Implications of the new public debt rule in the 'Fiscal Compact' for the Economic and Monetary Union

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Abstract :
   This paper proposes a simple modeling of the dynamic evolution of the interest rate, budgetary deficit and public debt of a member country of a monetary union. We combine a macroeconomic modeling of the evolution of a country's indebtedness with the behavior of a representative investor who has the choice between bonds from this country a benchmark bond. In this framework, we can analyze the consequences of the most recent measures included in the European Treaties, requiring the reduction of the public debt at a 'satisfactory pace': its distance with respect to the reference value must decrease at a rate of the order of one-twentieth per year. Then, we show that such a measure is fully reachable for Luxembourg, Finland, Germany, Austria or the Netherlands. However, the public debt target of 60% of GDP would necessitate sizeable fiscal consolidation efforts for Ireland, France and Belgium. Moreover, such a target would not even be stable for Italy, Portugal or Spain; and the Greek situation is explosive. Therefore, the European criteria appear as quite ambitious for some member countries of the Economic and Monetary Union.

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I. Introduction

Before the economic and financial crisis in 2008 and the sovereign debt crisis affecting the European countries since 2010, the debt criterion of the 'Treaty on the Functioning of the European Union' has concretely not been much taken into account by the political deciders. Indeed, in 1993, the Maastricht Treaty called for a public debt smaller than 60% of GDP of the Economic and Monetary Union (EMU) member countries. However, since the creation of the EMU, the Stability and Growth Pact (SGP) mainly keeps an eye on the budgetary deficits (which have to be smaller than 3% of GDP) of the member countries, with only a much more distant consideration for the debt levels. Nevertheless, the current economic situation has widely shown to economic analysts and to political deciders that public debt levels in Europe have a fundamental importance. Indeed, indebtedness levels have today become excessive and much higher than the threshold of the Maastricht Treaty in most European countries, which has finally implied the current sovereign public debts crisis in Europe. Therefore, on 29 September 2010, the European Commission proposed a revision of the Stability and Growth Pact, a set of six legislative proposals aiming at strengthening the European economic governance [see for example: Tamborini (2011)].

The 3% of GDP limit for budgetary deficits, the medium term objective of budgetary positions in balance, and the constraint for countries running a structural deficit to cut it by at least 0.5% of GDP per year are maintained. But the so-called 'Six Pack' has introduced a new set of rules for economic and fiscal surveillance in Europe, which are the following.

1) Countries will face sanctions if public spending increases more rapidly than GDP, unless this is compensated by a rise in taxation or if the country runs a budgetary surplus. Indeed, for each Member State, the preventive arm of the SGP estimates a medium-term budgetary objective (MTO) likely to ensure public finance sustainability. The new thing with the 'Six Pack' is then to define also an 'expenditure benchmark' in conformity with these MTOs, putting a ceiling on the annual growth of public expenditure in a given country according to its medium-term growth rate.

2) Countries in situation of excessive deficit will face sanctions if they do not cut their structural deficit by 0.5% per year. The Commission can even sanction a country not fulfilling the forecast path for deficit reduction.

3) Countries running a higher than 60% of GDP public debt ratio will be under an Excessive Deficit Procedure (EDP) if this debt ratio does not fall by 1/20th per year of the gap between the effective debt and the 60% reference value (on average over 3 years). Nevertheless, given that most Member States are today in EDP in the European Union, and therefore have to comply with agreed fiscal consolidation paths, a transitional period is foreseen in the amended legislation to ensure no abrupt change in these agreed paths. Accordingly, each Member State in EDP is granted a three-year period following the correction of the excessive deficit for meeting the debt rule. Nevertheless, during this transitional period, the Commission will verify that the progress towards compliance with the debt benchmark is sufficient.

4) Guilty countries (countries with too rapid rises in public spending, countries not cutting their structural deficit, or not complying with the measures associated with an EDP) will have to make a deposit of between 0.2% and 0.5% of GDP, which will possibly be converted into a fine if requested measures are not implemented.

5) Countries are supposed to introduce European rules in their fiscal frameworks (the 3% and 60% limits, the medium-term target of budgetary positions in balance), and to implement a surveillance of these rules by an 'independent budgetary institution'. Each country should include preferably in its national constitution a rule limiting the structural budgetary deficit to 0.5% of GDP and providing a mechanism for automatic correction, if the

ceiling is breached. The EU Court of Justice will verify that the rule complies with European rules.

6) Countries will need a qualified majority at the European Council to oppose sanctions for countries breaching the 3% ceiling or not complying with instructions given by the Commission, this being expected to ensure the automaticity of sanctions ('reverse qualified majority voting').

Therefore, the corrective part of the SGP has been strongly reinforced. Countries should submit each year a Stability and Convergence Program (SCP), and reduce their budgetary deficits according to a schedule proposed by the Commission. Countries under an EDP should submit their budgets and structural reform programs to the Commission and to the European Council, which will give their advice and monitor budget implementation. Besides, countries whose indebtedness levels exceed 60% of GDP are supposed to take commitments to make it converge towards a defined target. Specifically, a debt-to-GDP ratio above 60% is to be considered sufficiently diminishing if its distance with respect to this reference value has reduced over the previous three years at a rate of the order of one-twentieth per year. Therefore, indebtedness levels are now much more controlled and scrutinized in Europe. The new legislative package was finally approved by the Council and the European Parliament in November 2011 and entered into force on 13 December 2011. It is the fiscal part of a new 'Treaty on Stability, Coordination and Governance (TSCG)', called the 'Fiscal Compact', signed by 25 EU member countries on 2 March 2012. It is entered into force on 1st January 2013, after ratification by 12 Euro Area countries.

The numerous summits since 2010 intended to solve the European public debt crisis perfectly show that long term debt considerations are in fact much more important than budgetary deficits, and must be given a stronger weight in European rules. Furthermore, in order to avoid the recent speculative attacks against the public debts of some European countries, a stronger European institutional framework seems necessary. So, in order to contribute to this debate, the rest of the paper is organized as follows.

The second section mentions the traditional justification of budgetary and fiscal rules in a monetary Union like the EMU, where the width of fiscal externalities prevents interest rates on financial markets from efficiently disciplining the governments. Indeed, there are many econometrical studies on the link between budgetary policy and long term interest rates, whereas theoretical analyses regarding this link (like the one conducted in this paper) are much less numerous. More particularly, in this paper, we concentrate on the analysis of the new European rule requiring the decrease in the public debt ratio at a rate of one twentieth per year. The third section presents a simple macroeconomic modeling of the dynamic evolution of the public debt of a member country of a monetary union. The fourth section defines the optimal budgetary balance necessary to make the public debt decrease according to a predefined pace. Afterwards, the fifth section studies the sustainability of the new public debt rule for various EMU member countries. Finally, the sixth section concludes on the feasibility of this new rule for the EMU member countries.

II. Fiscal externalities in a monetary union

We could expect that financial markets are efficient enough to regulate by themselves the budgetary policies of the member countries of a monetary union. In these conditions, a country with a too lax fiscal policy would have to bear higher interest rates and a higher cost for the refund of its public debt, which would incite this country to conduct a more virtuous budgetary policy. Nevertheless, Lane (1993) mentions that an effective market discipline requires that capital markets be open, that information on the borrower's existing liabilities be

readily available, that no bailout be anticipated, and that the borrower responds to market signals. Regarding these conditions, financial markets are not perfect in Europe: in particular, the no-bailout clause of a member country with huge budgetary and indebtedness difficulties is simply not credible. The current sovereign debt crisis has proven that letting a member country of the EMU defaulting is a solution which, in fact, all other member countries will try to avoid. Therefore, there are large externalities and interdependences between the public debts of the member countries of a monetary union, which reduce the power of financial markets to discipline efficiently the fiscal policies of these countries' governments.

In a monetary union, one can rightfully expect the bailout of a country by other member countries [see for example: Demertzis and Viegi (2011) or Landon and Smith (2007)]. In the event of a too lax and unsustainable fiscal policy in one member country, the risk premium to pay and the yields on public bonds will then increase in all member countries of the monetary union, and not only in the faulting country. For example, in the framework of an overlapping generations model, Demertzis and Viegi (2011) show that a bailout is the optimal response to a fiscal crisis when the monetary union is very integrated and when the departure from the Ricardian equivalence is significant (i.e if the population growth rate is sufficiently high). Thus, the authors show that the *no-bailout* clause is not credible *ex ante*, as the cost of a bailout would be too high for the viability of the whole monetary union. This is especially the case in the framework of large entities in the monetary union, which can strongly influence the results of their partners. Indeed, a big country can more easily use strategically the harmful consequences of its default risk to force a fiscal bailout from other member states.

Another transmission mechanism of public debt externalities in a monetary union is the monetization of the public debt. Indeed, an increase in the public indebtedness of a member country can incite the common central bank to conduct a more accommodative monetary policy and to increase the global inflation rate, in order to reduce the weight of the public indebtedness [see: Landon and Smith (2007)]. This would then increase the yields on public debts of all member countries in the monetary union. Therefore, the large fiscal externalities existing in a monetary union would justify the monetary independence of the common central bank and the imposition of strong rules of virtuous budgetary behavior to the member countries. Indeed, the rationale of the creation of the Stability and Growth Pact was the following. In a monetary union, the disappearance of exchange rate differentials should imply a convergence of interest rate differentials among the member countries. Indeed, spreads on government bonds yields strongly narrowed between 1997 and 2007 among EMU member countries. Besides, the creation of the EMU should facilitate the access of member countries to the international financial markets in order to finance their public debts. Fiscal rules should thus compensate for the expected tendency to more fiscal laxity in a monetary union, as the costs of a lesser national fiscal discipline are shared among member countries. Nevertheless, what is the width of these fiscal externalities in a monetary union?

There are many econometrical analyses which study the link between budgetary policy and long-term interest rates in a national framework; in particular, the United States has been widely studied. Apart from the American framework, Landon and Smith (2007), for example, analyze empirically the debt spillovers in a federal country, Canada, during the period 1983-2005. Studying the provincial government bonds yields, they find that a one percentage point increase in the central government's debt to GDP ratio raises the yield on provincial government bonds by 4.2 basis points (mainly due to a higher expected depreciation, but also to a greater risk of default). Indeed, this federal debt can induce an inflationary monetary policy from the common central bank, and the federal government is then also in a weaker position to provide transfers or to bailout a province in financial difficulties. On the contrary,

aggregate provincial government debt accumulation would not have a statistically significant effect on the yields of bonds issued by individual provinces.

Ardagna *et al.* (2004) study 16 OECD countries between 1960 and 2002. They find that a one percentage point increase in the primary deficit-to-GDP ratio would lead to a 10-basis-point rise in the nominal interest rate on 10-year government bonds, and even to a cumulative increase of almost 150 basis points after 10 years in a dynamic framework. Regarding the implications of changes in the stock of public debt, they underline a non-linear effect: only for countries with above-average public debt levels does an increase in this public debt positively affect the interest rate. The authors also find that a worsening of public finances abroad increases national interest rates, even if the influence of the domestic fiscal policy remains much more important and matters beyond its effect on average and global fiscal variables (the financial integration is not perfect). In the same way, for nine OECD countries over the period 1977-1997, Ford and Laxton (1999) find that OECD-wide variables (net debt to nominal GDP, real government consumption plus investment to real GDP and variation in this real government absorption ratio) explain a large proportion of the variance in national *ex post* real interest rates.

In fact, Frémont *et al.* (2000) underline that, the government bonds interest rates have strongly converged after the creation of the EMU. However, in 2000, the authors already anticipated that divergences could still occur after monetary unification, even without exchange risk premiums. More precisely, persistent interest rate differentials in the EMU could reflect differences in credit risk (indebtedness levels and degrees of solvability) of the member countries. Indeed, the federal examples of Canada, Switzerland and Australia show that, sub-national governments without monetary creation power always pay a risk premium representing between about 100 and 200 basis points on the issuing of their public debt in comparison with the interest rates on federal bonds with the same maturity.

