Weil, Philippe, (1989), "Overlapping Families of Infinitely lived Agents", *Journal of Public Economics*, 38,183-198.

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