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ON PROSPERITY AND POSTERITY

THE NEED FOR FISCAL DISCIPLINE IN A MONETARY UNION

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THE NEED FOR FISCAL DISCIPLINE IN A MONETARY UNION [1]

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In 2004 all publications will carry a motif taken from the €100 banknote.

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CONTENTS

Abstract

We show how in a Blanchard-Yaari, overlapping generations framework, perfect substitutability of government bonds in Monetary Union tempts governments to exploit the enlarged common pool of savings. In Nash equilibrium all governments increase their bond financed transfers to current generations (prosperity effect) at the expense of future generations (posterity effect). The resulting deficit bias occurs even if one assumes that before Monetary Union countries had eliminated their deficit bias by designing appropriate domestic institutions. The paper provides a rationale for an increased focus on fiscal discipline in Monetary Union, without the need to assume imperfect credibility of existing Treaty provisions or to refer to extreme situations involving sovereign default. We draw on existing empirical evidence to argue that the degree of government bond substitutability within the European Monetary Union is an order of magnitude larger than in the global economy.

Keywords: fiscal spillover effects, common pool, overlapping generations, bond market integration, fiscal discipline, fiscal rules, European Monetary Union

JEL classification: D62, E61, E63

Non-technical summary

Budget deficits redistribute wealth and welfare from future to current generations. In this paper we discuss how financial integration associated with Monetary Union alters governments' incentives for the intertemporal distribution of government financing and thus intergenerational equity.

We start from a standard overlapping generations model and add the assumption that democratically elected governments face the temptation of benefiting generations currently alive (prosperity) at the expense of future generations (posterity). In a closed economy ("autarky") a profligate fiscal policy will push up interest rates, thus imposing long-term costs on future generations. In an intertemporal set-up a trade-off arises between the ability of governments to affect aggregate expenditure in the short run and adverse crowding-out effects with negative growth consequences via higher interest rates in the longer run. We formally capture this trade-off by specifying a government preference function including current transfers (prosperity) and the (negative) equilibrium interest rate (posterity).

The elimination of exchange rate risk implied by Monetary Union renders government bond markets close to perfect substitutes. The high degree of euro area bond yield convergence and the almost perfect correlation of euro area government bond yields since the start of European Monetary Union in 1999 indicate a lack of any sizeable market discrimination with regard to sovereign risk characteristics of government bonds. We also argue that empirically the degree of bond market integration within the euro area is an order of magnitude larger than that of global financial markets. The empirical evidence presented suggests that the introduction of the euro has had a significant impact on financing conditions for euro area governments.

Government bond market integration has the effect that the common interest rate in the monetary Union rises less in response to a single government's expansionary fiscal policy than this country's domestic interest rate would have responded in the case of autarky. The reason is that a government can now draw on the common pool of total Monetary Union savings. With reduced marginal long-run costs of profligate fiscal policy, each government has an additional incentive to expand its domestic fiscal policy in Monetary Union. Of course, each single government realizes that this incentive prevails for all governments and that the common interest rate will be determined by the combined fiscal policies of all countries participating in the Monetary Union. The Nash solution is the equilibrium in which each government's expectations about the other governments' fiscal policies are validated and in which, given these expectations, there is no incentive to deviate from the chosen fiscal stance.

The Nash equilibrium of this game between fiscal authorities shows that Monetary Union exacerbates the challenge of maintaining fiscal policies, which preserve intergenerational equity. Without additional mechanisms to foster fiscal discipline, interest rates will be higher, debt and deficits larger and future generations will lose relative to generations born earlier.

Our approach has two advantages compared to existing models explaining the need for fiscal discipline in the European Monetary Union. First, the case for fiscal discipline in our model does not rely on imperfect credibility of Treaty provisions in the fields of monetary policy and the fiscal policy framework. Second, our case for fiscal discipline does not have to assume unsustainable developments in public finances, which are hard to reconcile with models assuming forward-looking agents and rational expectations. Instead in our model, the relevant spillover effects in perfectly integrated bond markets operate at all times and provide an additional strong underpinning for the need for fiscal discipline in Monetary Union based on intergenerational equity considerations.

"As a very important source of strength and security, cherish public credit. One method of preserving it is to use it as sparingly as possible by cultivating peace (… and) avoiding likewise the accumulation of debt, not only by shunning occasions of expense, but by vigorous exertions in time of peace to discharge the debt that wars have occasioned, not ungenerously throwing upon posterity the burthen that we ourselves ought to bear."

George Washington, Farewell Address, 1796

1. Introduction

Since the 1970s, most industrialized countries have recorded persistent budget deficits, leading to the accumulation of public debt to levels unusual for peacetime. In the coming years the challenges for public finances are exacerbated by the impact of demographics and in this context the question of intergenerational equity has come to the fore. In most Member States of the European Union sustainability of pensions and health systems is among the most pressing challenges calling for structural reforms.

The benefits associated with sound public finances are generally recognized. Over the medium to long term budget deficits have a negative impact on growth or the level of potential output. From a neo-classical viewpoint, persistent budget deficits and the accumulation of public debt lead to an increase in equilibrium real interest rates, crowding out of private investment and, therefore, to a lower capital stock over time. Available empirical evidence seems to confirm these effects. For example, Easterly et al. (1994), using a cross-section sample of more than 50 countries covering the period from 1965-90, found a positive, and statistically significant relation between growth in GDP per capita, and budget surpluses (in per cent of GDP). Ardagna et al. (2004) provide evidence on significant interest rate effects of national public debt and deficits for 16 OECD counties even after controlling for the worldwide fiscal stance.

Budget deficits also redistribute wealth and welfare from future to current generations.[1] In this paper we are concerned with intertemporal effects from government financing and how financial integration associated with Monetary Union alters governments' incentives for deficit spending. We use an overlapping generation model to consider issues of intergenerational burden sharing. The basic idea is to argue that budgetary authorities face the temptation of benefiting generations currently alive (current prosperity) at the expense of future generations (posterity). In a closed economy ("autarky") when the government follows a profligate policy this pushes up interest rates. The long run costs of the policy pursued are

[1] See Blanchard (1985), Buiter (1988), Weil (1987).

apparent in the increased level of real interest rates. In an intertemporal set up a trade-off arises between the ability of governments to affect aggregate expenditure in the short run (say, for stabilization purposes) and the crowding out through higher interest rates with adverse effects on growth in the longer run.

At the national level, rules aiming at fiscal discipline may be justified on the basis of a politically motivated deficit bias (see Persson and Tabellini, 2000, for a review of the relevant arguments). In this paper, we need not rely on the assumption of a domestic deficit bias in order to establish a case for fiscal discipline in a Monetary Union. In an open economy spillovers across countries arise. In particular, monetary unification exacerbates the challenge of maintaining budgetary discipline to the extent that it is associated with a closer integration of bond markets. Then the cost of current deficit financing for individual governments, in terms of higher interest rates, is spread out over the whole union.

An earlier, closely related paper is Beetsma and Vermeylen (2003), who emphasize the supply side of public debt in a Monetary Union. An increased degree of debt substitutability in Monetary Union leads to a lower demand for government bonds. This implies a higher equilibrium interest rate. The effect on overall public debt issuance is ambiguous and works via the central bank reaction function. The authors show that the relative share of Monetary Union countries' debt issued by governments with previously more dependent central banks and more myopic governments increases in Monetary Union. Our contribution follows Beetsma and Vermeylen in focusing on implications from increased bond market integration. However, we do not take account of portfolio diversification effects in order to single out the effects of increased substitutability of sovereign bonds on governments' incentives to issue.

The conceptual framework in our paper and the relevant economic mechanism follows closely the contribution by Chang (1990) but uses it in the context of Monetary Union. The results follow from three features of the model. First, the model allows for departures from Ricardian equivalence. Therefore government finance has real effects. In Chang's model, the departure from Ricardian equivalence is implied by a discrete-time overlapping generations set-up, originally due to Samuelson (1958). Second, there is full capital mobility across countries. In other words government debt markets are assumed to be perfectly integrated. Third, national governments care about the welfare of their own national constituencies and disregard the welfare of foreigners. Chang argues that the first two conditions imply that there are negative spillovers associated with domestic expansion through higher interest rates. The third condition means that, in the absence of appropriate supra-national institutions, fiscal deficits will be excessive from the viewpoint of all countries taken together.

Our contribution differs from Chang's in two important aspects. First, instead of a discrete time set-up we use the continuous-time overlapping generation model of Blanchard and Yaari. This allows for a simpler presentation of the game among fiscal authorities. In our set-up the game is a simple static one-shot game. Second, Chang focuses on the world economy. He states: "In a world with international capital mobility, the fiscal deficit of any single government affects the world interest rates and therefore affects intertemporal resource allocation in all countries." We argue instead that the argument is much more relevant for monetary unions among sovereign nations (like the euro area). The argument is empirical. Specifically, we show that monetary unification is empirically associated with sovereign debt market integration inside the union, which is an order of magnitude deeper than in the global economy. This suggests that the case for fiscal discipline inside Monetary Union is much stronger than the case for a global concern over fiscal discipline.

In general, the need for supra-national fiscal discipline in Monetary Union is justified by the existence of relevant spillovers across countries. Broadly speaking there are three main types of spillover mechanisms mentioned in the literature. One source of spillovers results from the interaction of multiple fiscal authorities with the single monetary policy. An increased propensity to build public debt is seen to make the task of monetary policy to maintain price stability more difficult. The second mechanism relies on unsustainable public finances with the prospect of insolvency prompting a bail-out by other governments (either on political grounds or on fears of the systemic fall-out from a sovereign borrower default). Finally, the third type of argument, which is also the approach taken in our model, involves fiscal-fiscal spillovers in Monetary Union, which lead to higher real interest rates and a worsening of any pre-existing domestic "deficit bias".[2]

The remainder of the paper is organized as follows: Section 2 discusses some recent evidence on the integration of bond markets in the euro area. Drawing on evidence from Baele et al. (2004) and Cappiello et al (2003) we argue that the elimination of exchange rate risk in Monetary Union, together with progress towards the single European market, increasingly allows governments to consider euro area savings as a common pool when issuing public debt. Using non-euro area countries as controls we are able to show that the degree of integration reached inside the euro area is much deeper than at the global level.