As regards the fundamental question of fiscal externalities in a monetary union, empirical studies in the European context are today, unfortunately, very seldom, in particular because the short existence of the EMU implies a lack of long term data. However, it would be very important to know whether the budgetary policy in a given country mainly affects its own long-term interest rates, or whether it has also consequences on the yields of its partners. Do national fiscal policies affect mainly country spreads, or do they have a substantial effect on the average level of Euro area interest rates? In economic studies, there is a recent interest for debt spillovers in a monetary union: what are the consequences of the fiscal policy and of the indebtedness level of a member country, on the interest rates of the bonds issued by its partners? There are many empirical analyses which study the impact of the rise in national debt on the increase in interest rates on national bonds yields. However, studies of cross countries externalities, of the effect of one government debt on another government borrowing costs, are much less numerous. Nevertheless, this interrogation is absolutely fundamental for the European institutional framework, as strong and binding rules of fiscal discipline are usually justify by the width of fiscal externalities and interdependences in a monetary union as the EMU.

On the one hand, some studies underline the persistent dominance of national budgetary factors on long-term interest rates of the member countries of a monetary union. For example, Schiavo (2008) studies two historical episodes of large fiscal shocks, namely the German reunification in 1990 and the crisis of the Italian Lira in 1992. In these circumstances, he doesn't find a strong evidence that the fiscal situation of a given member country in a monetary union had consequences on the interest rate borne by other member states. In the same way, studying the period from 1980 to 2004, he doesn't find evidence that the fiscal situation of a country impacted the differential in interest rates with the other member

countries, before as well as after the creation of the EMU. The fiscal position of the euro area as a whole doesn't seem to affect bond yields in the various member States. Besides, the econometrical analysis by Chinn and Frankel (2003) shows that between 1973 and 2003, real interest rates in Europe (Germany, France, Spain and Italy) responded strongly to variations in foreign real interest rates in the United-States. Moreover, real interest rates on government debt depended significantly upon current and expected (changes of) national debt levels, in Europe as in the U.S. But the available data at the time of their study doesn't allow the authors to put light on the influence of the foreign indebtedness on national long term interest rates in the new framework of the EMU.

On the other hand, many studies shed light on the fiscal interdependences and externalities in a monetary union. For example, De Santis and Gerard (2006) show the strongest integration in the equity and the government bonds markets among the member countries of the EMU during the period 1997-2001. Bolton and Jeanne (2011) also underline the risks of contagion through the cross detention of government bonds by the banks of a financially integrated monetary zone. The authors assume that in Europe, the large credit exposures of banks and of institutional investors to their own government or to other EMU member countries could endanger the stability of the financial system. A default on the sovereign public debt of a member country could thus have harmful consequences on the banking sector, and then on the private output and on consumption in the partner countries. Indeed, as foreign debt is used as collateral in lending between national banks, a sovereign debt crisis can be spread between member countries. In this framework, according to Favero and Missale (2011) the creation of Eurobonds could have the advantage to reduce the exposure to a default of payment and to a debt crisis in the most indebted member countries. Therefore, the risks of contagion and of propagation of a debt crisis (for example, because of higher interest rates and of a higher defiance of investors towards all the monetary union, or because of cross-detention of assets by national banks of the member countries) could be reduced, even for the safer countries of the monetary union.

Indeed, exchange rate risks or differences in the tax treatment of bond yields have canceled in the framework of the EMU. Which factors could then imply differences in long term interest rates among EMU member countries? Codogno et al. (2003) provide evidence that yield differentials on Euro area government bonds in 2002 are not due to liquidity factors, but are mostly due to credit risk-related domestic and international factors. Therefore, in a monetary union as the EMU, this persistent sensitivity of yield differentials to credit-related factors (in particular, to debt to GDP ratios) provides a justification for fiscal discipline and for more budgetary convergence. Favero and Missale (2011) also find that default risk is today the main driver of yield spreads in Europe, the liquidity premium being already small thanks to the sufficient integration of financial markets. Furthermore, according to the authors, during the period 2005-2011, fiscal fundamentals matter in the pricing of the default risk premium, but only as they interact with the global risk that markets perceive, which strongly depends on contagion driven by shifts in markets sentiments.

Furthermore, Bernoth et al. (2004) study yield spreads of government bonds issued by European countries versus Germany or the United-States between 1991 and 2002. They show that these differentials are affected by international risk factors and reflect in particular positive default risk premiums. These premiums would increase with the debt, deficit and debt-service ratios. However, the authors also show that EMU membership reduces the effect of own-country debt accumulation on interest rates, probably because financial markets anticipate a fiscal support for EMU countries in financial distress. Besides, Chinn and Frankel (2007) find that real interest rates paid on government debt depend significantly upon current and expected future debt levels, in Europe as in the U.S., for the period 1988-2004. However, this result only emerges when they condition on foreign interest rates, illustrating financial

international integration. Furthermore, while U.S. interest rates appear important for determining European rates, the reverse is not true, suggesting that the United-States still dominates world capital markets; this asymmetry would not have disappeared with the creation of the EMU.

Caporale and Girardi (2001) analyze, thanks to a dynamic multi-country global VAR model over the period 1999-2010, the dynamic effects of fiscal imbalances in a given EMU member state on the borrowing costs for other member countries. Then, even if financial markets seem to be able to discriminate among various issuers, they find that euro-denominated government bonds yields are strongly linked with each other (except in the case of Greece). Faini (2006) also finds that for the first EMU member countries, on the period 1979-2002, the impact of an expansionary fiscal policy in one country is not seen much in the level of its spreads, but has a definite and more substantial impact on the aggregate level of interest rates. He also shows that the debt stock plays no role at the country level, but once again is quite significant for EMU as a whole. Therefore, fiscal spillovers would be non negligible in an integrated monetary area such as the European Economic and Monetary Union. In the same way, Clays *et al.* (2008) use a spatial panel data model for 16 OECD countries on the period 1990-2005. They find that the increase in national interest rates due to a fiscal expansion is significant, but is reduced by spillover effects across borders. In particular, these spillovers would be important in periods of major crises or in periods of coordinated policy actions; they would also be much stronger among EU countries with wide commercial links, with a great financial and economic integration.

As mentioned by Tamborini (2011), in the framework of the EMU, member countries are strongly interdependent: there are strong fiscal and budgetary externalities between them. However, these countries are still strongly structurally heterogeneous: divergences in initial indebtedness levels and in growth rates are striking between them. Nevertheless, no system of transfers and redistribution is institutionalized to cope with these divergences. Therefore, De Grauwe (2010) underlines that the problem of the current sovereign debt crisis in Europe is due to the existence of a monetary unification which is not accompanied by a political union, in comparison with the situation in the United-States for example. This explains why public debt management is particularly difficult in the EMU. In this framework, the aim of this paper is to analyze the consequences of a binding rule regarding public indebtedness, like the one mentioned in the 'Fiscal Compact' (see Introduction), to cope with the current sovereign debt crisis and the difficulties encountered by the European Union.

III. The model

Let's suppose a monetary union made of (k+1) member countries. We analyze the situation of one member country (i), in comparison with the situation of the (k) other partner member countries. We will express the dynamic evolution of the public debt in this country (i), according to the behavior of a representative investor maximizing his utility.

1. Dynamic evolution of the public debt

In the country (i), the dynamic evolution of the nominal public debt is the following:
$$D_{i,t} = Def_{i,t} + (1 + i_{i,t})D_{i,t-1} \quad (1)$$
With: $(GDP_{i,t})$: Nominal Gross Domestic Product of the country (i) in period (t)

$(Def_{i,t})$: Budgetary deficit of the country (i) in period (t); $def_{i,t}=Def_{i,t}/GDP_{i,t}$

$(D_{i,t})$: Public debt of the country (i) in period (t); $d_{i,t}=D_{i,t}/GDP_{i,t}$

$(n_{i,t})$: GDP nominal growth rate in the country (i) in period (t)

$(i_{i,t})$: nominal interest rate on the public debt of the country (i) in period (t).

We suppose that the nominal interest rate $(i_{i,t})$ on the public debt of the country (i) has a variance: $V(i_{i,t})=\sigma_i^2$, depending on the credit risk of the country (i), on its probability of default, and on the amount liable to be refund by the country (i) in case of default. Furthermore, as common macroeconomic factors define the credit risk of the member countries of a monetary union, the interest rates on bonds issued by the country (i) and by the partner countries (k) have the following covariance: $cov(i_{i,t}, i_{k,t})=\sigma_{i,k}$.

In this framework, the dynamic evolution of the public debt of the country (i) in percentage of GDP is:

$$d_{i,t} = def_{i,t} + \frac{(1 + i_{i,t})}{(1 + n_{i,t})} d_{i,t-1} \quad (2)$$

Thus, the variation in the public debt level of the country (i) verifies:

$$d_{i,t} - d_{i,t-1} = def_{i,t} + \frac{(i_{i,t} - n_{i,t})}{(1 + n_{i,t})} d_{i,t-1} \quad (3)$$

Therefore, the public debt increases if the country (i) has a budgetary deficit $(def_{i,t}>0)$ and/or if its nominal (real) interest rate is superior to its nominal (real) growth rate $[i_{i,t}>n_{i,t}]$. To achieve a given debt target or to stabilize its public indebtedness, if we suppose that $(n_{i,t})$ and $(i_{i,t})$ are exogenous parameters, its budgetary deficit is the only available variable for the country (i). It must have a budgetary surplus if its interest rate is superior to its growth rate, but it can have a budgetary deficit if its growth rate is higher.

In this framework, if the country (i) contemplates to reduce its public debt in comparison with a targeted level (d_i^*) at a rate of $1/T^{th}$ per year, we have:

$$d_{i,t} - d_{i,t-1} = \frac{(d_i^* - d_{i,t-1})}{T} < 0 \quad (4)$$

Thus, by combining equations (2) and (4), we have:

$$(-def_{i,t}^*) = \frac{(1 + i_{i,t})}{(1 + n_{i,t})} d_{i,t-1} - \frac{(T - 1)}{T} d_{i,t-1} - \frac{1}{T} d_i^* \quad (5)$$

Therefore, a country (i) whose level of indebtedness is excessively high, and whose growth rate is insufficient to allow an automatic decrease in this debt level, must have a budgetary surplus. Moreover, this budgetary surplus should increase with the interest rate $(i_{i,t})$ on the public debt of this country, with its former public debt level $(d_{i,t-1})$, and with the required speed of debt reduction $(1/T)$[1]. On the contrary, this budgetary surplus is a decreasing function of the targeted public debt level (d_i^*) and of the country's nominal growth rate $(n_{i,t})$.

2. The representative investor

Let's now suppose a representative investor in the monetary union maximizing his utility function. This function depends positively on his expected nominal wealth: $E_t(w_{t+1})$, and negatively on the variance of this nominal wealth[2]: $V_t(w_{t+1})$.

$$U_t = E_t(w_{t+1}) - \rho V_t(w_{t+1}) \quad (6) \qquad 0<\rho<1$$

where (w_t) is the nominal wealth in period (t) of the representative investor, and where the parameter (ρ) is an indicator of the risk aversion of this investor. Indeed, the smaller is (ρ), the more the investor is risk-neutral and is only interested in his average expected wealth. On

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[1] More precisely: $\frac{\partial(-def_{i,t}^*)}{\partial(d_{i,t-1})} = \frac{(i_{i,t} - n_{i,t})}{(1 + n_{i,t})} + \frac{1}{T} > 0$ if the interest rate is superior to the growth rate, and $\frac{\partial(-def_{i,t}^*)}{\partial T} = \frac{(d_i^* - d_{i,t-1})}{T^2} < 0$ if the debt level was too high in the former (t-1) period.

[2] We use a standard portfolio model; see for example Bernoth *et al.* (2004) or Tamborini (2011).

the opposite, the higher is (ρ), the more the investor is risk-adverse, and prefers the certainty of gains. The representative investor can allocate his global nominal wealth (W_t) to the detention of bonds from the country (i) or from other countries (k); both are priced in the same currency in a monetary union. Therefore, in proportion of GDP, we have:

$$w_t = \frac{W_t}{GDP_t} = \frac{D_{i,t}}{GDP_t} + \frac{D_{k,t}}{GDP_t} = m_i d_{i,t} + (1 - m_i)d_{k,t} \quad (7)$$

With: $w_t = W_t/GDP_t$: nominal wealth (invested in bonds) of the representative investor in proportion of the global GDP in the monetary union in period (t)

$m_i = GDP_{i,t}/GDP_t$: share of the country (i) in the monetary union[3].

