Does euro area membership affect the relation between GDP growth and public debt?

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Abstract: We analyse the relationship between the debt to GDP ratio and real per capita GDP growth for the euro area members by distinguishing between periods of sustainable and non-sustainable debt. Thresholds are theory-based and depend on the macroeconomic framework. If the interest rate exceeds nominal output growth, primary budget surpluses are required to achieve a sustainable debt ratio. The negative impact of the debt to GDP ratio is particularly strong for non sustainable ratios and especially relevant for the euro area. This suggests that the participation in monetary union might entail an additional risk for its members.

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1 Introduction

The rapid transformation of the financial crisis into a sovereign debt crisis called into question the medium and long run stability of the European Monetary Union. During the global slowdown, public deficits increased because of declining revenues and the launch of fiscal stimulus packages (BIS, 2012, ch5 and IMF, 2012, ch2). The strong commitment of governments to assist distressed systemic banks pushed the risk of sovereign default. As a consequence, solvency ratings worsened in many countries. While the crisis originated at the peripheral states, even core members have become affected. Policy actions at the EU level implemented supporting instruments for countries in emergency, such as the European Financial Stability Facility and the European Stability Mechanism. The funding is conditional on progress in fiscal consolidation and the implementation of structural reforms. Because the positive effects of these reforms usually materialize only in the long run, these responses bear the risk of stagflation, i.e. low output growth and high inflation. The debt crisis has revived the academic and policy interest on the economic impact of public debt. While theoretical models often predict a negative impact of government debt on economic growth, empirical evidence is still rather scarce.

According to the historical analysis of Reinhart and Rogoff (2009, 2010) for 44 countries in the past 200 years, the relationship between public debt and real GDP growth is characterized by strong nonlinearities. The impact of debt is weak for debt to GDP ratios below a threshold of 90 percent. If debt ratios exceed this level, median growth falls by one percent, and average growth falls considerably more. Therefore, countries with high debt should address their fiscal problems to avoid a deterioration in their growth

perspectives. Moreover, the creation of fiscal buffers might be an appropriate strategy to compensate for extraordinary shocks.

The magnitude of the threshold has been confirmed by later studies, more or less. Cechetti, Mohanti and Zampolli (2011) estimated a threshold of 85 percent for OECD countries beyond which government debt is harmful for growth. In contrast, Chang and Chiang (2009) reported an inverted *U*-shape relationship: The impact of the debt ratio is positive in any case, but higher in the middle regime and lower in the two outer regimes. The low and high debt regime are defined by ratios below (above) 33 (67) percent, respectively. Following Kumar and Woo (2010) initial public debt has a negative impact on subsequent growth in a mixed sample of industrial and emerging economies. On average, a 10 percentage point increase in the initial debt to GDP ratio is associated with a slowdown in real per capita GDP growth of 0.2 percentage points per year. Reinhart, Reinhart and Rogoff (2012) focused on debt overhangs, i.e. periods with a debt to GDP ratio exceeding 90 percent. As a striking feature, these periods are often long lasting with an average duration of 23 years. This suggests the association of debt and economic growth is not just a cyclical phenomenon, i.e. not strongly affected by endogeneity bias. Thus, the cumulative shortfall in output resulting from the debt overhang can be potentially massive.

Despite the ongoing debt crisis in the monetary union, only a few papers have examined the relationship for euro area countries. According to Checherita and Rother (2010) the turning point, beyond which government debt negatively affects growth, is at about 90-100 percent of GDP. Baum, Checherita-Westphal and Rother (2012) detected a similar threshold using a dynamic panel approach. While the short-run impact of debt on per capita GDP growth is positive and significant, it decreases to 0 beyond debt to GDP

ratios of 67 percent. For ratios exceeding 95 percent, additional debt has a negative impact on growth. Moreover, the long-term interest rate is subject to increased pressure if the debt to GDP ratio is above 70 percent.