[2] See, for example, Beetsma (2001) or Ongena and Winkler (2001) for a review. Uhlig (2003) presents a model based on the third mechanism. In the discussion Gaspar (2003) outlines the approach followed in our paper.

In Section 3 we introduce a standard work-horse in macroeconomics – the Blanchard-Yaari continuous time overlapping generations model with government bonds as the single state variable. This allows to capture the trade-off a fiscal policy maker faces between current and future generations' welfare. The trade-off occurs because the government has the power to grant transfers to current generations to the detriment of future generations, who will have to share the burden of higher taxes. We sketch how the government balances the prosperity of current with the welfare of posterior generations. Thus the model can be used to illustrate the possibility of a political-economy domestic deficit bias in an intergenerational framework, which would then be exacerbated by spillovers arising in a Monetary Union.

In Section 4 we argue that due to the integration of bond markets in a Monetary Union, governments are likely to face a "common pool problem". Specifically, in Monetary Union there is an important fiscal-fiscal spillover associated with the integration of bond markets. When a government engages in expansionary transfers, benefiting current generations, it affects the interest rate less than it would have in a closed economy. This weaker effect lowers the (domestic) costs of fiscal profligacy. The (static) Nash solution shows that the introduction of a Monetary Union creates a deficit bias even if it did not exist in the closed economy (and worsens an existing deficit bias).

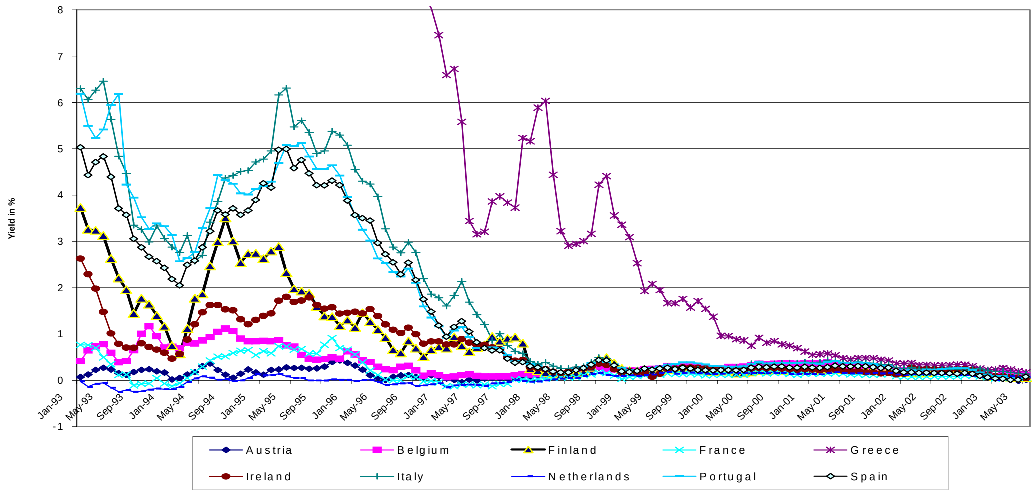
Section 5 concludes.

2. The integration of euro area bond markets

In this section we present some evidence on the degree of integration of bond markets in the euro area. The evidence presented supports our claim that after the event of European Monetary Union (EMU) euro area savings can be considered as a common pool by euro area governments, when issuing their debt securities. The degree of integration of euro area bond markets, although not perfect, is of a scale not comparable to international integration of bond markets elsewhere. Thus we argue that over and above the more generalised trend towards globalised financial markets, the introduction of the euro has had a significant impact on financing conditions for euro area governments. Euro area bond market integration in our view has reached a level, at which the common pool spillover exposed in Section 4 is of significant concern.

It is possible to imagine multiple reasons justifying a link between monetary unification and financial integration. Such links are not directly addressed in the real (non-monetary) model presented in sections 3 and 4. For the argument put forward in this paper, the precise determinants of bond market integration, leading to high substitutability among sovereign bonds, are not important. What is important is that government bonds are regarded as perfect (sufficiently close) substitutes in portfolios. An obvious link between monetary unification and bond market integration is provided by the impact of exchange rate risk, and other departures from uncovered interest rate parity. Gordon and Gaspar (2001) present an example where bonds provide a hedge against domestic inflation risk before monetary unification, inducing a "home bias" in bond portfolios. In their setting the bias is eliminated after monetary unification and bonds inside the single currency area become perfect substitutes[3].

Figure 1: Yield spread for 10-year government bonds relative to Germany



Source: Baele et al. (2004, p. 50, Chart 5.1)

Figure 1 taken from Baele et al. (2004) depicts the decline in nominal yield spreads of euro area countries with respect to German government bonds. The striking decline of spreads towards the vicinity of zero by May 1998[4] for all countries except Greece (which adopted the euro in January 2001) suggests that interest rate differentials related to expected exchange rate depreciation with respect to the DM (possibly together with an exchange rate risk premium) seem to have dominated spreads of euro area countries. The exchange rate risk seems not to have been transformed into idiosyncratic default risk in EMU. This suggests that market

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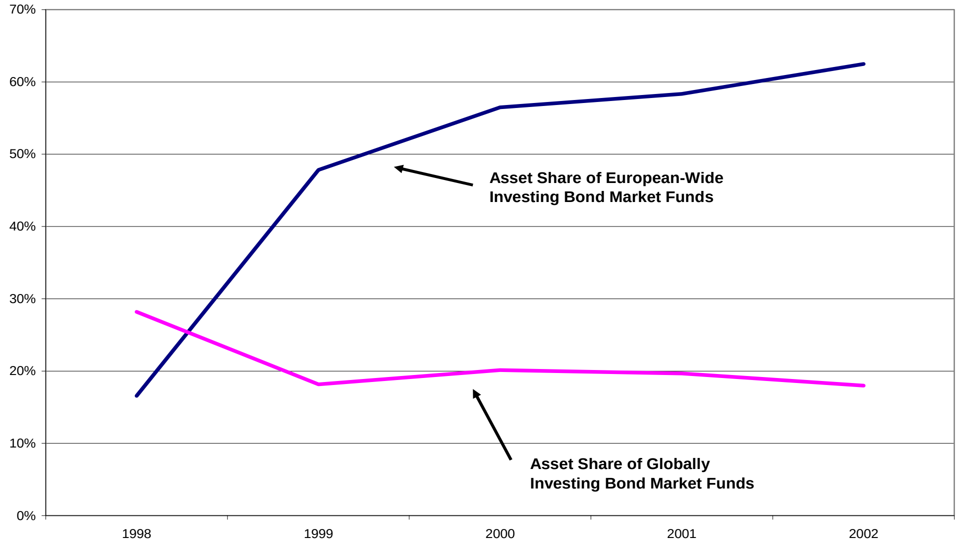
[3] Monetary Union has also been associated with a number of important regulatory changes. For example the elimination of exchange rate risk made bonds issues by sovereign borrowers, in the euro area, equivalent from the viewpoint of investment ratios of pension funds and other financial institutions.

[4] Note that on 3 May 1998, the procedure for determining the irrevocable conversion rates for the euro was announced. It was decided that the conversion rates would be based on the ERM bilateral central rates.

discipline could not be much relied upon to guarantee fiscal discipline in a Monetary Union as recognised in the debates about how best to ensure budgetary discipline in EMU[5].

Another interesting piece of evidence from Baele et al. (2004) which supports our common pool assumption regards the asset share of bond market funds investing Europe-wide, which has increased dramatically since 1999.

Figure 2: Average share of bond funds with European or global investment strategies



Source: Baele et al. (2004, p. 72, Chart 6.9)

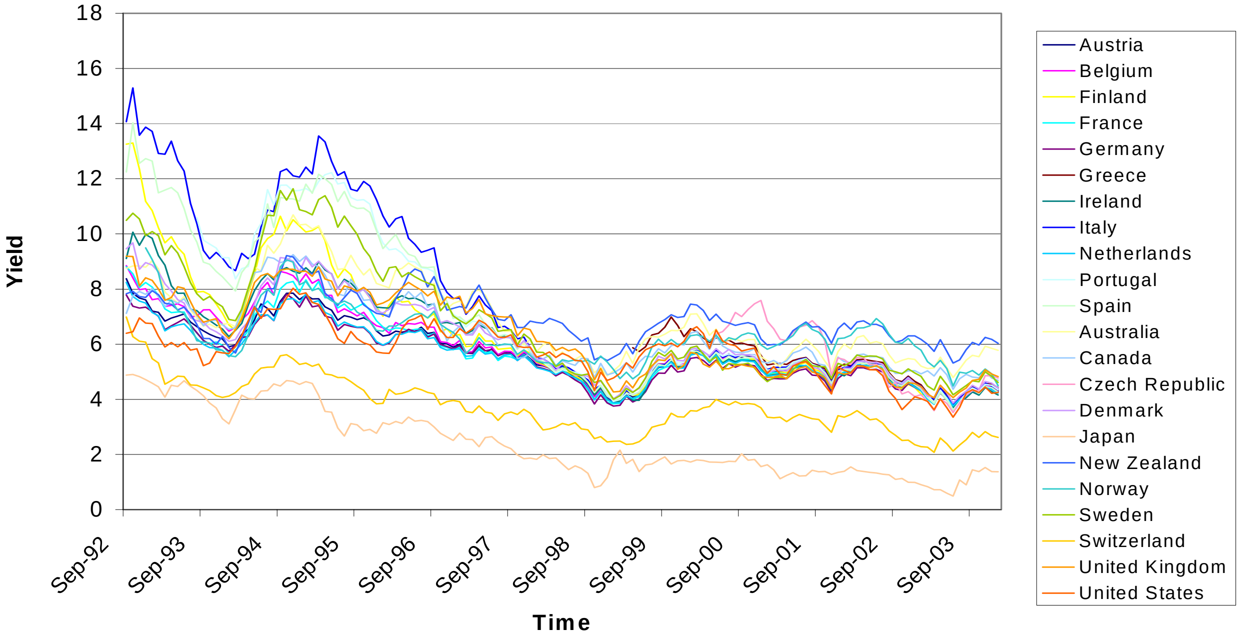
As depicted in Figure 2, the asset share of European-wide investing funds increased from about 20% in 1998 to above 60% in 2002 mainly at the expense of nationally oriented bond market funds. At the same time the share of globally investing bond market funds also declined from about 30% to just below 20%. The latter development supports our claim that