Let's suppose that anticipations are rational and that variables can perfectly be anticipated for the following period (t+1). According to equations (7) and (2), the expected wealth of the investor for the next period (t+1) is then:

$$E_t(w_{t+1}) = m_i E_t(d_{i,t+1}) + (1 - m_i)E_t(d_{k,t+1})$$

$$= m_i def_{i,t+1} + \frac{m_i(1 + i_{i,t+1})}{(1 + n_{i,t+1})}d_{i,t} + (1 - m_i)def_{k,t+1} + \frac{(1 - m_i)(1 + i_{k,t+1})}{(1 + n_{k,t+1})}d_{k,t} \quad (8)$$

The variance of next period's nominal wealth of the investor is therefore:

$$V_t(w_{t+1}) = V_t[\frac{m_i d_{i,t}}{(1 + n_{i,t+1})}(1 + i_{i,t+1}) + \frac{(1 - m_i)d_{k,t}}{(1 + n_{k,t+1})}(1 + i_{k,t+1})]$$

$$= \frac{m_i^2 d_{i,t}^2}{(1 + n_{i,t+1})^2}\sigma_i^2 + \frac{(1 - m_i)^2 d_{k,t}^2}{(1 + n_{k,t+1})^2}\sigma_k^2 + \frac{2m_i(1 - m_i)d_{i,t}d_{k,t}}{(1 + n_{i,t+1})(1 + n_{k,t+1})}\sigma_{i,k} \quad (9)$$

By combining equations (6), (8) and (9), we can then obtain the utility function of the representative investor:

$$U_t = m_i def_{i,t+1} + \frac{m_i(1 + i_{i,t+1})}{(1 + n_{i,t+1})}d_{i,t} + (1 - m_i)def_{k,t+1} + \frac{(1 - m_i)(1 + i_{k,t+1})}{(1 + n_{k,t+1})}d_{k,t}$$

$$- \frac{\rho m_i^2 d_{i,t}^2}{(1 + n_{i,t+1})^2}\sigma_i^2 - \frac{\rho(1 - m_i)^2 d_{k,t}^2}{(1 + n_{k,t+1})^2}\sigma_k^2 - \frac{2\rho m_i(1 - m_i)d_{i,t}d_{k,t}}{(1 + n_{i,t+1})(1 + n_{k,t+1})}\sigma_{i,k} \quad (10)$$

Therefore, we can also deduce the optimal shares of bonds held by the representative investor. Indeed, $\partial U_t/\partial d_{i,t} = \partial U_t/\partial d_{k,t} = 0$ implies:

$$d_{i,t} = \frac{(1 + n_{i,t+1})[(1 + n_{k,t+1})(1 + i_{i,t+1}) - 2\rho\sigma_{i,k}(1 - m_i)d_{k,t}]}{2\rho m_i \sigma_i^2(1 + n_{k,t+1})}$$

$$d_{k,t} = \frac{(1 + n_{k,t+1})[(1 + n_{i,t+1})(1 + i_{k,t+1}) - 2\rho\sigma_{i,k}m_i d_{i,t}]}{2\rho(1 - m_i)\sigma_k^2(1 + n_{i,t+1})} \quad (11)$$

Combining these equations, we have[4]:

$$d_{i,t} = \frac{(1 + n_{i,t+1})[\sigma_k^2(1 + i_{i,t+1}) - \sigma_{i,k}(1 + i_{k,t+1})]}{2\rho m_i(\sigma_i^2\sigma_k^2 - \sigma_{i,k}^2)}$$

$$d_{k,t} = \frac{(1 + n_{k,t+1})[\sigma_i^2(1 + i_{k,t+1}) - \sigma_{i,k}(1 + i_{i,t+1})]}{2\rho(1 - m_i)(\sigma_i^2\sigma_k^2 - \sigma_{i,k}^2)} \quad (12)$$

Thus, let's suppose that the country (i) is more risky ($\sigma_i^2 > \sigma_k^2$) and has a higher future anticipated interest rate ($i_{i,t+1} > i_{k,t+1}$) than its partners. Then, if (ρ) is high, the relative risk

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[3] The analysis by Tamborini (2011) was restricted to the case where two countries in a monetary union have the same size and the same nominal GDP.

[4] We can also mention that: $\sigma_i^2 = cov(i_{i,t}, i_{i,t}) > cov(i_{i,t}, i_{k,t}) = \sigma_{i,k}$; $\sigma_k^2 > \sigma_{i,k}$.

aversion of the investors reduces the detention of bonds from this country (i); on the contrary, if (ρ) is small, the risk-neutrality of the investors increases their detention of more risky bonds from the country (i). Besides, the debt of the country (i) and the detention of bonds issued by this country are an increasing function of the future anticipated yields on these bonds ($i_{i,t+1}$), but they are a decreasing function of their variability (σ_i^2), as well as a decreasing function of the relative higher attractiveness of the yields on foreign bonds ($i_{k,t+1}$)[5]. The debt of the country (i) also increases with the anticipated nominal growth rate of the country ($n_{i,t+1}$), but decreases with the share of this country in the monetary union (m_i).

3. <u>Interest rate spread and stability of the public debt target</u>

In the framework of our model, we can then define the bonds' yield spread between the country (i) and its partners (k) in the monetary union. Indeed, equation (12) implies:

$$i_{i,t+1} = 2\rho\left[\frac{m_i\sigma_i^2 d_{i,t}}{(1+n_{i,t+1})} + \frac{(1-m_i)\sigma_{i,k}d_{k,t}}{(1+n_{k,t+1})}\right] - 1$$

$$i_{k,t+1} = 2\rho\left[\frac{(1-m_i)\sigma_k^2 d_{k,t}}{(1+n_{k,t+1})} + \frac{m_i\sigma_{i,k}d_{i,t}}{(1+n_{i,t+1})}\right] - 1 \quad (13)$$

Therefore, we have:

$$i_{i,t} - i_{k,t} = 2\rho\left[\frac{m_i(\sigma_i^2-\sigma_{i,k})d_{i,t-1}}{(1+n_{i,t})} - \frac{(1-m_i)(\sigma_k^2-\sigma_{i,k})d_{k,t-1}}{(1+n_{k,t})}\right] \quad (14)$$

So, the spread of interest rates increases with the differential in indebtedness levels between the country (i) and its partners: it increases with the level of indebtedness of the country (i) and decreases with the indebtedness of the other countries (k). This spread also increases with the relative share (m_i) of the country (i) in the monetary union. However, it decreases with a higher economic growth in the country (i) in comparison with its partners ($n_{i,t}>n_{k,t}$). Finally, this spread increases with a higher volatility of government bonds yields in the country (i): it increases with the variance of bonds yields in the country (i) (σ_i^2) but decreases with the variance of foreign bonds yields (σ_k^2).

Our theoretical model is thus consistent with Caporale and Girardi (2011)'s result. A higher debt in countries considered as less risky reduces the interest rates in the partner countries because of a 'liquidity effect': there is a larger demand of these risk free assets on the financial markets, and prices of government bonds decrease because of a smaller average and global risk premium on the bonds markets. On the contrary, a higher level of indebtedness in a fiscally weak and risky country leads to a 'fly-to-quality' behavior, to a decrease in demand and to an increase in interest rates for government bonds from this country. Indeed, risk aversion recently led to widening spreads for Greece or Portugal vis-à-vis the core EMU economies, for example, implying higher debt financing costs for these economies with weak macroeconomic fundamentals. As mentioned by Faini (2006), in a monetary union with fiscal externalities, there can be a circularity of the equilibrium, and possible multiple equilibria. Indeed, if interest rates are high, debt charges are high, which increases mechanically the indebtedness, and therefore the risk premium required by the investors. On the contrary, if interest rates are small, debt charges are moderate, which reduces the indebtedness and the risk premium.

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[5] The signs of: $\frac{\partial d_{i,t}}{\partial \sigma_k^2} = \frac{(1+n_{i,t+1})\sigma_{i,k}[\sigma_i^2(1+i_{k,t+1})-\sigma_{i,k}(1+i_{i,t+1})]}{2\rho m_i(\sigma_i^2\sigma_k^2-\sigma_{i,k}^2)^2}$ and

$\frac{\partial d_{i,t}}{\partial \sigma_{i,k}} = \frac{(1+n_{i,t+1})[2\sigma_{i,k}\sigma_k^2(1+i_{i,t+1})-\sigma_{i,k}^2(1+i_{k,t+1})-\sigma_i^2\sigma_k^2(1+i_{k,t+1})]}{2\rho m_i(\sigma_i^2\sigma_k^2-\sigma_{i,k}^2)^2}$ are more ambiguous.

In the framework of our model, we can now define the conditions of stability for the public debt target of the country (i) (d_i*). The stability concerns the fact that in case of a shock, the system is endogenously endowed with counter-cyclical mechanisms, which are able to bring back the economy on its equilibrium path. In case of a small deviation, the economy is then brought back by itself on its long run equilibrium path. So, putting the expression in equation (14) for (i_t) in the public debt equation (2), we obtain:

$$d_{i,t} = (def_{i,t}^*) + \left[1 + i_{k,t} - \frac{2\rho(1-m_i)(\sigma_k^2 - \sigma_{i,k})d_{k,t-1}}{(1+n_{k,t})}\right]\frac{d_{i,t-1}}{(1+n_{i,t})} + \frac{2\rho m_i(\sigma_i^2 - \sigma_{i,k})}{(1+n_{i,t})^2}d_{i,t-1}^2 \quad (15)$$

Therefore, the public debt automatically decreases ($\partial d_{i,t}/\partial d_{i,t-1} < 1$) if and only if:

$$\frac{1+i_{k,t}}{(1+n_{i,t})} - \frac{2\rho(1-m_i)(\sigma_k^2 - \sigma_{i,k})d_{k,t-1}}{(1+n_{k,t})(1+n_{i,t})} + \frac{4\rho m_i(\sigma_i^2 - \sigma_{i,k})}{(1+n_{i,t})^2}d_{i,t-1} < 1 \quad (16)$$

If the public debt target is the same for all member countries of the monetary union (d_i*=d_k*=d*), once it has been attained, this target is thus stable if and only if it verifies:

$$d^* < \frac{(1+n_{i,t})(1+n_{k,t})(n_{i,t} - i_{k,t})}{2\rho[2m_i(\sigma_i^2 - \sigma_{i,k})(1+n_{k,t}) - (1-m_i)(\sigma_k^2 - \sigma_{i,k})(1+n_{i,t})]} \quad (17)$$

If the public debt target (d*) mentioned in (17) is attained by a member country of the monetary union, shocks on the debt level of this country are afterwards self-correcting, without any budgetary surplus (or deficit). On the contrary, if the public debt target is higher than the one mentioned on the right side of equation (17), this target is not stable and fiscal shocks are then not self correcting for a given country (i). This country should then run a budgetary surplus (-$def_{i,t}$) in order to keep its public debt on target [see the following section IV]; otherwise, its indebtedness would be on a divergent path, even if the targeted debt level (d*) had been formerly reached.

In conclusion, the budgetary and fiscal interdependences between the member countries of a monetary union imply strong constraints. The public debt target (d*) is stable for a given country only if it is sufficiently small; the choice of this target is hardly constrained as it mustn't be too high in order to ensure the stability of the indebtedness path. First, according to equation (17), a positive public debt target is stable only for the countries whose growth rate is higher that the interest rate in the partners countries from the monetary union ($n_{i,t} > i_{k,t}$); the higher this differential, the higher the public debt target can be. On the contrary, only a small target is stable for the countries which are big (m_i is high) whereas their fiscal situation is also mostly uncertain and risky (σ_i^2 is high), or if the risk aversion of the investors (ρ) is high. Therefore, the interdependences due to monetary unification might make the way to debt stabilization more difficult for the member countries. However, the situation of the European countries regarding the stability of their indebtedness path is very heterogeneous, as we will see in section V.