In contrast to the previous literature, this paper is based on the distinction between sustainable and non-sustainable debt periods. Empirical estimates of the threshold might be biased, if they do not refer to macroeconomic conditions. If the debt to GDP ratio enters as an additional regressor, it is independent of this environment. When a model is fitted to the data, optimizing criteria are involved, i.e. the residual sum of squares is minimized. Thus, the threshold will rise, as debt levels have increased during the financial crisis. Such a result is counterintuitive, since risk perceptions of financial markets have become more pronounced in recent years.

Whether a debt ratio is harmful for growth of a country or not depends on the macroeconomic conditions embedded in the nominal interest rate, growth perspectives, and the primary budget surplus. If the interest rate exceeds nominal output growth, primary surpluses are required to stabilize debt to GDP, i.e. to achieve a sustainable debt ratio. This condition is applied in a nonlinear pooled regression model for the euro area to investigate the effects of the debt to GDP ratio on real per capita GDP growth. A second panel of European countries is defined for comparison. The results indicate a negative impact of the debt to GDP ratio on real per capita GDP growth. It is particularly strong for non sustainable debt ratios in the euro area. Participation in the monetary union might entail an additional risk for its members, probably due to deficits in the macroeconomic management of the euro area. The countries agreed to fulfill the Maastricht criteria, the no bail out and the probihition for the central banks to finance the government. Such an arrangement may increase the risk of a sovereign default. In the next section (Section 2),

criteria for fiscal sustainability are derived from the public budget constraint. Data and results are reported in Section 3, and conclusions are stated in Section 4.

2 Criteria for fiscal sustainability

Higher public debt, caused by higher public spending or lower taxes, can stimulate domestic demand, with expansionary effects on income and output in the short run. There is a partial crowding out effect on private demand. Since the financing of the deficit will reduce public saving, nominal and real interest rates increase, if private saving or capital inflows do not offset the public borrowing. Hence, a decline in consumption and investment is involved, but it will not fully compensate the expansionary effect.

In the long run, however, taxes need to be raised or spending need to be cut to achieve the sustainability of public debt, with adverse effects on business conditions. The slowdown in real capital accumulation due to the increase in real interest rates can lower potential output growth (Elmendorf and Mankiw, 1999). Dreger and Brautzsch (1999) and Balassoni, Francese and Page (2011) pointed out that negative effects of public debt on growth operates through the channel of private investment demand for the German and the Italian economy, respectively. The impact could be reinforced if a cut in public expenditures is implemented through a decrease in government investment such as infrastructure.

Negative effects are more pronounced if high debt elevates uncertainty about default. Sufficiently high levels of debt call into question fiscal sustainability and trigger higher risk premia and its associated higher long term real interest rates. In addition the interest rate increase may have distributional effects in the sense that it redistributes income

from workers to capitalists. The fact the workers are usually poorer that capital owners may be a reason why such redistribution is undesirable (Romer, 2006). The long run aspect is in line with Modigliani (1961) who has argued that government debt is a burden for next generations, since the implied lower private capital stock produces a lower flow of income. Only an increased public capital stock financed by public borrowing can mitigate this effect. In addition, an increase in the debt ratio might imply higher future distortionary taxation and higher inflation to reduce the real burden of public debt.

Romer (2006) has proposed a model connecting the probability of sovereign default and the revenues to finance public debt. Two elements are striking. First, the probability of default depends on the difference of the real interest rate of public debt and the risk-free interest rate of the world. When the government is certain to repay its debt the interest rate equals the risk-free rate. As the probability of default rises, the interest rate the government must offer increases. It tends to infinity as the probability of default approaches unity. Second, the government might or might not collect sufficient revenues (primary surplus) to serve interest payments. If the value of the revenues is higher than the interest payments the probability of a default is zero. Otherwise, the default probability will approach unity.