[5] For example the Delors Report (Committee for the Study of Economic and Monetary Union, 1989) stated (page 24): "(…) experience suggests that market perceptions do not necessarily provide strong and compelling signals and that access to a large capital market may, for some time, facilitate the financing of economic imbalances. Rather than leading to a gradual adaptation of borrowing costs, market views about the creditworthiness of official borrowers tend to change abruptly and result in the closure of access to market financing. The constraints imposed by market forces might either be too slow and weak or too sudden and disruptive. Hence countries would have to accept that sharing a common market and a single currency area imposed policy constraints." In a companion piece Lamfalussy (1989) reiterates that there is reason to be sceptical about the adequacy of sanctions imposed by the market mechanism." For empirical evidence and further discussion see Restoy (1996) and Bernoth et al. (2004), who examine the evolution of sovereign risk premia between 1991 and 2002. See also the small effects of sovereign default risk found in Codogno et al. (2003) and Portes (2003).

the bond market integration in the euro area is likely to be a distinct development from the general globalisation of financial markets.

Nevertheless, the question whether the integration process in European bond markets has a parallel in the globalisation of bond markets at the world level deserves further investigation. Further evidence presented in Figures 3, 4 and 5 supports our view that integration inside the euro area is much stronger and deeper than that prevailing at the global level and is closely associated with the process of monetary unification.

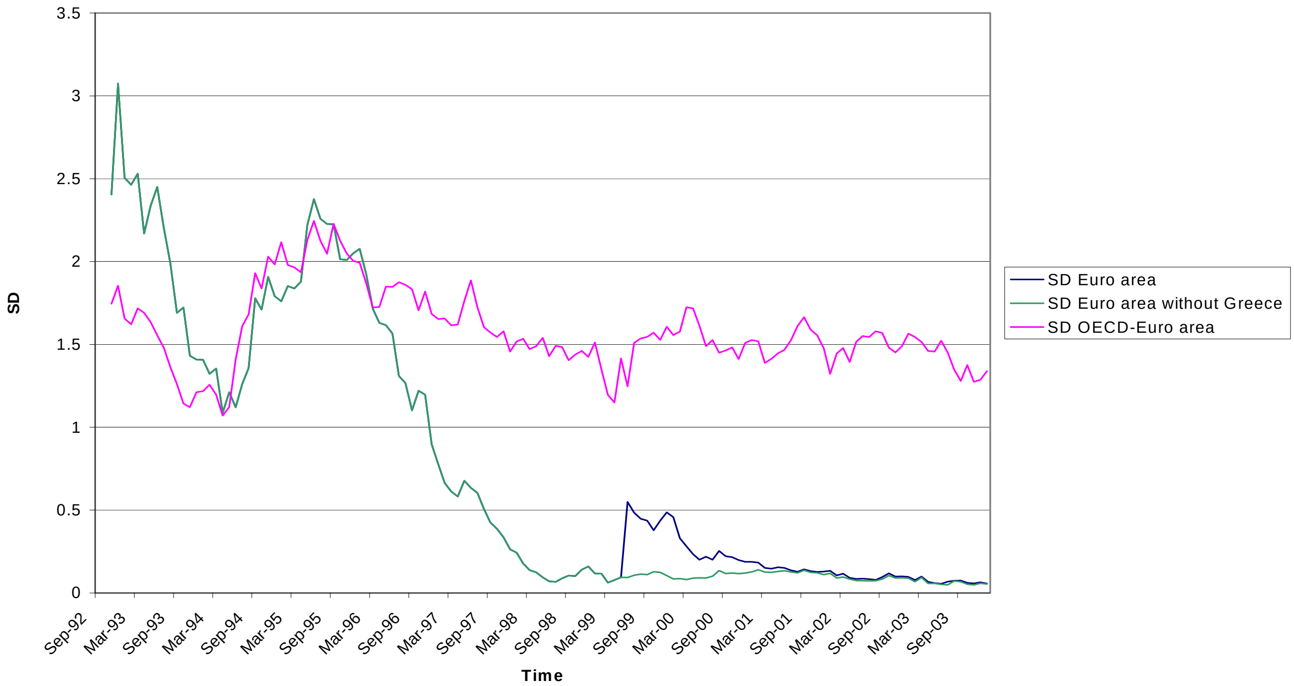
Figure 3: 10-year government bond yields



Source: Datastream, daily observations.

Figure 3 plots the 10-year bond yields for twenty-two OECD countries (eleven from the euro area – Luxembourg is not included – and eleven non-euro area countries). The data differs from Figure 1 because in that figure differentials to German bonds are shown, while Figure 3 is presented in levels. It is obvious from Figure 3 that euro area countries cluster closely together. The point is made more precise in Figure 4 which plots the standard deviation of 10 year bond yields in the euro area.

Figure 4: Cross sectional dispersion (SD) for 10-year maturity governments bonds



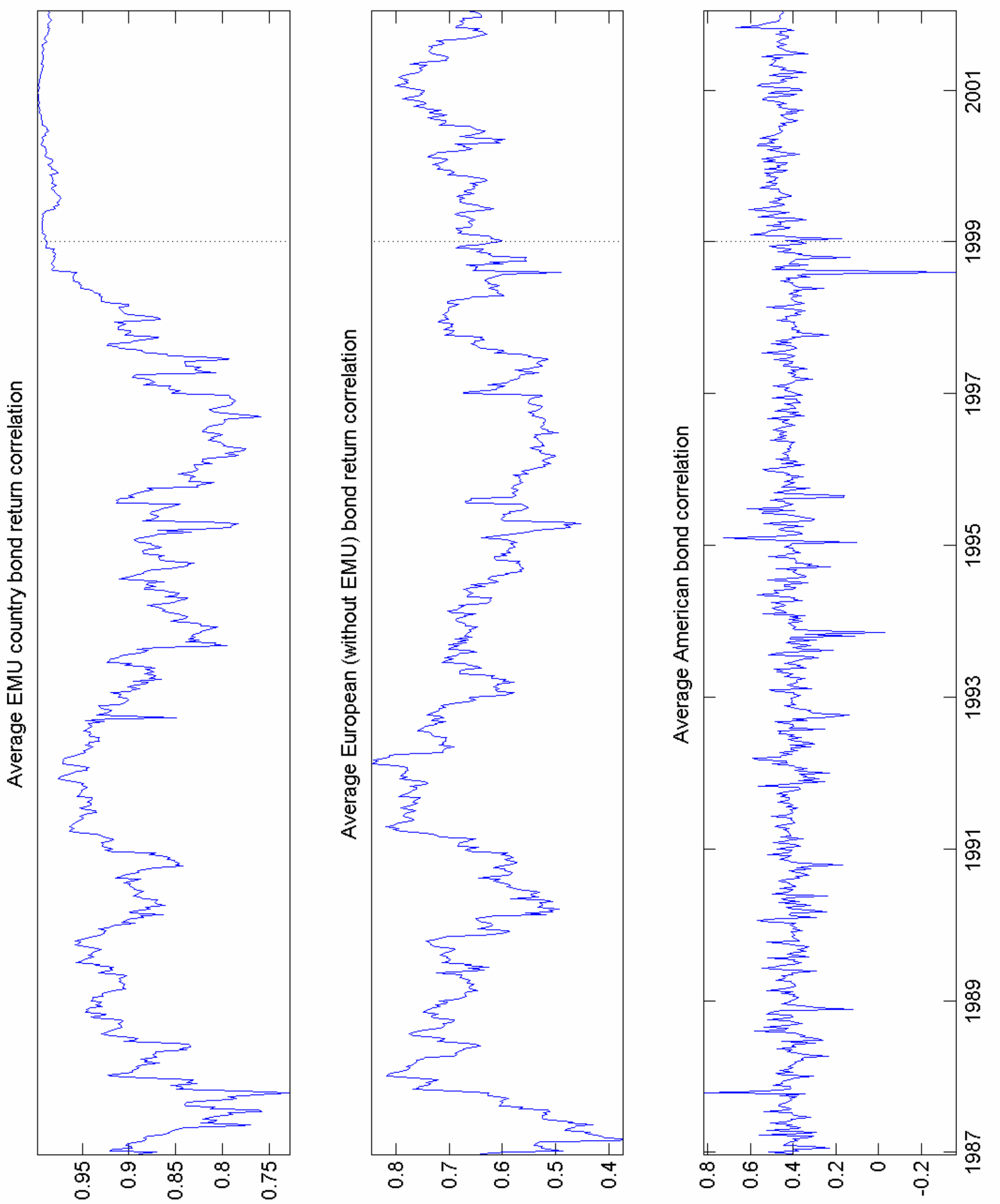
Source: Datastream, daily observations.

It is clear that yield dispersion diminished rapidly in the run-up to monetary union and now stands at very low levels. The decline became pronounced from 1995 and since 1999 seems to have stabilised at very low levels. The same did not happen in non-euro area OECD countries, where the dispersion of bond yields remained rather flat in the last decade.

Some recent papers are relevant for a deeper look at the issue of euro area versus global bond market integration[6]. For the rest of the section we follow Capiello, Engle and Shephard (2003). In this paper the authors look at changes over time in correlation patterns across international asset markets. They find significant changes associated with the introduction of the euro. Specifically they find strong evidence of structural breaks in conditional correlations. For bond markets inside the euro area they find that bond returns became virtually perfectly correlated already 15 weeks before the start of EMU. Ever since the correlation has always remained above 0.96 (see Figure 5). The same did not happen for the European countries not participating in the Monetary Union. Correlation stayed basically unchanged. The same holds true for North America, i.e. the correlation between Canada and the US (see Figure 5).