IV. Definition of the optimal budgetary balance

1. Necessary budgetary surplus or deficit

We can obtain the necessary budgetary surplus or deficit for the country (i) by putting the national interest rate mentioned in (14) in equation (5). This value is the one necessary to make the public debt tend towards the targeted level (d_i^*) at a rate of 1/T[th] per year.

$$(-def_{i,t}^*) = \frac{2\rho}{(1+n_{i,t})}\left[\frac{m_i(\sigma_i^2 - \sigma_{i,k})d_{i,t-1}}{(1+n_{i,t})} - \frac{(1-m_i)(\sigma_k^2 - \sigma_{i,k})d_{k,t-1}}{(1+n_{k,t})}\right]d_{i,t-1}$$

$$+ \frac{(i_{k,t} - n_{i,t})}{(1 + n_{i,t})} d_{i,t-1} + \frac{1}{T}(d_{i,t-1} - d_i^*) \qquad (18)$$

Therefore, as long as the variance of the interest rate on foreign bonds ($\sigma_k{}^2$) is sufficiently small, the necessary budgetary surplus for the country (i) is an increasing but also a quadratic (and not only a linear) function of its level of public debt ($d_{i,t-1}$). This is due to the dependence of the interest rate on the indebtedness ratio in equation (14). Besides, the required budgetary surplus is an increasing function of the variance of the interest rate on national bonds ($\sigma_i{}^2$) and of the relative size of the country (i) in the monetary union (m_i), but it is a decreasing function of the growth rate of the country (i) ($n_{i,t}$) [6]. It is also an increasing and exponential function of the required speed of debt reduction (1/T) but a decreasing linear function of the targeted indebtedness ratio (d_i^*).

Besides, contrary to the case of a single independent country, in the framework of a monetary union with fiscal interdependences, the necessary budgetary surplus for a given country (i) also depends on foreign variables. It is an increasing function of the foreign interest rate ($i_{k,t}$). Indeed, a higher foreign interest rate, and in particular in the benchmark country, increases interest rates in all the monetary union [see equation (14)], and therefore it accelerates the growth dynamic of the indebtedness level in the country (i). Furthermore, the required budgetary surplus is a decreasing function of the variance of interest rates on foreign bonds ($s_k{}^2$) and of the foreign indebtedness level ($d_{k,t-1}$). Indeed, this reduces the spread of interest rates with the rest of the monetary union in equation (14), and therefore it reduces the cost of the debt service as well as growth in the debt level in the country (i). On the contrary, the necessary budgetary surplus is an increasing function of the foreign growth rate ($n_{k,t}$); nevertheless, the sensitivity is here empirically quite insignificant.

So, there are important implications of our results for the budgetary and fiscal policy of a member country of a monetary union. First, according to the first term in equation (18), if the country (i) is initially much more indebted than its partners in the monetary union ($d_{i,t-1} > d_{k,t-1}$), the spread of interest rates and the cost of its debt service is higher for this country (i), according to equation (14). Therefore, it can be much more difficult for a country to have a sustainable budgetary situation in a fiscally interdependent monetary union than if it were independent. Indeed, the membership in a monetary union whose members have low indebtedness levels implies a supplementary constraint for a country whose debt level is higher. Even if a country has already a quite low level of public debt and if this ratio decreases, it can turn out to be insufficient, and the country can be compelled to run a budgetary surplus only because the indebtedness levels of its partners are lower.

In the same way, as mentioned by Tamborini (2011), "history matters". That is to say, if a country (i) has been in the past more risky ($\sigma_i{}^2 > \sigma_k{}^2$) than its partners, and if the yields on its national bonds have been formerly more uncertain, the first term in equation (18) shows that this increases the current budgetary constraint for the country (i). Indeed, even if this country has afterwards attained the same level of indebtedness as its partners, it can be compelled to pay a higher risk premium, which increases the interest rate spread with its partners in equation (14). Therefore, the country (i) can then be constrained to have a budgetary surplus, whereas the other member countries of the monetary union can afford to have budgetary deficits. Our conclusion is thus consistent with the result by Tamborini (2011), who underlines the interdependences between fiscal policies and debt levels of the member countries of a monetary union. Indeed, the author shows that for countries starting

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6 $\frac{\partial(-def_{i,t}^*)}{\partial n_{i,t}} = -\frac{d_{i,t-1}}{(1+n_{i,t})^2}\left[1 + i_{k,t} + \frac{4\rho m_i(\sigma_i^2 - \sigma_{i,k})d_{i,t-1}}{(1+n_{i,t})} - \frac{2\rho(1-m_i)(\sigma_k^2 - \sigma_{i,k})d_{k,t-1}}{(1+n_{k,t})}\right] < 0$;

$\frac{\partial(-def_{i,t}^*)}{\partial \sigma_{i,k}} = \frac{-2\rho}{(1+n_{i,t})}\left[\frac{m_i d_{i,t-1}}{(1+n_{i,t})} - \frac{(1-m_i)d_{k,t-1}}{(1+n_{k,t})}\right]d_{i,t-1}$ is ambiguous.

with historically higher risk premiums and higher indebtedness levels than their partners, the reduction of their debt levels and their convergence towards a target like 60% of GDP may be a painful way and may take much time. Monetary unification creates interdependences making fiscal stabilization more difficult, as member countries can then no longer choose their budgetary policies without taking into account the economic and fiscal situation of their partners.

Besides, our model also allows us to shed light on a phenomenon which was not mentioned in the paper by Tamborini (2011), where the two member countries of the monetary union had the same size. The first term in equation (18) shows that the necessary budgetary surplus increases with the relative size of the country (i) in the monetary union. Indeed, a bigger country produces stronger fiscal externalities on its partners. Therefore, a big country whose nominal growth rate is insufficient (m_i is high and $n_{i,t} < n_{k,t}$) needs to run a higher budgetary surplus than a smaller country in the monetary union, even if they had the same budgetary and economic situations.

Finally, once the public debt target has been reached, and if this target is the same for all member countries of the monetary union ($d_{i,t-1} = d_{k,t-1} = d^*$), the long term budgetary surplus necessary for the country (i), in order to continue to stick to this public debt target, is the following:

$$\left(-def_{i,t}^{*LT}\right) = \frac{2\rho}{(1+n_{i,t})}\left[\frac{m_i\left(\sigma_i^2 - \sigma_{i,k}\right)}{(1+n_{i,t})} - \frac{(1-m_i)\left(\sigma_k^2 - \sigma_{i,k}\right)}{(1+n_{k,t})}\right]d^{*2} + \frac{(i_{k,t} - n_{i,t})}{(1+n_{i,t})}d^* \quad (19)$$

2. **Factors requiring a budgetary surplus**

In order to estimate the previous equation (18), let's suppose the following calibration. We make the hypothesis that the nominal interest rate is: $i_{k,t}=3\%$ and the indebtedness level: $d_{k,t-1}=80\%$ for the benchmark country of the monetary union, and that nominal growth rates are: $n_{i,t}=n_{k,t}=4\%$ in the monetary union. We also suppose that the public debt target is: $d^*=60\%$, the required speed of its reduction: T=20, and that the risk factors are respectively: $[\rho(1-m_i)(\sigma_k^2 - \sigma_{i,k})]=0.001$ and $[\rho m_i(\sigma_i^2 - \sigma_{i,k})]=0.005$ (a justification for this calibration related to the EMU is provided in the following section V).

Logically, the budgetary surplus necessary to make the public debt decrease at a satisfactory pace is a decreasing function of the growth rate in a given country in comparison with the benchmark interest rate ($n_{i,t}-i_{k,t}$). Nevertheless, our model also shows that these budgetary surpluses should often be very high! Indeed, according to our calibration, countries with very low indebtedness levels ($d_{i,t-1}=20\%$) could get a budgetary deficit. However, as soon as the debt level of a given country is 50% of GDP, its growth rate should verify ($n_{i,t} > i_{k,t}-0.5\%$) in order to allow it to have a budgetary deficit. Indeed, for higher debt levels, Figure 1 shows that the budgetary surpluses of the member countries of the monetary union should theoretically be quite high, if they had not very high growth rates.

This is precisely the framework of the current debates about fiscal consolidation plans in Europe. The reduction in European budgetary deficits mustn't be detrimental to economic growth, as the latter is an important factor allowing a decrease in public debts. As mentioned by Tamborini (2011), there can be a vicious circle between the necessity of a budgetary surplus to stabilize the debt, then the cut in public expenditure and the increase in taxes, the lower economic growth (increasing taxes may be detrimental to households' consumption or to companies' investment), and finally the supplementary increase in the budgetary surplus necessary to stabilize the public debt. Therefore, the cut in public expenditure should, obviously, mainly concern expenditures which are only weakly or which are not productive.

Figure 1: Necessary budgetary surpluses according to the growth rates of the countries
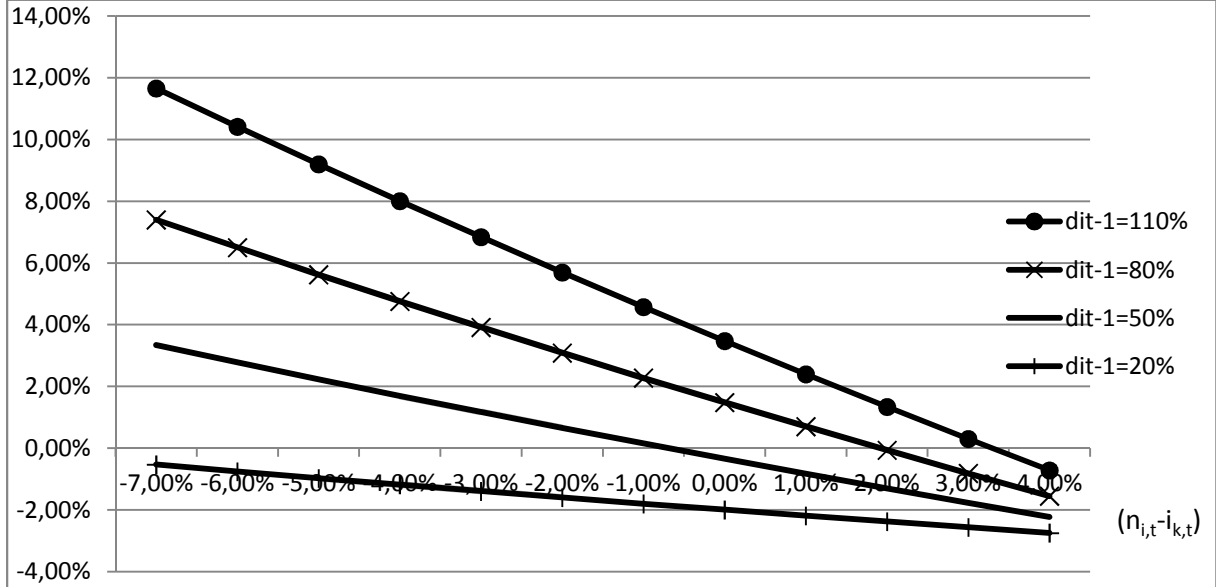
The necessary budgetary surplus is also an increasing function of the variability in yields on national bonds in comparison with the variability in benchmark bonds' yields $[\rho m_i(\sigma_i^2-\sigma_{i,k})>\rho(1-m_i)(\sigma_k^2-\sigma_{i,k})]$. Here also, our model shows that these budgetary surpluses should often be quite high. Indeed, according to our calibration, 'risky' countries with a low indebtedness level $(d_{i,t-1}\leq50\%)$ could get a budgetary deficit. However, as soon as the debt level of a 'risky' country exceeds 80% of GDP, this country should have a budgetary surplus. Indeed, for high debt levels, Figure 2 shows that the budgetary surplus of a 'risky' member country of a monetary union should theoretically be high, and it is a strongly increasing function of the degree of riskiness of the country (higher slope of the straight line).

Figure 2: Necessary budgetary surpluses according to the riskiness of the countries
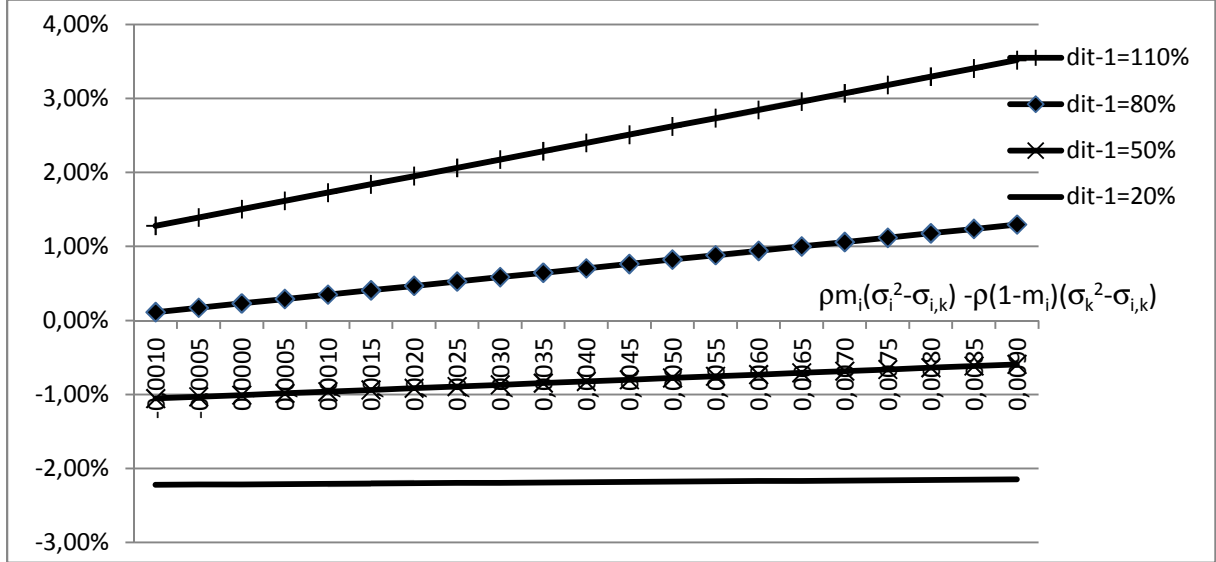
Finally, the necessary budgetary surplus is an increasing and exponential function of the national debt level. According to our calibration, whatever the foreign debt level, a given country should get a budgetary surplus as soon as its indebtedness level exceeds 65% of its GDP, and this necessary surplus increases exponentially with the debt level of the country. Besides, Figure 3 shows that regarding this relationship, the debt level of the foreign

benchmark country has a negligible importance. Therefore, the necessary budgetary surplus of a given country must, obviously, be estimated according to its indebtedness level. Indeed, as mentioned by Faini (2006), the interest rate spillover effects of too expansionary fiscal policies in high-debt countries are relatively larger than in low-debt countries. On the contrary, high debt countries with sustainable public debt dynamics have no harmful consequences on the interest rates of their partner countries. In a monetary union, it would thus be necessary to treat the countries differently whether or not they have a high public debt level and whether or not this public debt is on a sustainable path.

Figure 3: Necessary budgetary surpluses according to the debt levels of the countries
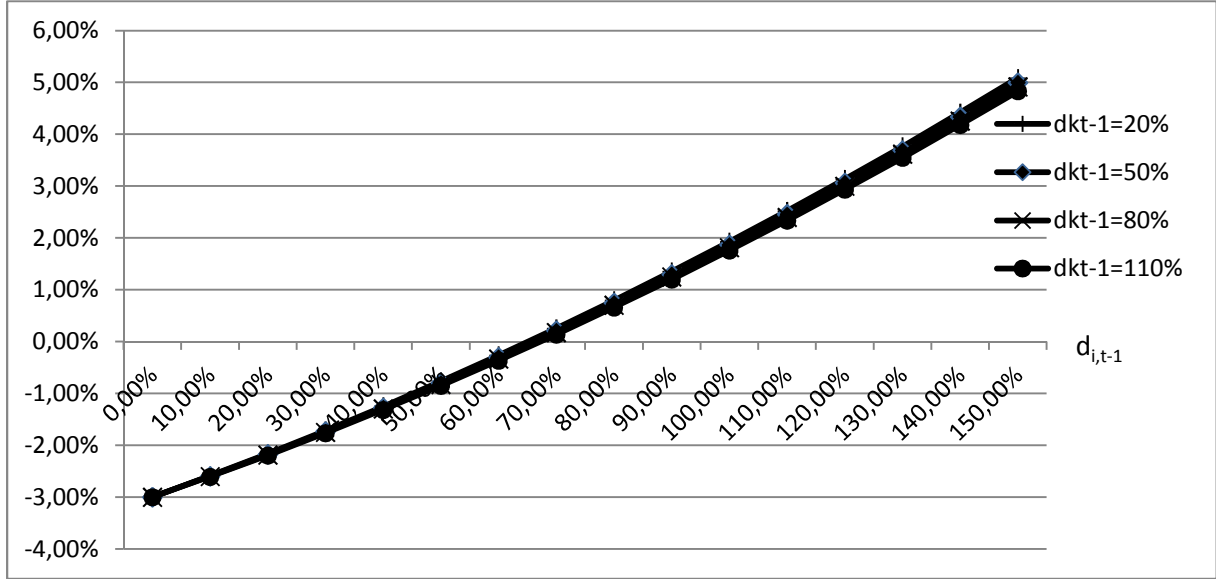
V. Lessons for the European Economic and Monetary Union

This section now aims at defining the lessons of our theoretical model for the Economic and Monetary Union in Europe. Let's first start by calibrating our model.

In the new 'Treaty on Stability, Coordination and Governance (TSCG)' in force since January 2013 (see Introduction), a debt-to-GDP ratio above 60% is to be considered sufficiently diminishing if its distance with respect to this reference value has reduced over the previous three years at a rate of one-twentieth per year. Therefore, we will take: (T=20). Furthermore, in the Maastricht Treaty, the public debt target is set at 60% of GDP (d^*=0.6).

Besides, EMU member countries are heterogeneous regarding various variables: their former debt levels ($d_{i,t-1}$), their growth rates, their inflation rates. Therefore, we will consider the following variables (source: *Eurostat*):

($n_{i,t}$): GDP nominal growth rate (at current market prices) in period (t) in the country (i)

(-$def_{i,t}$): general government net lending (+) or net borrowing (-), percentage of GDP at market prices, in period (t) in the country (i)

($d_{i,t}$): public debt, percentage of GDP at market prices, in period (t) in the country (i).

In the long run, we will suppose that the nominal interest rate will be: ($i_{k,t}$=3%) for the benchmark country: Germany. We also make the hypothesis that long run GDP nominal growth rates will be about: ($n_{i,t}$=$n_{k,t}$=4%) for the member countries of EMU, slightly weaker than the levels attained in 2007, but higher than the levels obtained during the current economic and financial crisis.

Finally, we still have to estimate the risk aversion towards the bonds of a given country. To this aim, we suppose that ρ=0.01: the representative investor is mainly concerned with its average wealth, but has a non negligible degree of risk aversion. Besides, we use:

($i_{i,t}$): Nominal long term interest rates on 10 years government bonds of the country (i) (source: *Eurostat*). We have estimated the variance (σ_i^2) and covariance ($\sigma_{i,k}$) of these bonds for the period since the Maastricht Treaty: 1992-2010.

(m_i): share of the country (i) in terms of nominal GDP (at current prices) in the Euro Area.

Then, Table 1 can estimate a risk aversion towards the bonds of a given country.

Table 1: Risk aversion towards the bonds of a given country [$\rho m_i(\sigma_i^2 - \sigma_{i,k})$]

Germany	Austria	Luxembourg	Netherlands	Belgium	Ireland	France	Finland
0	0	0	0	0.0001	0.0001	0.0004	0.0005

Portugal	Spain	Greece	Italy
0.0009	0.0045	0.0089	0.0098

In the framework of our model, we can then define five groups of EMU member countries.

- Luxembourg (20.5% of GDP) and Finland (53.4% of GDP) had very low indebtedness levels in 2012. Therefore, there is no problem of sustainability of their public debts for these two countries, which are allowed to have budgetary deficits according to equation (18), higher than those which are effectively anticipated. Today, there is no Excessive Deficit Procedure (EDP) for these two countries.
- Germany, Austria and the Netherlands need immediate moderate fiscal consolidation efforts, as their indebtedness levels are above 60% of GDP. However, whatever public debt target would afterwards be stable for these countries.
- France, Ireland and Belgium need immediate substantial fiscal consolidation efforts. However, the public debt target of 60% of GDP could be stable for these countries.
- Italy, Portugal and Spain should have substantial budgetary surpluses to reach the public debt target of 60% of GDP at a satisfactory pace. Besides, this target would be unstable for these countries.
- The situation is explosive for Greece. The current optimal necessary budgetary surplus would be above 20% of GDP in 2012, and then only slowly decreasing!

## 1. *Countries for which whatever public debt target is stable*

A first EDP was launched for Germany between January 2003 and June 2007, where it was abrogated. However, after little time, the situation deteriorated again. Because of the economic and financial crisis, which implied an abrupt decline in private investment and foreign trade in the export-oriented manufacturing sector, nominal GDP strongly decreased by -4% in 2009 in Germany. Therefore, in the framework of this severe downturn, and because of the recovery measures necessary to limit the recession, the budgetary deficit reached 3.1% of GDP in 2009, exceeding the reference value of the SGP. At the same time, the public debt reached 74.5% of GDP in 2009, in particular on account of financial market stabilization measures and measures to support EU Member States. In these conditions, in December 2009, the European Council launched a new Excessive Deficit Procedure for Germany. Nevertheless, the economic recovery was very fast. Nominal GDP increased by 5.1% and 3.9% respectively in 2010 and 2011. Besides, in order to correct the excessive deficit, the German government decided budgetary consolidation measures: cuts in unemployment benefits, costs savings in the public sector, etc. Therefore, the budgetary deficit, after reaching a maximal value of 4.1% of GDP in 2010, was reduced to 0.8% of GDP as soon as 2011. In

particular, the social security funds (health and pensions) ran primary surpluses. In the same way, the public debt slightly began to decrease. After a maximal value of 82.5% of GDP in 2010, it was reduced to 80.5% of GDP in 2011.

To explain the relative better capacity of Germany to go out of the economic and financial crisis, we can mention that within the Lisbon Strategy framework, the country has implemented a number of measures to reform its labor market, enhance competition in network industries and to support R&D and innovation activity. Germany has the advantage to benefit from large commercial surpluses and from a robust labor market. It must preserve the achievements of past pension reforms and further reforms of the social security system aimed at curbing the increase in age-related expenditures. Indeed, Germany is facing specific challenges in the face of demographic change and of an ageing population. However, the step-wise increase of the statutory retirement age to 67 years by 2029 will lead to a considerable strengthening of the system's financial sustainability. The government also contemplates the strengthening of the long-term care insurance and health system. We can also mention that Germany decided to set a ceiling for the federal structural deficit at 0.35% of GDP from 2016 onwards with a transition period starting in 2011. This context can explain that Germany succeeded to restore adequate levels of primary surpluses.

Therefore, on May 30th 2012, the European Council abrogated the EDP against Germany. Indeed, its nominal GDP growth rate is anticipated to be around 3-4% in 2014-2016, close to its potential trend. Besides, the German budgetary balance was equilibrated as soon as 2012 (budgetary surplus of 0.1% of GDP), whereas the German public debt is supposed to be on a decreasing trend. Besides, according to our model, under optimal conditions, with an average nominal growth rate ($n_{i,t}=4\%$) since 2016, Germany could be allowed to get a budgetary deficit as soon as 2018, and this optimal deficit (compatible with converging towards the public debt target of 60% of GDP at a satisfactory pace) could even reach 0.58% of GDP in the long run (see Figure 4)[7].

Figure 4: Optimal budgetary deficit (-) or surplus (+) if ($n_{i,t}=4\%$)

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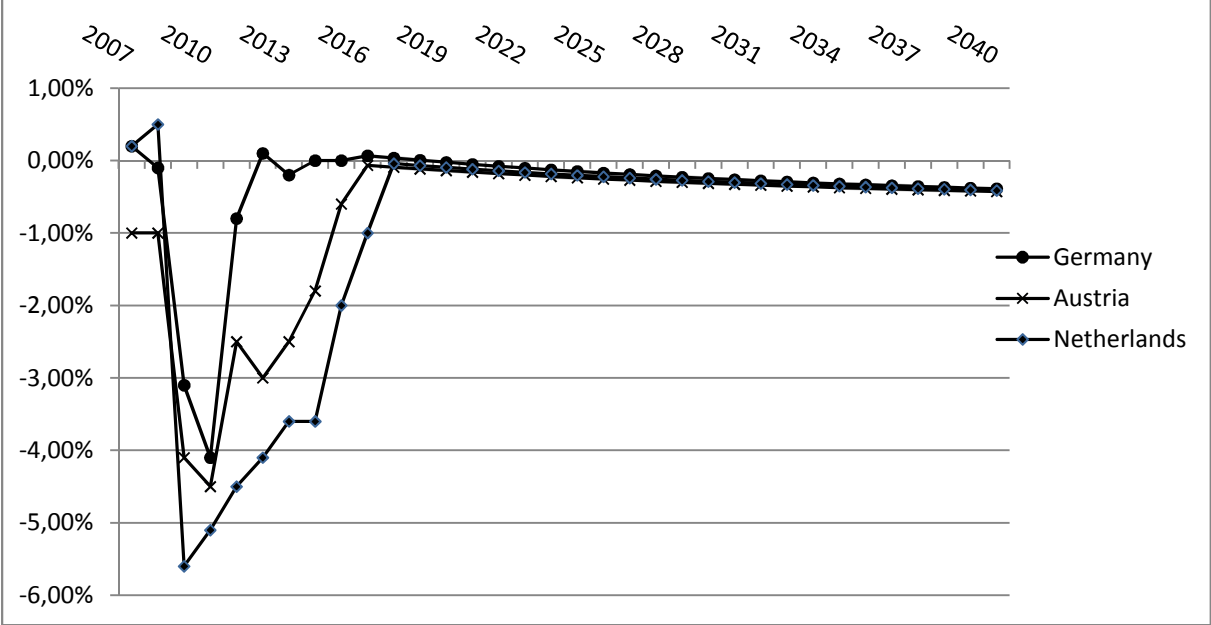
[7] Because of the three-year period following the correction of the excessive deficit granted for meeting the debt rule, we will suppose that this rule will not apply before 2016 for Germany, Austria and Italy, not before 2017 for the Netherlands, and not before 2018 for France, Belgium, Ireland, Portugal and Spain.