[6] Including Kearney and Poti (2004), Skintzi and Refenes (2004), Berben and Jansen (2004) Christiansen (2004), Kremer, Pesanti and Strauch (2004) and Capiello, Engle and Shephard (2003).

Figure 5: Average bond correlation for the three groups of countries



Source: Capiello et al (2003, p. 56)

The authors also report on the bond return correlation between the euro area, the remainder of Europe and North America[7]. They find that correlations between the euro area and the rest of the world also have increased since the start of Monetary Union (see Figure 6.) However the magnitude of the correlation is quite different. Even inside Europe between the euro area and other European countries the correlation is about 0.7. Between each of the two groups of European countries, on the one hand, and North America on the other, the correlation is much lower, in the range of 0.3 to 0.4.

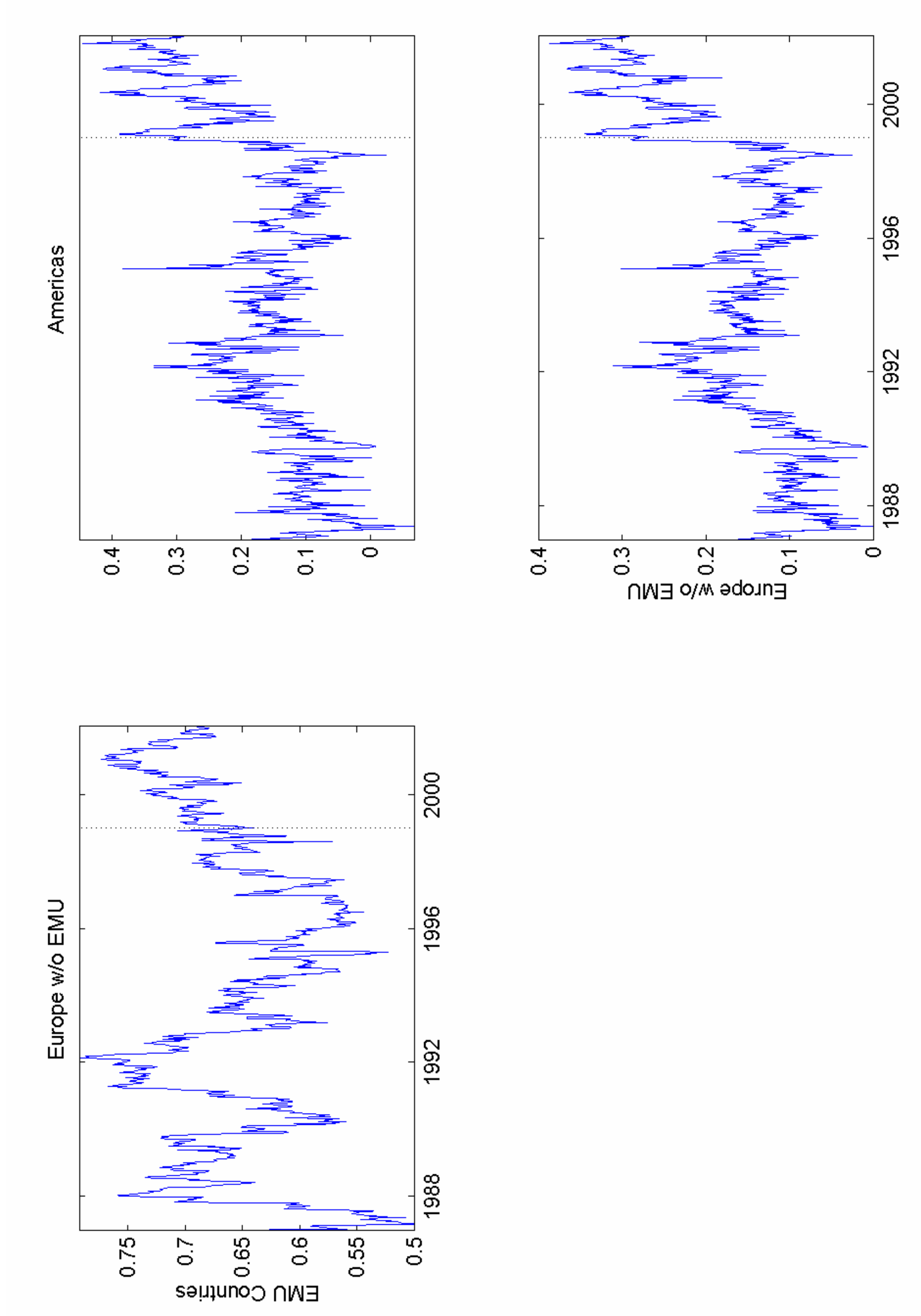
We conclude that the evidence shows that a) bond market integration has increased markedly in the euro area. In particular, there is a strong link between sovereign debt market integration and monetary unification in 1999. By contrast, b) comparable trends at global level (if they exist) are much less pronounced. In any case the degree of integration achieved inside the euro area is much greater than observed in the global economy (even when considering only OECD countries).[8]

We believe that the empirical evidence above is sufficiently strong to motivate applying the theoretical model presented in the following sections to the case of European Monetary Union. In this vein, Beetsma (2001) in the first instance links the spillover effect from fiscal policy, through the accumulation of public debt, to an increase in world real interest rates. Therefore he argues that, from a conceptual viewpoint, the interest rate effect is not linked to monetary union *per se.* Nevertheless, he recognises that in a world where sovereign bonds are not perfect substitutes it is likely that monetary unification would increase the substitutability of bonds issued by participating countries. The empirical evidence we present provides a sufficiently strong link between monetary union and bond market integration to justify treating the savings in Monetary Union as a common pool as we assume in section 4 of this paper.

[7] The countries include in the sample used are Austria, Belgium, France, Germany, Ireland and the Netherlands, for the euro area; Denmark, Sweden, Switzerland and the United Kingdom, for the rest of Europe; Canada and the US for North America.

[8] An entirely different hypothesis would be that instead of monetary unification it is rather the existence of the Stability and Growth Pact, which by making sovereign default very unlikely, might be responsible for the very high correlation of euro area government bond returns. We do not regard this argument as convincing. First, the SGP binds also EU Member States outside the euro area, where we do not see this increase in return correlation. Second, past difficult episodes with regard to the implementation of the SGP have not widened spreads significantly and did not reduce correlations.

Figure 6: Bond return correlation between the EMU, the rest of Europe, and North America



Source: Capiello et al (2003, p.55)

3. The Blanchard-Yaari model: the trade-off

We use the standard Blanchard-Yaari continuous overlapping generations model with infinitely lived agents (Weil, 1987) with government debt and without capital and money. Each moment in time the growth rate of the population is *n*. Newborns are disconnected from current members of the population by the fact that they are born with no financial wealth and initially start consuming only due to their positive endowment.

Each individual of generation *[x]* will face the following maximisation problem.

$$(1) \qquad \max_{c_s[x],} \left\{ \int_{s=t}^{\infty} \ln\left(c_s[x]\right) e^{-\theta(s-t)} ds \right\}$$

$$(2) \qquad s.t. \quad \dot{b}_s[x] = r_s b_s[x] + y - \tau_s - c_s[x]$$

The index indicates time and the square brackets give the birth date of an individual to identify his/her generation. Real consumption is denoted *c* and real government bonds are *b*. θ is the rate of time preference, while *r* stands for the real interest rate. Real non-interest income, a constant endowment, is denoted *y* and real lump sum taxes by τ. New generations are born with zero non-human wealth, which is reflected by the fact that financial wealth is accumulating at rate *r* and not *r-n* in the differential equation for the state variable *b* in equation (2).

The individual consumption function, derived from the first order conditions, is depicted in equation (3)[9]. Agents consume with propensity θ out of their total wealth, consisting of financial and human wealth, *h*.

$$(3) \qquad c_t[x] = \theta[b_t[x] + h_t]$$

where human wealth is defined as the present value of endowment receipts net of taxes.

$$(4) \quad h_t = \int_{s=t}^{\infty} \left((y - \tau_s)\, e^{-\int_{u=t}^{s} r_u du} \right) ds$$

[9] The intertemporal elasticity of substitution of 1 will not restrict the generality of the results, as the focus will be on the steady state and not on the transition paths (Fischer 1979, Cohen 1985).

Human capital in each point in time is the same for each generation alive, which is why h_t does not need a *[x]* in equation (3). Equation (5) immediately follows from the first order conditions and describes the behavior of individual consumption over time. A positive difference between the real interest rate and the rate of time preference encourages people to buy government bonds at early stages of their lives to afford a rising consumption stream over time.

(5) $$\dot{c}_t[x] = (r_t - \theta)\, c_t[x]$$

Equation (6) shows the procedure to derive aggregate per capita values. This procedure is necessary because different generations will have accumulated different amounts of financial wealth and thus will have different levels of consumption. Population is growing at rate n.[10] The total population size in period t is e^{nt} thus the populations size in period 0 was 1. The size of a generation born in period x is $n\, e^{nx}$. Each variable is first summed up over all generations as x is running from period 0 until today and the sum is then divided by the current population size. Capital letters denote these transformed variables, i.e. real aggregate per capita variables.

(6) $$Q_t = \frac{\int_{x=0}^{t} q_t[x] n e^{nx}\, dx}{e^{nt}}$$

Equation (7) describes the dynamics of aggregate per capita consumption on the optimal path. Note that the second term on the right hand side of equation (7) is the difference to the dynamics of individual consumption in equation (5). It is explained by the fact that newborns (n) consume θB less than the other generations alive, as they do not yet own any government bonds.

(7) $$\dot{C}_t = (r_t - \theta)\, C_t - n\theta B_t$$

As Y is constant and government (non-interest) expenditures are zero, C must be permanently constant also on the transition path to a new steady state. Thus equation (7) will determine the interest rate for a given size of the economy and stock of government debt.