Austria doesn't take advantage of the favorable economic situation before 2008 in order to improve its budgetary situation, as the structural deficit then worsened. Therefore, with the deterioration in economic conditions, the budgetary deficit reached afterwards 4.1% of GDP in 2009 (whereas it was only 1% the two previous years), beyond the limit of the SGP, and the public debt attained 69.2% of GDP. This was due to the severe economic downturn and decrease in the nominal GDP (-2.3%) with the economic and financial crisis. The recession reflected the abrupt decline in private investment and foreign trade in the export-oriented manufacturing sector as a consequence of the global and worldwide slowdown. In December 2009, the European Council thus launched an EDP for Austria. Afterwards, Austria experienced a gradual recovery with a higher than expected GDP nominal growth rate of 3.7% and 5% in 2010 and 2011 respectively. Recovery was led first by net exports, and then by internal demand. For example, the 2009 tax reform included stimulus measures like: relief for families with children and tax cuts for the self-employed, whereas a fiscal stimulus package intended to fight against the deteriorated economic prospects. But the budgetary deficit then increased to 4.5% of GDP in 2010. Indeed, the primary deficit was still growing in connection with the former recovery measures, which were mainly supposed to be permanent, as income tax cuts or social contribution rate.

Since 2009, Austria has made huge efforts to increase the attractiveness of the country for investors, with increasing R&D and infrastructure expenditures. The long-term budgetary impact of ageing in Austria is lower than the EU average, with pension expenditure projected to decrease as a share of GDP over the long-term. However, the European Commission considers that improving the quality of public finances in the sectors of education or health care remains necessary in Austria. More precisely, in order to insure the long run sustainability of the public debt, reforms aimed at limiting the increase in age-related expenditure, in particular by rising the effective retirement age in line with life expectancy, would be necessary. Austria still has to face some problems, like the low employability of older workers, the widespread use of early retirement and invalidity pension schemes, the high tax and social security burden on labor income, and the relatively high concentration of women in low-wage and part-time employment. Nevertheless, as soon as 2011, the budgetary deficit was reduced to 2.5% of GDP in Austria, thus below the limit of the SGP. Besides, for 2012, the government adopted a 'stability package', including reforms in the field of pensions, health, subsidies, administration and the labor market, as well as a 'solidarity fee' for high income individuals. On 7 December 2011, the Austrian Parliament also adopted a debt brake, which specifies that the Austrian federal budget must be structurally balanced (a deficit smaller than 0.35% of GDP) by 2017. Finally, in the last Austrian SCP in April 2012, measures are mostly on the expenditure side: decrease in pensions, subsidies and public servants' salaries; and regarding revenues: closing loopholes in VAT collection, hikes in income tax for high-earners and rise in social contributions for certain groups.

In this framework, with a nominal GDP growth rate expected above 3% after 2014, after re-increasing to 3% of GDP in 2012, the Austrian budgetary deficit could be around 2.5% of GDP in 2013, and could decline afterwards in order to reach a budget in balance in 2016. Furthermore, after reaching more than 75% of GDP in 2013, the Austrian public debt is supposed to be on a decreasing trend afterwards. So, according to our model, under optimal conditions, with an average nominal growth rate ($n_{i,t}$=4%), Austria could be allowed to get a limited budgetary deficit, going from 0.10% in 2016 to 0.58% of GDP allowed in the long run (see Figure 4).

A first EDP was launched for the Netherlands between June 2004 and June 2005, where it was abrogated. The country afterwards succeeded to have limited budgetary surpluses the two years before the crisis. However, in 2009, the budgetary deficit reached

5.6% of GDP, thus exceeding the limit of the SGP, whereas the public debt (60.8% of GDP) was also beyond the reference value of the Maastricht Treaty. This was due to the severe economic downturn, accompanied by slower capital accumulation, a sharp deterioration in the output gap and a huge decrease in the nominal GDP (-3.6%). Therefore, in December 2009, the European Council launched an EDP for the Netherlands. The downturn in this country mainly reflected the sharp fall in exports, as a result of the fall in world trade. In this difficult economic context, the Dutch government also had to support the financial sector and to undertake operations to stabilize the financial markets. Thus, in 2010, the Dutch budgetary deficit still represented 5.1% of GDP, and the public debt (63.1% of GDP) continued to grow. The better cyclical economic conditions, with a nominal GDP growth rate of 2.7% and 2.3% respectively in 2010 and 2011, allowed an improvement. However, the Dutch budgetary deficit still represented 4.5% of GDP and the Dutch public debt 65.5% of GDP in 2011.

The long-term budgetary impact of ageing seems higher in the Netherlands than the EU average, mainly as a result of a relatively high increase in pension and long-term care expenditure as a share of GDP over the coming decades. Therefore, the European Commission had recommended high primary surpluses and a further reform of the social security system aimed at curbing the substantial increase in age-related expenditures. In this framework, the Dutch government decided a reform of the pension system (higher retirement age linked to life expectancy) and of the long term care in order to reduce the financial burden of the ageing Dutch society. In its last SCP in June 2012, it also promised additional consolidation measures to foster economic growth and to improve the functioning of the housing and labor markets. Due to uncertainties about the sovereign debt crisis, the cooling of world trade, and the decline in private consumption, the Dutch economy was again in recession in 2012 (decrease of 0.2% in nominal GDP). Indeed, the budgetary adjustment had so far relied mostly on expenditure cuts, which were detrimental to growth. Therefore, the Dutch budgetary deficit still attained 4.1% of GDP in 2012.

The European Council required that the Dutch budgetary deficit be reduced to 3% of GDP in 2013. However, the latter is expected to remain excessive, at about 3.6% of GDP in 2013 and 2014. Furthermore, the Dutch government hasn't precisely defined the measures contemplated in order to reach its objectives; nominal GDP growth is anticipated to be above 3% from 2013, which is quite optimistic. Therefore, a further fiscal consolidation effort seems necessary in the Netherlands, in order to reduce the budgetary deficit to a negligible amount in 2017. It is only in these conditions that the public debt, after reaching a maximal value near 75% of GDP in 2014, could be placed afterwards on a decreasing trend. Nevertheless, according to our model, under optimal conditions, with an average nominal growth rate ($n_{i,t}$=4%), the Netherlands could be allowed to get an optimal budgetary deficit, which would first be limited in 2017 after the fiscal consolidation effort, but which could reach 0.58% of GDP in the long run (see Figure 4).

To conclude, we can mention that for Germany, Austria or the Netherlands, the optimal budgetary deficits and trajectories formerly mentioned are fully reachable, as comparable results were attained by these countries before the economic and financial crisis, in 2007-2008. Besides, once their budgetary deficits would be put on their optimal paths, whatever threshold of public debt (for example: 60% of GDP, but a smaller target could also be reachable) would be progressively attained, the indebtedness converging gradually towards this level. Furthermore, once this threshold would be reached, it would be stable. Indeed, these three countries have a history of particularly low interest rates volatility (see Table 1). Therefore, after reaching the public debt threshold, the sustainability of this public debt would not be contestable and vulnerable to macroeconomic shocks and to unexpected variations in the economic framework; the mechanism would be self correcting for these countries.

2. *Countries for which the target d*=60% is stable*

France has a structural budgetary deficit which is much too high, and this is the main problem for the country. Indeed, even when economic growth was not damaged and in 2007, the budgetary deficit (2.8% of GDP) was already near the threshold allowed by the SGP. Therefore, fiscal consolidation has been insufficient when economic conditions were the most favorable, and there wasn't any room for maneuver in the event of a downturn. In this context, the budgetary deficit reached its peak of 7.5% of GDP in 2009 because of the financial and economic crisis. The public debt represented then already 79.2% of GDP. This was due to the 'recovery plan', supporting investment and employment following the severity of the downturn, as well as to bank rescue measures for the financial sector. So, in April 2009, the European Council launched an EDP for France. Indeed, French public expenditures and taxation rates are among the highest in the EMU. The reform of the pension system was necessary to avoid a further deterioration of public finances; however, further structural reforms are still necessary, especially regarding healthcare and local authorities.

In 2011, the French public debt reached 86% of GDP, which is much higher than the threshold of the Maastricht Treaty. Nevertheless, the budgetary deficit (5.2% of GDP) was smaller than the forecast and the request from the European Commission. This was due to recovery as regards domestic demand (investment and households' consumption), which implied a 3.1% nominal GDP growth rate, and to the freeze on nominal governmental expenditure, excluding debt service and pensions. The structural budgetary improvement continued in 2012, due to targeted tax and social security contribution hikes and containment of public spending in real terms. However, according to the European Council, France should undertake to shift the tax burden from labor to other forms of taxation that weigh less on growth and external competitiveness, in particular environmental and consumption taxes. Besides, the long run sustainability of the French pensions system is put into question.

In 2012, international tensions implied a slow nominal GDP growth of 1.7%, and a budgetary deficit of 4.6% of GDP. Nevertheless, the French government expects a return to a GDP nominal growth rate above 3.5% from 2014, led by exports and afterwards by consumption. In this framework, the last French SCP in April 2012 promised the return to a deficit of 3% of GDP in 2013, as required by the Commission, and to the budgetary equilibrium in 2016. However, the budgetary deficit will probably be well above the target in 2013 and 2014. It should only fall below 3% in 2015, for a budget in balance in 2018. Such a commitment could put the public debt on a sustainable path, decreasing after a maximal value above 95% of GDP in 2015. Indeed, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}$=4%), France should have a budgetary surplus, decreasing from a surplus of 0.83% of GDP in 2018 to a deficit of 0.55% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}$=5%), France could allow itself to have a budgetary deficit, firstly limited but reaching 1.12% of GDP in the long run. To sum up, the optimal trajectory for the French budgetary deficit could be the one mentioned in Figure 5.