[10] Note that the results would also go through for a constant or even shrinking population, if a non-zero death rate was introduced in the model. All that is strictly needed is a positive birth rate.

We introduce a tax reaction function as specified in equation (8), which means that the government can decide on a permanent, lump sum transfer payment of the size z ($z \geq 0$). In order to prevent real per capita debt from violating the transversality condition, taxes will be increased at rate β with the growing stock of government debt. This rules out debt sustainability issues in our model.[11]

(8) $$T_t = \beta B_t - z$$

Note that taxes are lump sum thus do not depend on individual holdings of government bonds, but only on the aggregate per capita level of government bonds. After inserting the tax function into the equation describing government debt dynamics, the model can then be fully described by equations (9)-(11).

(9) $$r_t = \theta + \frac{\theta n}{C} B_t$$

(10) $$\dot{B}_t = (r_t - n - \beta) B_t + z$$

(11) $$Y = C$$

Assuming $r_t - n < \beta < 1$ in steady state is a necessary and sufficient condition to have a positive steady state debt level when $z>0$. Equation (9) reveals that assuming $\theta>n$ will make sure that we are only dealing with dynamically efficient equilibrium.

Figure 7 shows the phase diagram for the model (9)-(11) in r/B space. The upward sloping straight line is equation (9) while the B demarcation line derived from (10) is given in (12).

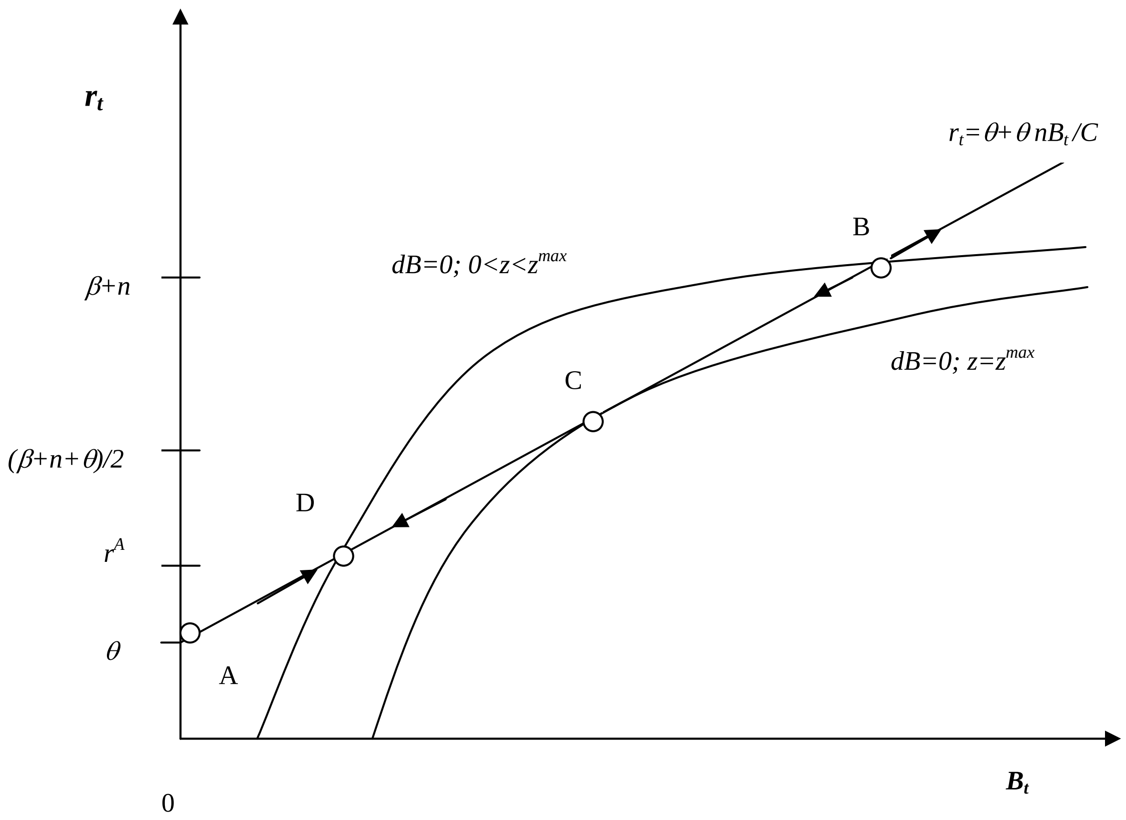
(12) $$\dot{B}_t = 0: \qquad r_t = \beta + n - \frac{z}{B_t}$$

There could exist two equilibria. The first one (e.g. point D) is stable, while the second one (e.g. point B) is unstable. We do restrict our attention to the first equilibrium, where equation (9) also represents the adjustment path. There exists a maximum value for the transfer z, which is associated with equilibrium point C, in which the interest rate would reach its maximum level of $(\beta + n + \theta)/2$. A fiscal policy with no transfers, i.e. $z=0$, would lead to

[11] See Blanchard 1985, p. 240 who uses this tax function with a constant interest rate version of this model.

equilibrium in point A, with no debt and the interest rate equal to the rate of time preference. Point D depicts some equilibrium for $0<z<z^{max}$.

Figure 7: The phase diagram



For the sake of simplicity we assume that the parameter of the tax reaction function, β, is given[12], so that z is really the only control variable for the government.

The government then faces a trade-off between prosperity and posterity in the following sense. A positive and permanent transfer, z, which is financed by accumulating debt, redistributes wealth from future to current generations. In steady state the net (of tax) wealth of the aggregate per capita stock of government debt is B-T/r. The latter is positive as long as new generations enter the economy. More precisely the contribution to steady state net wealth stemming from government debt to generations currently alive is nB/r or with our fiscal

[12] The purpose is to keep the government decision problem one-dimensional. As we already excluded on purpose the issue of public solvency, not allowing the government to manipulate the timing of debt repayment should not affect the results in any qualitative sense.

policy regime $zn/[r(\beta+n-r)]$. Government bonds are net wealth to those who hold them, as future generations will have to share the tax burden to finance the debt[13].

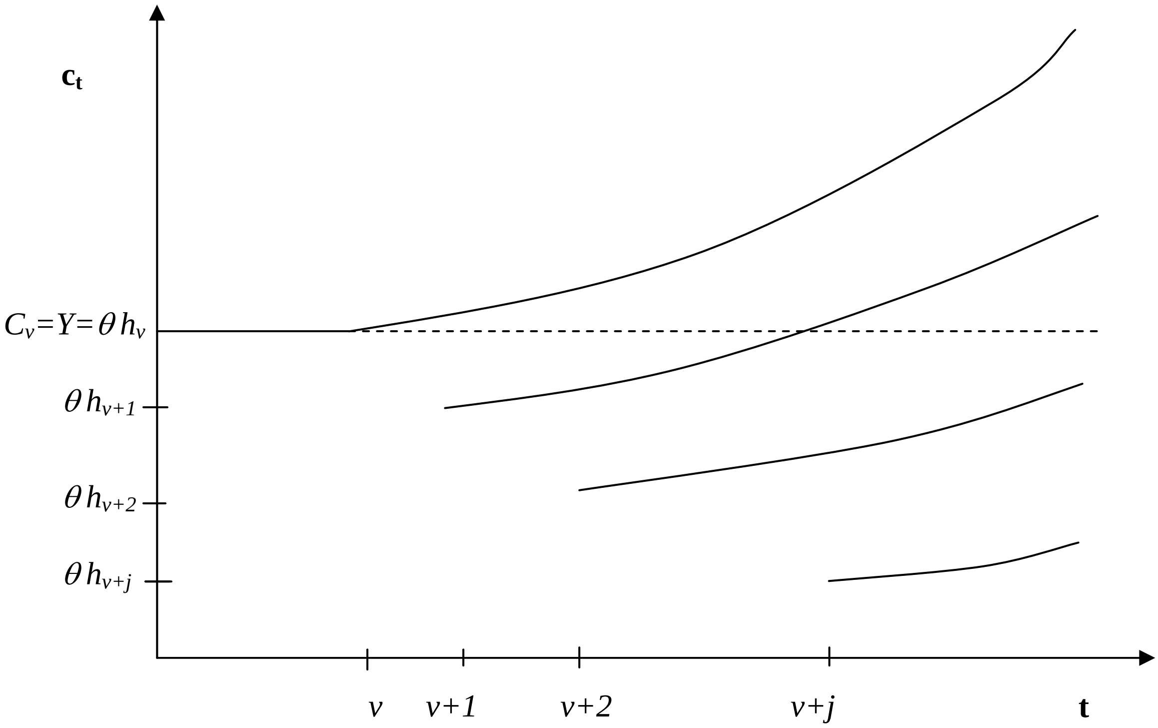
To see exactly how the redistribution of wealth from future to current generations works when z is increased, consider an initial situation at point A in Figure 7 where no transfers take place and r is equal to the rate of time preference θ. Define time $t=v$ the moment in time where the government introduces a fiscal regime according to the tax rule (8) and decides on a positive transfer $0<z<z^{max}$. All generations currently alive - including the generation born in $t=v$ - are exactly equal in terms of their consumption and saving profile. As equation (3) also holds in aggregate per capita variables and the simultaneous issuance of government bonds does not yet give rise to a positive wealth effect, aggregate per capita consumption is purely determined by human wealth, i.e. $C_v = \theta H_v$. As aggregate per capita consumption C must always equal Y it follows that H_v remains also constant. Thus for all generations alive at the time of the change in policy $t=v$ the positive transfer policy has no effect on their human wealth. The reason is that the infinite stream of current and future transfer payments is exactly compensated by higher future tax payments and higher future interest rates. Generations alive at time v use all their transfer receipts in period v to buy the government bonds issued to finance the transfer. The incentive to save the transfer is due to the fact that r instantaneously exceeds θ. From time v onwards consumption of all generations alive rises at the rate $r-\theta$, according to equation (5). Given that C is a constant and newborns in $t>v$ do initially not own any government bonds as opposed to previous generations, implies that newborn generations at time $t>v$ have an initial consumption level at birth, which is less than Y. Furthermore, the initial consumption level at birth of generations born after time v is declining, as depicted in Figure 8. Figure 8 shows the consumption level paths of generations born at arbitrary points in time, i.e. v (and before), $v+1$, $v+2$ and $v+j$.