Figure 5: Optimal budgetary deficit (-) or surplus (+) if ($n_{i,t}$=5%)
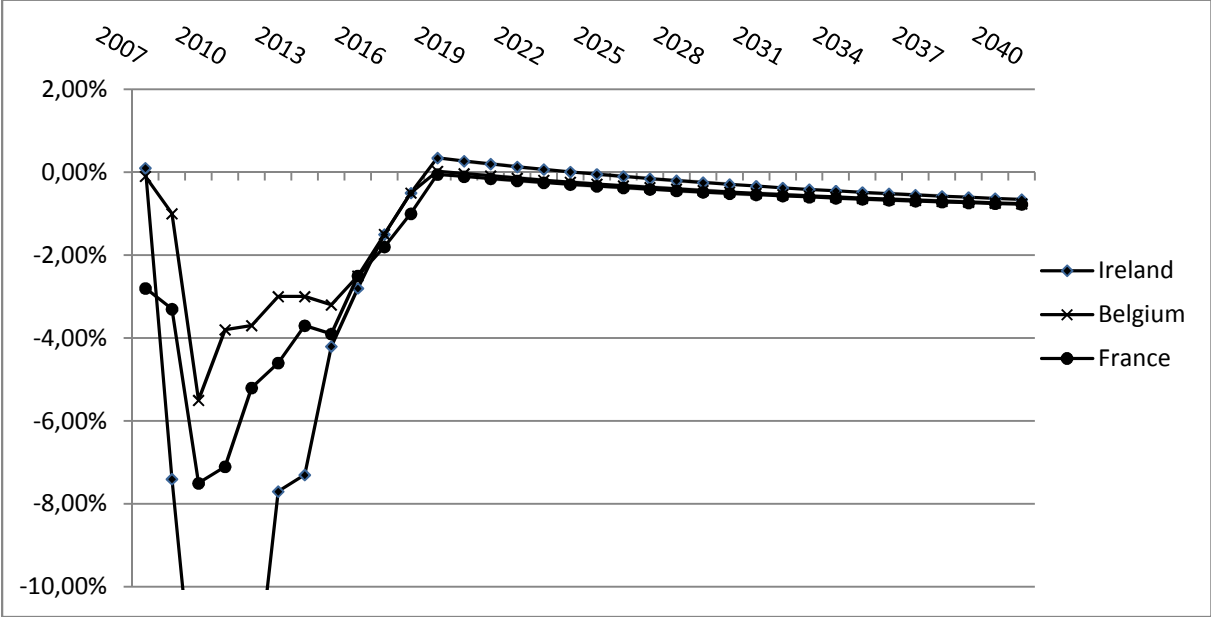
Belgium has an indebtedness level which is much too high, and this is the main problem for the country. After the maximal public debt level of 134.2% of GDP attained in 1993, the Belgian public debt has much decreased with the help of large budgetary surpluses and of the decrease in real interest payments on the debt. Indeed, the public debt was reduced to 84% of GDP in 2007. However, the indebtedness level rose again afterwards, because of the economic and financial crisis. Operations to stabilize the financial system taken in the last months of 2008 and the recovery plan (support to the financial system and to corporations, public investment and infrastructures...) increased the budgetary deficit to a maximal value of 5.5% of GDP in 2009. Nevertheless, the fiscal escalation was largely due to the severity of the downturn, growth rates falling largely below their potential levels (negative nominal growth rate of -1.6% in 2009). Therefore, the structural budgetary deficit deteriorated and became much too high. Indeed, in Belgium, age-related spending is still projected to increase significantly more than the EU average. General public services and social protection expenditures are high and rising, and a relatively high increase in pension expenditures as a share of GDP is expected over the coming decades. Therefore, in Belgium, structural reforms of the social security system, of the labor and product markets to enhance potential growth and to increase the employment rate, and reforms to reduce the budgetary impact of ageing are absolutely necessary, in order to improve the long-term sustainability of public finances and to put the public debt on a sustainable path. So, in January 2010, the European Council launched an EDP for Belgium.

In 2010 and 2011, its budgetary deficit decreased thanks to better than expected macroeconomic conditions (GDP nominal growth rates of 4.5% and 3.9%), to attain 3.7% of GDP. The recovery was led first by the exports and the pick-up in world trade. The deficit fell again to 3% of GDP in 2012, with a nominal GDP growth rate at 2.5%. For the following years, in its last SCP in April 2012, the Belgian government promised a budgetary deficit gradually decreasing until being balanced in 2015 (there was nearly no deficit in 2007 before the crisis). To this aim, the measures taken include, in particular: increase in the taxation of dividends and interests, revenues from fight against tax evasion, savings in healthcare spending and increase in the degree of degression in unemployment benefits. Furthermore, for 2012-2014, substantial additional savings were decided for the federal public services, notably a reduction in staff appropriations and investment grants, or regarding social security and

health care. Public authorities are also currently implementing structural reforms related to pensions (more particularly early retirement) and the labor market, intended to boost the employment rate (of young and older people) and to face the problem of an ageing population. In this context, the Belgian public debt, after reaching 100% of GDP in 2012, could decrease afterwards. However, realistic estimations anticipate that the Belgian budgetary deficit should increase again to 3.2% of GDP in 2014, in particular because of the rising trend in healthcare and pension spending. Therefore, in May 2012, the European Commission mentioned that more permanent measures were necessary for the coming years.

So, let's suppose that the Belgium budgetary deficit will only decrease after 2014, until being equilibrated in 2018. In these conditions, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}$=4%), Belgium should have a budgetary surplus, decreasing from a surplus of 0.94% of GDP in 2018 to a deficit of 0.57% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}$=5%), Belgium could allow itself to have a budgetary deficit as soon as 2019, firstly limited but reaching 1.14% of GDP in the long run. To sum up, the optimal trajectory for the Belgian budgetary deficit could be the one mentioned in Figure 5.

Ireland is the country which experienced the strongest and the quickest deterioration in its public finances. Indeed, after the boom period of exceptionally high growth rates at the end of the 1990s, Ireland enjoyed several years of still strong growth (on average 5.5% in the period 2003-2007), which became increasingly driven by domestic demand, with a particularly buoyant construction sector. Ireland still had a budgetary surplus in 2007 (0.1% of GDP), and the public debt then only amounted to 24.6% of GDP. However, the sharp adjustment in the housing market started in 2007, and spread to other sectors through negative effects on confidence and employment, amplified by the financial crisis and global slowdown. The variation in the global economic framework was then extreme, from a strongly positive (+6.2%) in 2007 to a negative nominal GDP growth rate of –5.2% in 2008. Therefore, the budgetary deficit reached 7.4% of GDP as soon as 2008. Public investment is traditionally very high in Ireland; but these expenditures couldn't explain alone such deterioration in the structural deficit; social transfer payments in response to the quick rise in unemployment and public wages have also increased. Consequently, in April 2009, the European Council launched an EDP for Ireland. Afterwards, the decline in demand and in the nominal growth rate (with a minimal value of -9.8% in 2009) continued further. Therefore, the very high budgetary deficit in 2009 (13.9% of GDP) and the reaching of the threshold of 60% of GDP for the public debt were mainly due to the implied decrease in fiscal resources, despite the consolidation measures taken by the government. They were also the consequence of capital injections into Anglo Irish banks and of the government's bank guarantees. Thus, the Irish government had to take measures in order to reduce public expenditures, including mostly public sector wage cuts, social welfare savings, and a reduction in public investment.
However, these measures, deemed necessary to preserve financial stability and restore confidence in the banking sector, and thereby to support the economy's return to sustainable growth, had a larger than expected additional cost. The budgetary deficit reached 30.9% of GDP in 2010, and the public debt 106.4% of GDP in 2011! Indeed, despite the return to a modest, export driven nominal GDP growth rate of 1.6% in 2011, thanks to an improvement in competitiveness, the economic recovery was very slow. Besides, the long-term budgetary impact of ageing in Ireland is well above the EU average, mainly as a result of a relatively high projected increase in pension expenditures over the coming decades. Thus, a reform of the social security system seems necessary, in complement to the reform of the security State pension in progress. From 2012, the Irish government contemplates an increase in indirect taxation: VAT rate, excise duties and carbon taxes, a broadening of the income tax base, as

well as cuts in public service pay and in social welfare expenditures. In the framework of such consolidation measures, after having attained 13.4% of GDP in 2011, and 7.7% of GDP in 2012, a smaller level than the targeted value thanks to a nominal GDP growth rate of 2.5%, the Irish budgetary deficit could progressively continue to decrease. In its last SCP in April 2012, the commitment of the Irish government is to reach a budgetary deficit of 7.5% of GDP in 2013, 4.8% in 2014 and below 3% of GDP in 2015. In the same way, after having reached 117.2% of GDP in 2012, the public debt could peak above 120% of GDP in 2013 and then decrease and be put again on a sustainable path.

Besides, over the medium term, a return to robust and more sustainable growth is foreseen. While exports are expected to continue supporting economic activity, a gradual pick-up in domestic demand is projected after some years of contraction. From 2014, nominal GDP is forecast to expand by 4.5% per annum on average. Then, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}$=4%), Ireland should have a budgetary surplus, decreasing from a surplus of 1.35% of GDP in 2018 to a deficit of 0.57% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}$=5%), Ireland could allow itself to have a budgetary deficit after 2024, decreasing from a surplus of 0.34% in 2018 to a deficit of 1.13% of GDP in the long run. To sum up, the optimal trajectory for the Irish budgetary deficit could be the one mentioned in Figure 5.

To conclude, we can mention that for France, Belgium or Ireland, once the budgetary deficit would be put on its optimal path, the threshold of a public debt of 60% of GDP would be progressively attained, the indebtedness converging gradually towards this level. Furthermore, once this threshold would be reached, it would be stable. Indeed, these three countries have a history of relatively low interest rates volatility (see Table 1). Therefore, after reaching the threshold of 60% of GDP, the sustainability of their public debts would not be contestable and vulnerable to macroeconomic shocks and to unexpected variations in the economic framework.

### 3. *Countries for which the target d*=60% isn't stable*

Italy is today hardly restrained by the very high level of its public debt. The cost of debt service is very high, and the non negligible primary surpluses of the country are insufficient to compensate for this cost. Indeed, real GDP growth rates in Italy have been below the euro area average since the 1990s, under the impact of weak productivity growth. Therefore, a first EDP for Italy was initiated in July 2005 but closed in June 2008. Indeed, the public indebtedness was brought back to 103.3% of GDP in 2007, even if it remained very high, and the budgetary deficits were below the threshold of the SGP (2.7% of GDP in 2008). However, as soon as 2009, in the framework of the economic and financial crisis, the budgetary deficit reached 5.4% of GDP, and the public debt began to grow again. The budgetary difficulties were mostly due to the deep recession, the nominal GDP contracting by -3.5% in 2009, and to capital injections in the banking sector. Indeed, the government took measures to ensure the stability of the financial system, guaranteeing higher protection of savers and adequate levels of bank liquidity and capitalization. Besides, high cost of the debt service and high pension spending crowded out more productive expenditures as well as other social spending and contributed to the overall rigidity of Italy's public spending.

Afterwards, the economic recovery was very slow in 2010 and 2011, with GDP nominal growth rates around 2%. To reduce the budgetary deficit (4.5% in 2010 and 3.9% of GDP in 2011) the governmental measures fell mainly on current expenditures. In particular, half of cuts in public expenditures were borne by the local authorities, as transfers from the

central government were reduced. The rest included restraints in wages and recruitment throughout the public sector and cuts to ministerial expenditures. Besides, Italy had to face an ageing population and the increase in healthcare and long term care expenditure; thus, the reform of the pension system adopted in 2011 brought the retirement age to the highest level in Europe. However, the public debt still rose to 120.7% of GDP in 2011. Therefore, in its last SCP in April 2012, the Italian government decided the reduction of budget appropriations to Ministries and a streamlining of healthcare expenditures. On the revenue side, fight against tax evasion was stepped up. Moreover, the aim was to shift the tax burden away from earned income towards a greater taxation of property and consumption, in order to establish a more growth-friendly taxation system, and to enhance productivity, for example with the liberalization of the labor market. In these conditions, despite the recession (nominal GDP decrease of -0.9%), the budgetary deficit was reduced to 2.9% of GDP as soon as 2012, below the Maastricht threshold, and it is supposed to remain very small thanks to high primary surpluses (around 5% of GDP) from 2013. Regarding the indebtedness level, difficulties were mainly due to tensions on the financial markets with the sovereign debt crisis, implying a huge increase in interest rates on the Italian public debt. However, the economic recovery is expected from 2014 with nominal GDP growth rates around 3%. After reaching nearly 128% of GDP in 2013, the public debt could then decrease afterwards and be brought back on a sustainable path.

Italy has a problem of slow economic growth, due to a weak internal demand and to large current account deficits with the low growth in productivity. So, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}=4\%$), Italy should have very high budgetary surpluses, decreasing from a surplus of 4.87% of GDP in 2016 to a surplus of 0.07% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}=6\%$), Italy could have smaller budgetary surpluses, decreasing from a surplus of 2.43% in 2016 to a deficit of 1.07% of GDP allowed in the long run. To sum up, the optimal trajectory for the Italian budgetary surplus could be the one mentioned in Figure 6.