As shown above, human capital remained constant in time v. Thereafter human capital will shrink as taxes and interest rates are continuously increasing with the level of aggregate per capita bonds on the path to the new steady state (see adjustment path in Figure 7). To compare the extremes, note that human capital for a generation born at time v (or before) as of time v (or before) is Y/θ. Human capital for a generation born in the new steady state with a positive z, say at time $v+j$ in Figure 8 is $\dfrac{y - z\dfrac{r-n}{\beta+n-r}}{r}$, where r is then the higher new

[13] See Blanchard (1985), Buiter (1988) and Weil (1989). See Detken (1999) for intergenerational distribution effects in this model in the presence of a central bank monetising part of the government debt.

steady state interest rate. This composite term is less than Y/θ as we are in a dynamically efficient economy where $r>n$.

Figure 8: The intergenerational consumption profiles [14]



Note that the present discounted value of consumption of a generation born in period t is simply $\int_{s=t}^{\infty} c_t[t] e^{\int_{u=t}^{s}(r_u-\theta)du} e^{-\int_{u=t}^{s} r_u du} ds = \dfrac{c_t[t]}{\theta}$, thus equal to its consumption at birth divided by θ. It follows that the present value of consumption of generations born up to (and including) the period of the introduction of the transfer system $t = v$, remains unchanged at Y/θ, despite the introduction of positive transfers. But lifetime utility of these generations after introducing the transfer system is clearly higher than before, due to the effect that consumption is now on an ever increasing path.

[14] Note that the population share weighted sum of all generations' consumption at any point in time in Figure 8 equals C.

The higher consumption path and increased utility of current generations is achieved at the cost of lower consumption and lower utility of future generations. The annex proves that the lower initial consumption level at birth of generations born in the new steady state - in Figure 8 possibly depicted by the consumption path starting in period $v+j$ - translates into lower utility for these generations than the utility of generations living forever in a fiscal regime without transfers (despite the fact that the consumption path starting in $v+j$ is rising forever). Having thus shown that the utility of generations currently alive increases, while the utility of generations born in the new steady state decreases with respect to the situation of no fiscal transfers, suggests that there is some generation born at $t>v$ which is indifferent to the introduction of the transfer policy regime. All generations before this "break-even" generation would profit while following generations would suffer a loss in utility. The tax adjustment parameter β determines how soon the "break-even" generation will see the light of day – the faster the tax adjustment (the higher β), the fewer yet unborn generations will profit from the introduction of a fiscal transfer regime.

As the rate of increase of consumption depends on r-θ, it follows that generations currently alive would prefer that the government commits itself to a permanent transfer policy with z as large as possible. The vast majority of future generations instead would instead prefer no previously installed transfer system in order to minimise the inherited tax burden associated with the public debt. Note that in a complete model with capital, the lower interest rate associated with lower debt would be translated into higher steady state per capita consumption, a higher per capita capital stock and higher wages, which reinforces this line of reasoning.

Keeping track of continuous generations' welfare in the Blanchard/Yaari model is a cumbersome exercise. To simplify matters we assume a government preference function, which captures this trade-off between current and future generations in an ad hoc way. The trade-off between current and future generations is perennial both in economics and in politics. In our set up it is natural to think of the authorities' attempt to transfer resources to the generations currently alive as represented by z while the longer run costs are represented by the steady state level of interest rates, r. The size of z (prosperity effect) and the size of r (posterity effect) approximate the trade-off a policy maker faces between current and future generations' welfare. We simply assume government preferences can be described by equation (13), where α is the weight given to those generations profiting from a transfer policy z, and (1-α) the weight to those future generations for whom lower steady state interest rates are more important.

(13) $U = \alpha\ z - (1-\alpha)\ r^2$

The particular shape of (13) is arbitrary. But any function which is well-behaved in the arguments *z* and *r* would do for our purposes.[15]

One might argue that in the real world the weight α will be very large, as governments are inclined to give much more weight to current generations, which are the current voters. This would give rise to what has been labelled the deficit bias of democracies in the political economy literature. Without loss of generality we will assume that in the closed economy (autarky) case, national institutions have been devised in such a way as to perfectly deal with the deficit bias problem so that each generation is treated alike. This assumption makes the results presented below concerning the negative incentive for fiscal laxity in a Monetary Union stronger. We will show that the event of Monetary Union would not only worsen any existing deficit bias, but that it would deteriorate the overall fiscal outcome even if national institutions had been devised optimally to deal with the national deficit biases before Monetary Union.

Maximising (13) with respect to *r* after substituting *z* by using (9) and (12) one derives the optimal steady state interest rate in a closed economy ("autarky"). Equation (14) depicts the interest rate maximising the government preference function.

(14) $$r^{opt,autarky} = \frac{\alpha\ \ C(\theta+\beta+n)}{2\ \ [(1-\alpha)\ \ \theta\ \ n+\alpha\ \ C]}$$

For the sake of simplicity we assume that the socially optimal transfer policy is *z=0*, so that each generation is treated alike. The corresponding "optimal" weight $\alpha^{*\ autarky}$ resulting in $r=\theta$ can then be derived as follows.

(15) $$\alpha^{*\ autarky} = \frac{2\theta^2 n}{2\theta^2 n + C(\beta + n - \theta)}$$

[15] E.g. one can show that if the *z* (prosperity) term on the right hand side of (13) is replaced by the net wealth of government bonds of current generations in steady state *zn/[r(β+n-r)]*, the preference function is still sufficiently well-behaved for the results to go through. These results are available on request.

If r equals θ in equilibrium, there is no incentive to save, z and B will be zero and all generations simply consume their endowments. We will assume in the following that national institutions manage to provide incentives so that for the government $\alpha = \alpha^{*\ autarky}$.[16]

In terms of Figure 7, we will consider equilibrium in point A as our starting value for comparison with the case of integrated bond markets in Monetary Union.

4. The Blanchard-Yaari model: the common pool problem in Monetary Union

Switching from a closed economy to a Monetary Union with integrated bond markets requires to discuss three aspects of our model from a different perspective.

First, it is important to note that the same intergenerational trade-off would be present in a small open economy, which takes the world interest rate as given. The government would face the same trade-off between transfers to current generations and the welfare of future generations. The difference is that in a small open economy transfers reduce the wealth of future generations by the accumulation of net foreign liabilities.[17]

Second, national consumption is not anymore restricted to the national endowment, as running current account deficits allows to boost national consumption. We do not characterise current account deficits explicitly for two reasons. We consider perfectly symmetric countries so that in equilibrium all countries in a Monetary Union behave the same. Thus no current account deficits among participating countries arise in equilibrium.[18] Furthermore, as mentioned above, it does not really matter whether the trade-off is cast in terms of rising interest rates or net foreign liabilities, one can proxy for the other. Nevertheless, the possibility of running current account deficits, drawing on other union member countries' current endowments provides an additional incentive for expansionary national fiscal policy in a Monetary Union. The reason is that each government realises that if it does not increase transfers but other governments do, domestic agents forego current consumption to finance the partner countries' fiscal transfers.

[16] $\alpha^{*\ \text{autarky}}$ is always smaller than 1 as $\beta > \theta - n$ due *to* $\beta > r - n$ and $r \geq \theta$.
[17] See Blanchard (1985).
[18] In the model we abstract from any relationship with countries outside the Monetary Union.

Third, to capture the common pool problem[19] in the Monetary Union we need to explicitly assume that governments are nationalistic, in the sense that they only care about the welfare of their own domestic consumers. As in a Prisoner's Dilemma type situation this implies that interest rate spillovers from national fiscal policies are not internalised across the Monetary Union.

In the following we will derive the Nash equilibrium in the static game, when all countries are perfectly symmetric. Upon entering Monetary Union, the government has to set its transfer policy by choosing *z*, once and for all. Any change of *z* from its autarky level will lead to adjustment processes of taxes, debt and interest rates accompanied by redistribution of wealth across generations. Here we will not focus on the transition path, but compare the steady state situation before and after Monetary Union. We show in a very simple way how, starting with "optimal" national institutions before Monetary Union (MU), fully integrated bond markets will then lead to a deficit bias. This result carries over to the case of pre-existing national deficit biases, which would worsen when a common pool of savings becomes available to governments.

We present the government preference function *U(z, r)* and the common pool problem graphically in *r/z* space, which is why we first derive the slope *dr/dz* of *U(z, r)* by means of the implicit function theorem.

$$(16)\quad \left.\frac{dr}{dz}\right|_U = \frac{\alpha}{2(1-\alpha)r}$$

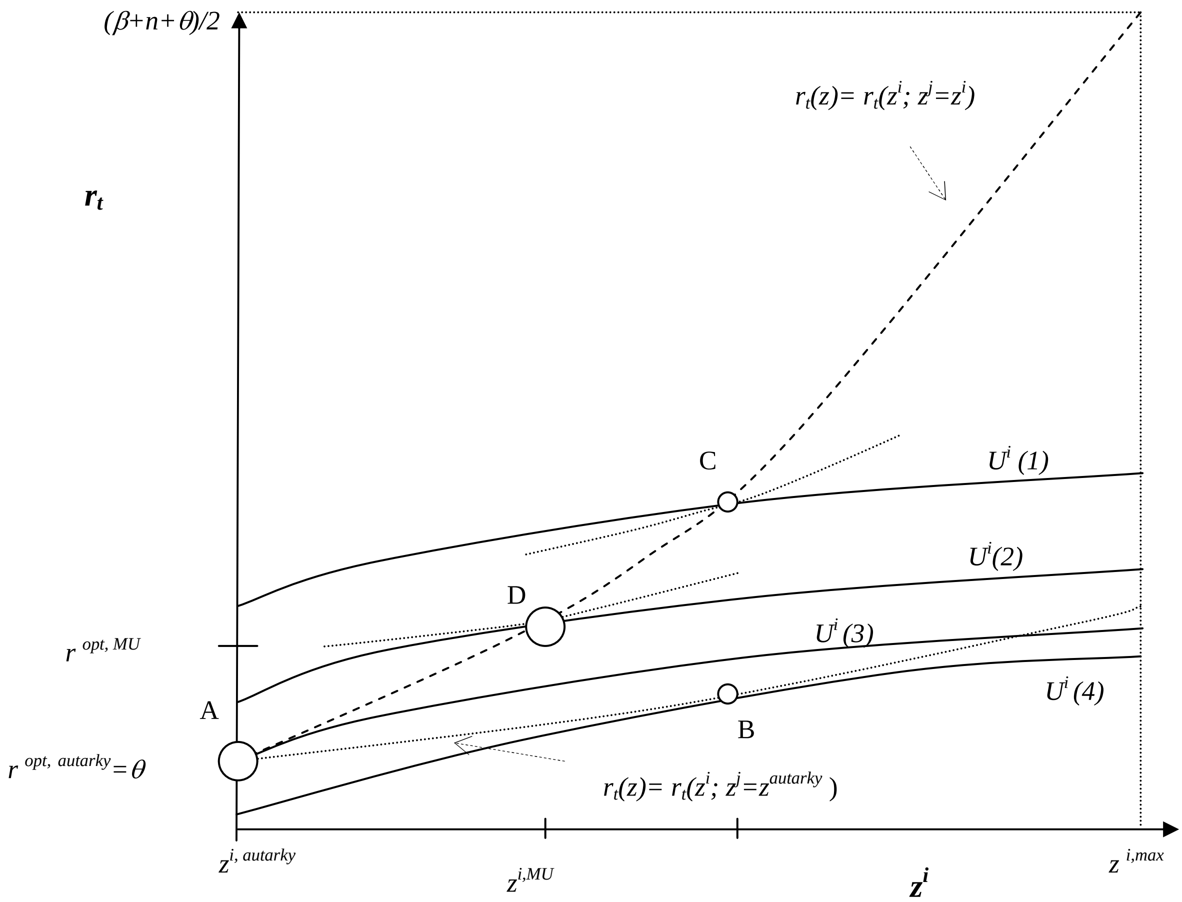
The slope depicted in (16) is definitely positive for a positive *r*. In *r/z* space, the set of indifference curves can be depicted as in equation (17) for different levels of *U*.

$$(17)\quad r = \sqrt{\frac{\alpha}{1-\alpha}z - \frac{U}{1-\alpha}}$$

The set of preference functions can then be depicted in *r/z* space as in Figure 9. A higher utility is obtained, the closer is the depicted indifference curve to the lower right corner, thus *U(1)<U(2)<U(3)<U(4)*. The concave shape of the indifference curves is due to the fact that at higher levels of *z* and thus of *r*, further increases of the interest rate are seen as increasingly costly in terms of disadvantaging future generations (posterity effect).

[19] On common pool problems with respect to fiscal policy see e.g. Persson and Tabellini (2000, Ch. 7+13) and Von Hagen and Harden (1996).

Figure 9: The common pool problem



The solution of the model (9)-(11) for the interest rate as a function of *z* can easily be derived. As from now on we are interested in comparing this outcome with the outcome in a Monetary Union, we will introduce country superscripts where appropriate. Equation (18) reveals the (closed economy) equilibrium interest rate for country *i* as a function of z^i.

(18) $$r_t^i = \frac{\beta+n+\theta}{2} - \sqrt{\frac{(\beta+n+\theta)^2}{4} - \theta(\beta+n) - \frac{\theta n}{C^i} z^i} \quad \text{with}$$

(19) $$\frac{dr_t^i}{dz^i} = \frac{\theta n}{2C^i \sqrt{\frac{(\beta+n+\theta)^2}{4} - \theta(\beta+n) - \frac{\theta n}{C^i} z^i}}$$

Obviously $dr/dz>0$ and it is straightforward to show that $d^2r/dz^2>0$ as well. Thus equation (18) has the convex shape depicted in Figure 9 (hyphenated line). The equilibrium, maximising government preferences, in a single closed economy with α at $\alpha^{*\,autarky}$ is depicted by point A. In equilibrium the government of country *i* has chosen $z^{i\ autarky}=0$.

We assume now country *i* enters a Monetary Union of all-together *m* perfectly symmetric countries ($z^1\ldots z^i\ldots z^m$). Bond markets will become integrated as bonds of each country can now be sold to other countries citizens, which was not possible or desirable before Monetary Union. The rationale is that eliminating the exchange rate risk and disregarding default risk makes government bonds of the *m* participating countries perfect substitutes. There is only one common interest rate level in the union.

In the Monetary Union equations (9)-(11) now have to be rewritten as follows.

(20) $$r_t = \theta + \frac{\theta n}{\sum_{j=1}^{m} C^j} \sum_{j=1}^{m} B_t^j$$

(21) $$\sum_{j=1}^{m} \dot{B}_t^j = (r_t - n - \beta)\sum_{j=1}^{m} B_t^j + \sum_{j=1}^{m} z^j$$

(22) $$\sum_{j=1}^{m} Y^j = \sum_{j=1}^{m} C^j$$

Furthermore the steady state value for all Monetary Union countries debt is given in (23).

(23) $$\sum_{j=1}^{m} B_t^j = \frac{\sum_{j=1}^{m} z^j}{\beta + n - r_t}$$

As all *m* countries are perfectly symmetric and all governments will eventually chose the same *z* in equilibrium, we know that (24) holds.

(24) $$\sum_{j=1}^{m} C^j = mC^i; \quad \sum_{j=1}^{m} B^j = mB^i; \quad \sum_{j=1}^{m} z^j = mz^i$$

Inserting (24) in the model (20)-(22) and solving for the common interest rate, *r*, results in the very same equilibrium locus as give in equation (18) and depicted in Figure 9.

Also the indifference curves in Figure 9 apply for each country with or without Monetary Union in the very same way. This is so because we keep institutional incentives as summarised by α constant across regimes. Doing so allows us to highlight the effect of an integrated bond market without any provisions to simultaneously enhance fiscal discipline.

However, the function $r_t(z)$ depicted in Figure 9 changes in Monetary Union, once one assumes that governments take the fiscal policies of the other countries as given. Solving the model (20)-(22) gives the following result for *r*:

$$(25) \qquad r_t = \frac{\beta+n+\theta}{2} - \sqrt{\frac{(\beta+n+\theta)^2}{4} - \theta(\beta+n) - \frac{\theta n}{\sum_{j=1}^{m} C^j}\left[z^i + \sum_{\substack{j=1\\ j\neq i}}^{m} z^j\right]}$$

where the slope in *r/z* space is given by (26).

$$(26) \qquad \frac{dr_t}{dz^i} = \frac{\theta n}{2\sum_{j=1}^{m} C^j \sqrt{\frac{(\beta+n+\theta)^2}{4} - \theta(\beta+n) - \frac{\theta n}{\sum_{j=1}^{m} C^j}\sum_{j=1}^{m} z^j}}$$

Again we see that the slope is positive, but comparing (26) with (19) one realises that the slope of $r_t(z)$ in Monetary Union is smaller in equilibrium for all z^i, as $\sum_{j=1}^{m} C^j > C^i$ and $\frac{\theta n}{\sum_{j=1}^{m} C^j}\sum_{j=1}^{m} z^j = \frac{\theta n}{C^i} z^i$.

The flatter schedule is represented by the dotted curves in Figure 9, for different assumptions with regard to the other countries transfer policies ($\sum z^j$ for all $j \neq i$). The lowest one, passing through point A, is drawn for the case the government of country *i* expects all other countries to leave their transfers unchanged at their autarky levels. Under this assumption country *i*'s government could hope to reach point B by increasing their transfers significantly, which would result in higher utility as *U(4) > U(3).*The reason why the government could benefit from being more expansionary is that the country could possibly draw on savings of the whole union to finance its transfers. This would dampen the increase in interest rates and allow for higher domestic consumption. In our simple model, the government would expect foreign consumers to give up part of their present consumption to buy part of country *i*'s debt. In B country *i* would be expecting to run a current account deficit vis á vis the other union members.

Eventually, B will not be an equilibrium as each government will face the same incentives and countries are perfectly symmetric. The interest rate is determined as a function of *z* under symmetric behaviour on the $r_t(z)$ schedule as given in equation (18). In terms of Figure 9, point C would be the equilibrium if all governments would expand as much as country *i* did under the unrealistic assumption that the others would not change their transfer policy in the Monetary Union. But C is not the equilibrium either, as each single government could improve its situation by unilaterally reducing transfers, taking the other's expansionary policies as given (moving down the dotted line passing through C) and because in C each government's assumption about the other governments' actions would turn out to be wrong. The Nash equilibrium is depicted in point D, at which no government can improve its position, given the other countries' fiscal policies in equilibrium. Only in D expectations concerning other countries' fiscal policies are validated.

To show that point D is associated with a larger z^i and thus higher *r* than in point A it is sufficient to have concave indifference curves (see (17) and a flatter $r_t(z)$ schedule in EMU than in the Pre-MU period at the equilibrium (or symmetry-) locus (compare (19) and (26)).

Thus we have for $r_t(z)$ on the equilibrium schedule (18):

(27) $$\left.\frac{dr_t}{dz^i}\right|\left(z^j = z^i\right)\forall j \quad > \quad \left.\frac{dr_t}{dz^i}\right|\left(z^j = \bar{z}^i\right)\forall j \neq i$$ where $\bar{z}^i$ stands for a constant *z* equal to z^i, corresponding to the respective locus on the equilibrium schedule (18).

More formally the new equilibrium D can be characterised by the slope equality of (26) and (16) evaluated at the equilibrium schedule (18).