Figure 6: Optimal budgetary deficit (-) or surplus (+) if ($n_{i,t}=6\%$)
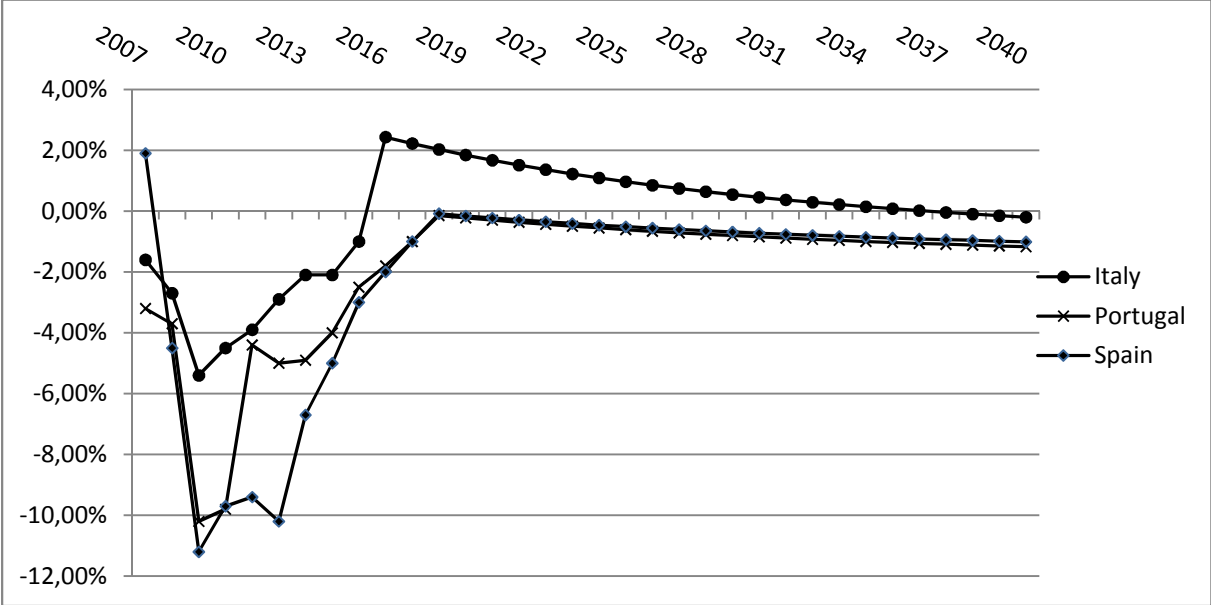
Regarding Portugal, two EDP have been previously opened: November 2002 -May 2004, and September 2005 -June 2008. The latter was closed because the fiscal consolidation had brought back the budgetary deficit to 3.2% of GDP in 2007, near the threshold of the SGP. However, a new EDP was initiated in December 2009, because the budgetary deficit

had reached 10.2% of GDP and the public debt 83.2% of GDP in 2009. As in other European countries, in Portugal, fiscal difficulties could mainly be explained by the severe economic downturn, nominal GDP contracting by -2% in 2009. More generally, Portuguese GDP growth rates have usually been low and below the EU average, especially because productivity is quite weak, and because of large external deficits; structural deficits are thus non negligible. So, these high budgetary deficits have increased the indebtedness level, in the framework of the global economic and financial crisis. In this context, the Portuguese government took fiscal consolidation measures: old-age pension reform, reform of health services, effort in research and development expenditures and infrastructure investment in order to increase the productivity. However, economic recovery was slow: the nominal GDP increased by 2.6% in 2010 but decreased again by -1% in 2011. Therefore, the budgetary deficit still represented 9.8% in 2010 and 4.4% of GDP in 2011 [thanks to a transfer of banks' pension funds to the social security]; and the public debt reached 108% of GDP in 2011.

So, it seemed necessary that the Portuguese government took additional fiscal measures in order to enhance the quality and efficiency of public finances. For example, in May 2010, the government announced: hikes in all VAT rates and surcharges on personal and corporate income taxes, cuts in capital spending and in the wage bill of the government, and tighter rules on social benefits. For 2012, two thirds of the measures are on the expenditure side and include a significant cut of public sector wages and pensions, a reduction in the number of government employees and a rationalization of state-owned enterprises, as well as a decrease in health and education expenditures. On the revenue side, the government reduced tax exemptions, increased VAT rates and excise taxes and enhanced efforts to fight tax evasion and fraud. However, further reforms enhancing the flexibility of the labor market would also be necessary, according to the European Commission. Besides, in the framework of such contractionary measures, economic recession was accentuated in 2012 (decrease in nominal GDP by -3.2%), with a slowdown in exports, which became unable to compensate for the weak internal demand (in particular investment activity). Therefore, the budgetary deficit has attained 5% of GDP in 2012.

Nevertheless, economic recovery and nominal GDP growth rates around 3.5% can be anticipated from 2014; the Portuguese government also expects primary surpluses around 3.5% of GDP from 2016. Furthermore, in March 2013, the European Commission granted more time to Portugal to reduce its budgetary deficit, because of the deterioration in its economic growth and outlook: the targets were fixed at 4% in 2014 and 2.5% of GDP in 2015. So, in this framework, the public debt could peak above 124% of GDP in 2014, and could decrease afterwards and be put again on a sustainable path. Besides, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}$=4%), Portugal should have a budgetary surplus, decreasing from a surplus of 2.12% of GDP in 2018 to a deficit of 0.52% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}$=6%), Portugal could allow itself to have a budgetary deficit as soon as 2018, reaching 1.64% of GDP in the long run. To sum up, the optimal trajectory for the Portuguese budgetary deficit could be the one mentioned in Figure 6.

In Spain, the combined effect of significant primary surpluses (the budgetary surplus was still 1.9% of GDP in 2007) and strong nominal GDP growth rates were the main driving forces behind the observed path of debt reduction before 2007. Internal demand was in expansion but there were large external imbalances and deficits. However, the severe downturn and the global economic and financial crisis changed the economic context. In particular, a sizeable downsizing began in the construction sector to more sustainable levels of activity. Spain experienced a reversal of the continuous domestic demand expansion of over a decade, which was associated with high indebtedness of the private sector, an oversized

housing sector and fast rising asset prices (notably real estate assets). Therefore, even if the output gap still remained positive, the budgetary deficit broke for the first time the reference value of the SGP in 2008, and it attained 4.5% of GDP. The public debt (40.2% of GDP) was still very weak in 2008. Nevertheless, in April 2009, the European Commission opened an EDP for Spain. Thus, the government undertook to improve the low productivity in the country: it increased infrastructure, education and R&D expenditures. The measures announced in May 2010 also included: cuts in government wages, reduction of public investment, freeze on pensions, and cuts in transfers to regional and local governments. Nevertheless, in 2009 and 2010, the nominal GDP contracted by -3.7% and increased by only 0.1% respectively, with the output gap turning markedly negative. This was due to a shrinking domestic demand and reinforced by a still sluggish export sector. Therefore, the budgetary deficit reached 11.2% in 2009 and 9.7% of GDP in 2010, and the public debt exceeded the threshold of 60% of GDP in 2010.

Afterwards, in 2011, national demand still contracted, whereas the exports continued to support economic activity (the nominal growth rate was 1.4%); the unemployment rate (near 25%) was then among the highest in the EU. The budgetary deficit (9.4% of GDP) thus only slightly decreased, whereas the public debt continued to increase and reached 69.3% of GDP. Besides, the long-term budgetary impact of ageing populations is well above the EU average in Spain. Therefore, Spain implemented in 2011 a reform of the pension system, increasing the retirement age, and also a stronger control and cuts in healthcare expenditure. Furthermore, in March 2012, Spain adopted a very restrictive fiscal program: temporary increases in personal and corporate taxes, enlargement of tax bases, wages reductions in the public sector (for example by ceasing to recruit civil servants), and measures to make the dependency system sustainable. In its last SCP in April 2012, the Spanish government also decided an increase in the VAT rate, in order to improve the efficiency of the tax system by increasing the share of the more growth-friendly indirect taxes, a decrease in unemployment benefits, and savings in the areas of health and education. In this context, in 2012, economic growth was less than expected (nominal GDP decrease of -1.4%), and the recession should continue in 2013. High private sector indebtedness, a record-high unemployment (more social expenditure) and the depressed internal demand (less fiscal resources) should continue to depress the macroeconomic outlook for Spain. Therefore, in 2012, the budgetary deficit (10.2% of GDP) was much higher than the value required by the Commission, and the public debt reached 88.4% of GDP. In its last SCP in April 2012, the Spanish government planned to bring the budgetary deficit below the 3% reference value by 2013, but this goal seems unreachable; the budgetary deficit should still be about 6.7% of GDP in 2013.

Even the new target, agreed by the European Commission in July 2012, to postpone to 2014 the goal of a deficit below 3% of GDP (2.8%), and to 2017 the goal of a budget in balance, would hardly be reachable. In the more realistic framework proposed in Figure 6, the Spanish public debt could peak near 100% of GDP in 2014 and then decrease and be put again on a sustainable path. Indeed, the nominal GDP growth rate is supposed to be above 3% from 2014, with the weak national demand slowly beginning to increase. So, according to our model, under optimal conditions, with a nominal growth rate ($n_{i,t}$=4%), Spain should have a budgetary surplus, decreasing from a surplus of 1.79% in 2018 to a deficit of 0.28% of GDP allowed in the long run. However, with a higher nominal growth rate ($n_{i,t}$=6%), Spain could have a budgetary deficit of 0.09% of GDP in 2018, even reaching 1.41% of GDP in the long run. To sum up, the optimal trajectory for the Spanish budgetary deficit could be the one mentioned in Figure 6.

To conclude, we can mention that for Italy, Portugal or Spain, once the budgetary deficit would be put on its optimal path, the threshold of a public debt of 60% of GDP would

be progressively attained, the indebtedness converging gradually towards this level. However, even when this threshold would be reached, it would not be stable. Indeed, these three countries have a history of relatively high interest rates volatility (see Table 1). Therefore, after reaching the threshold of 60% of GDP, the sustainability of their public debts would still be contestable and vulnerable to macroeconomic shocks and to unexpected variations in the economic framework.

VI. Conclusion

This paper proposes a simple modeling of the dynamic evolution of the interest rate, budgetary deficit and public debt of a member country of a monetary union. We combine a macroeconomic modeling of the evolution of a country's indebtedness with the behavior of a representative investor who has the choice between bonds from this country and a benchmark bond. In this context, we can analyze the consequences of the most recent measures included in the new European 'Treaty on Stability, Coordination and Governance (TSCG)', called the 'Fiscal Compact'. In particular, the latter requires the reduction of the public debt at a 'satisfactory pace': its distance with respect to the reference value (60% of GDP) must decrease at a rate of the order of one-twentieth per year.

In the framework of our model, we find that the necessary budgetary surplus for a given country is an increasing function of its public debt level (quadratic function), of the variance of the interest rate on national bonds, of the relative size of the country, and of the interest rate on foreign benchmark bonds. However, this necessary budgetary surplus is a decreasing function of the growth rate of the country, of the variance of interest rates on foreign bonds and of the foreign indebtedness level. Indeed, in the framework of a monetary union, it seems much more difficult for a given country to have a sustainable indebtedness path if this country is initially more indebted than its partners, or if it has a history of more risky public bonds with a higher variance in interest rates in the past. Besides, a given public debt target is not automatically stable and self correcting for the member countries of a monetary union. This target mustn't be too high in order to ensure the stability of the indebtedness path. First, a positive public debt target is stable only for countries whose growth rates are higher than the interest rate on public bonds in the benchmark country of the monetary union. On the contrary, only a small target is stable for big countries whose fiscal situations are mostly uncertain and risky.

According to this theoretical framework, the fiscal situations of Finland and Luxembourg are fully sane: the budgetary deficits and public debts of these countries remain moderate. Germany, Austria and the Netherlands are on the way to verify the criteria of the 'Fiscal compact' regarding the decrease in their indebtedness levels. However, the decrease at a satisfactory pace towards the public debt target of 60% of GDP would necessitate sizeable fiscal consolidation efforts for Ireland, France and Belgium. Besides, reaching such a target should be very costly in terms of fiscal restriction for Italy, Portugal or Spain; it would necessitate high growth rates, and such a target would not even be stable for these countries. Finally, the Greek situation is explosive. Therefore, in the framework of our theoretical modeling, the European criteria appear as quite ambitious for some member countries of the Economic and Monetary Union. Nevertheless, after many years of economic crisis and recession, everything depends on the capacity of the European countries to recover higher and more stable growth rates.

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