(28) $$\frac{\alpha}{2(1-\alpha)r} = \frac{\theta n}{2mC^i\sqrt{\frac{(\beta+n+\theta)^2}{4} - \theta(\beta+n) - \frac{\theta n}{C^i}z^i}}$$

Using (18) to replace the square root in (28) one obtains the optimal steady state interest rate in Monetary Union given by (29).

(29) $$r^{opt,MU} = \frac{\alpha \ m \ C^i(\theta+\beta+n)}{2 \ [(1-\alpha) \ \theta \ n + \alpha \ m \ C^i]}$$

Note that if *m* equals 1 (the no Monetary Union case), the optimal interest rate is obviously the same as shown in (14). Equation (30) reveals that *dr/dm* is positive. A higher interest rate is, of course, associated with a policy providing higher transfers *z* according to equations (18) or (25).

$$(30) \qquad \frac{dr^{opt,MU}}{dm} = \frac{\alpha \quad (1-\alpha)C^{i}\theta \quad n \quad (\beta+n+\theta)}{2 \left[(1-\alpha)\theta \quad n+\alpha \quad mC^{i}\right]^{2}} > 0$$

Thus the larger the Monetary Union, the more important will be the need for institutions to safeguard fiscal discipline. If *m* approaches infinity, which means that governments will not expect any interest rate effect whatever their transfer policy, (29) shows that $r^{opt,\,MU}$ tends to $(\beta+\theta+n)/2$, which in Figure 7 is associated with the largest possible transfer policy at z^{max} as depicted by point C. One can obtain the required change in the institutional setting also by calibrating again the optimal weight α^{*MU}, which would allow maximisation of the government preference function to lead to $r=\theta$.

$$(31) \qquad \alpha^{*\,EMU} = \frac{2\theta^{2}n}{2\theta^{2}n+mC(\beta+n-\theta)}$$

Comparing (15) with (31) shows that $\alpha^{*Pre\text{-}MU} > \alpha^{*MU}$ for $m > 1$. Thus to maintain the same level of intergenerational equity in a Monetary Union, institutions have to be adjusted so that governments have less incentives to favour current generations.

We have shown that the common pool problem creates – or exacerbates – an intergenerational, political economy deficit bias in a Monetary Union. In our simple model the bias becomes visible through the difference $r^{MU} - \theta > 0$ triggered by the increased transfer to current generations as $z^{MU} > 0$ when no deficit bias was present initially. But more generally, any pre-existing national bias would get worse as a result of the common pool problem as becomes clear from equations (29) and (30). We have thus exposed a rationale for an enhanced need for fiscal discipline in a Monetary Union.

Our argument could possibly be strengthened further in an extended model with capital accumulation. Then, as a result of initially higher aggregate per capita consumption following the fiscal expansion, steady state capital would be significantly lower when governments draw on a common pool of savings, creating an additional channel for intergenerational redistribution. As a result, in the absence of a strong mechanism providing incentives for fiscal discipline, potential output and, in a model with endogenous growth, steady state real growth would be lower in Monetary Union.

5. Conclusions

There are many different views in the literature on the role of fiscal policies in a monetary union. Those who emphasize the need for discipline rely mainly on three sets of different arguments. The first view is based on the link between the sustainability of fiscal positions and the credibility of the commitment of monetary policy to maintain price stability. The idea is that unsustainable debt accumulation in a Member State could put pressure on the central bank to erode the real value of debt through inflation. The second view stresses possible systemic implications from the default of a sovereign borrower. Given a threat of contagion and systemic risk, other governments would be tempted to bail out a heavily indebted country. Sometimes the first mechanism is labeled "ex ante" bail out and, analogously the second is labeled "ex post" bail out. The third type of argument relies on a "deficit bias" in national public finances, which is exacerbated by spillovers operating in a Monetary Union driving up real interest rates as a result.

The argument in our paper belongs to the latter category where the spillover derives from the temptation, for national governments, to exploit the enlarged common pool of savings in Monetary Union at the expense of future generations. Most existing theoretical analysis has focused on the need for fiscal constraints in order to underpin the sustainability of long-term public finances. In our model sustainability is not an issue, but instead the question of the intergenerational distribution of resources provides a rationale for fiscal discipline. The case for discipline is enhanced in Monetary Union due to spillovers from national fiscal policies on the common interest rate in an integrated bond market. In other words, the marginal effect of any individual country's increase in public debt on debt financing costs falls, when a country can draw on a larger common pool of savings in Monetary Union. In equilibrium this spillover encourages free-riding behavior by all governments leading to higher interest rates and intergenerational redistribution at the expense of posterity.

We recognize that some features of our model – e.g. the assumption of perfect bond market integration and the use of a real model with no role for money or monetary policy – obviously leave out some important issues. At the same time, in our view this simple story has two main attractive features relative to alternative modeling approaches offered in the literature. First, the case for fiscal discipline in our model does not rely on the motive to prevent any of the two types of bail out, which would imply a lack of credibility of existing Treaty provisions (i.e. the primary objective of price stability, no monetary financing and the so-called no bail out clause). Second, our case for fiscal discipline need not rely on unsustainable developments in public finances and thus on extreme and relatively unlikely events, which are hard to reconcile with models assuming forward-looking agents and rational expectations. Instead in our model, the relevant spillover effects in perfectly integrated bond markets operate at all times. The intertemporal budget policy considered is sustainable and therefore compatible with equilibrium under perfect foresight on the part of the private sector.

We have motivated the relevance of our model for Monetary Union (but not the global level) by pointing to the evidence that monetary unification has been empirically associated with sovereign debt market integration. The degree of integration inside the Union is an order of magnitude deeper than in the global economy. This suggests that the need for fiscal discipline to safeguard intergenerational equity inside Monetary Union is much stronger than at the global level. Obviously, any effort to increase fiscal discipline based on this argument would at the same time also promote prospects for the sustainability of public finances. It would also help counteract any tendency to run-up higher debt as a consequence of the fall of borrowing costs associated with interest rate convergence to lower levels in the transition to Monetary Union and access to a larger, deeper pool of capital.

We conclude with a few remarks on possible extensions of our model and avenues for further research. First, it would be possible, though cumbersome, to explicitly introduce capital into the model. In this case, as already emphasized, any increase in the equilibrium interest rate would lead to a lower per capita capital stock and possibly growth and lower welfare in steady state. Second, our model compares the autarky (closed economy) case and Monetary Union while possible additional affects from the global economy are not taken into account. This seems justified as a first approximation on the basis of the different scale of bond market integration observed, but could be explored further both theoretically and empirically. Third, we assume symmetric, identical countries. Instead, one could explore differences in government (intergenerational) preferences or country size. All else equal, the spillover effects in our model would suggest that large countries (with proportionally larger effects on the common interest rate) would be relatively more disciplined compared to smaller Member States. Furthermore, in the presence of rules to safeguard fiscal discipline, the model suggests that smaller countries would be particularly interested in the larger countries' compliance with these rules. These suggestions of course do not take into account political economy type considerations such as the degree of ex-post bargaining power with respect to the enforcement of rules, which could also be related to country size.

This brings us to our final concluding remark: our model forcefully restates the case for fiscal discipline in Monetary Union, based on intergenerational equity considerations. However, it is silent on how fiscal discipline might be best achieved. This is a question of mechanism design and the operation of budgetary rules and institutions and beyond the scope of this paper.

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Annex

In the following we show that the lifetime utility of generations living in the old steady state without transfers is higher than the lifetime utility of generations born in the new steady state with the bond financed transfer system in place.
The lifetime utility of generations living in a regime with no fiscal transfers and thus no debt and taxes is given in (A1)

$$\text{(A1)} \qquad \int_{s=t}^{\infty} \ln(c_s[x])\, e^{-\theta(s-t)} ds \quad = \quad \int_{s=t}^{\infty} \ln(Y)\, e^{-\theta(s-t)} ds \quad = \quad \frac{\ln(Y)}{\theta}$$

The lifetime utility of generations born in the new steady state with $z>0$ is depicted in (A2). Note that starting from the consumption at birth, consumption permanently increases at the rate r-θ. The interest rate r is the constant equilibrium interest rate in the new steady state.

$$\text{(A2)} \quad \int_{s=t}^{\infty} \ln\left(\frac{\theta}{r}\left(y - \frac{(r-n)z}{\beta+n-r}\right) e^{(r-\theta)(s-t)}\right) e^{-\theta(s-t)} ds$$

or equivalently

$$\text{(A3)} \quad \int_{s=t}^{\infty} \ln\left(\frac{\theta}{r}\left(y-\frac{(r-n)z}{\beta+n-r}\right)\right) e^{-\theta(s-t)} ds \quad + \quad \int_{s=t}^{\infty} (r-\theta)(s-t)\, e^{-\theta(s-t)} ds$$

Using integration by parts for the second integral in (A3) leads to

$$\text{(A4)} \quad \frac{1}{\theta}\left[\ln\left(Y-\frac{(r-n)z}{\beta+n-r}\right) \quad + \quad \frac{r-\theta}{\theta} \quad - \quad \ln\left(\frac{r}{\theta}\right)\right]$$

Note that for the case where *z=0* and thus $r=\theta$ (A4) equals (A1). The third term in square brackets can be written as $\ln\left(1+\frac{r-\theta}{\theta}\right)$, which for small values of *(r-θ)/θ* can be approximated by *(r-θ)/θ.* The second and third term in square brackets thus cancel. (A4) is can then simply be written as (A5).

$$\text{(A5)} \quad \frac{1}{\theta}\ln\left(Y-\frac{(r-n)z}{\beta+n-r}\right)$$

Comparing (A5), i.e. the lifetime utility of a generation born in the steady state of a fiscal regime with *z>0*, with (A1), i.e. the lifetime utility of a generation living in a regime where *z=0*, reveals that (A5) is smaller than (A1) as long as we are in a dynamically efficient economy where *r>n*. Obviously, if the interest rate *r* would be smaller than the population growth rate *n*, government debt would not constitute a burden for future generations, and transfers would be beneficial for all generations. But dynamic inefficiency is excluded due to the assumption θ>*n* and the result that *r>*θ when *z>0.*

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