If investors are certain the government will repay its debt the default probability is zero. In this case, the interest rate for government debt is very close to risk-free rate. However, if there is some probability of default, the government has to offer a higher interest rate at which the investors are willing to buy the debt. The probability of default is the probability that tax revenues are high enough to cover interest payments. The interest rate is above the risk-free rate. If a default is almost sure, investors refuse to buy public

debt at any interest rate. The implication of such model is that the higher the probability of default, the higher the interest rate the investors demand. However, the higher the interest rate the higher the probability of default. Romer (2006) stressed the importance of expectations, which might be self-fulfilling. The default probability depends on fundamentals such as the risk-free interest rate, the amount the government wants to borrow and a downward shift of expected public revenues.

These effects may be stated in the budget constraint of the government, see Greiner and Fincke (2009). The change of public debt (ΔD) is equal to the difference of government expenditures (G) and government revenues (E) plus the interest which is paid on public debt (iD)

$$\Delta D = G - E + iD \tag{1}$$

Dividing the relationship by nominal GDP (Y) one obtains the public balance to GDP ratio, i.e.

$$\frac{\Delta D}{Y} = \frac{G}{Y} - \frac{E}{Y} + i\frac{D}{Y} = p + i \cdot d \,. \tag{2}$$

Differentiating the debt to GDP ratio with respect to time and rearranging yields

$$\frac{\partial (D/Y)}{dt} = p + (i - y)d \tag{3}$$

where p is the primary surplus to GDP ratio, y the growth rate of nominal output and d the debt to GDP ratio. If the primary budget P is on balance the debt to GDP ratio will not increase, as long as the nominal interest rate is lower than nominal output growth. If interest rates exceed this bound, primary surpluses are required to stabilize the debt to

GDP ratio. In the analysis, a dummy variable is set to unity, when if the primary surplus is less than the product of public debt and the difference between the interest rate and nominal output growth, i.e. the non sustainable case. Otherwise the dummy is zero. According to the Stability and Growth pact of the Maastricht treaty, government debt is not seen as critical as long as the debt to GDP ratio is below a 60 percent threshold. The dummy *Z*

$$\begin{aligned} &Z_t = 1 \quad if \quad P_t \geq (i_t - y_t)D_t \quad or \quad d_t \leq 0.6 \\ &Z_t = 0 \quad otherwise \end{aligned} \tag{4}$$

is designed to capture both criteria.

3 Data and empirical results

The analysis is conducted using annual data for 12 euro area members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. A second sample is defined for 4 European states which do not participate in the euro area: Denmark, Sweden, the United Kingdom and Turkey. The series runs from 1991 to the most recent experience (2011). The last years (2008-11) include the financial and sovereign debt crisis. Data are taken from the AMECO database of the EU Commission. The share of non-sustainable debt ratios revealed from equation 4 is shown in Figure 1.

While the fiscal stance has been non-sustainable in Greece, it turned out to be sustainable in Finland and Luxembourg for the entire sample period. Government debt has been non sustainable for the huge euro area countries (Germany, France and Italy) for most

years. The Stability and Growth Pact has been routinely broken by Germany and France in the period before the financial crisis, and primary surpluses have been insufficient to stabilize the debt ratios. In contrast debt ratios have been more sustainable for smaller economies, with the exception of Austria and Greece. The share is below average for non euro area countries.

-Figure 1 about here-

The endogenous variable is the real per capita GDP growth rate (y). Since the interest is on the additional impact of the government to GDP ratio beyond other variables, further determinants are included in the regressions: the share of gross fixed capital formation to GDP, trade openness, i.e. the sum of exports and imports to GDP, population growth and the real interest rate, the latter defined as the difference between the nominal interest rate and consumer price inflation. Pooled regressions are based on a nonlinear approach

$$y_{it} = \alpha + \sum_j \beta_j \boldsymbol{x}_{tj} + \gamma_1 Z_{it} q_{it}^{ns} + \gamma_2 (1 - Z_{it}) q_{it}^{s} + u_{it} \tag{5}$$

where the indices i and t denote countries and time. The standard growth determinants are included in the vector $\boldsymbol{x}$. The debt to GDP ratio q might have a different impact, depending on whether it is in the sustainable (s) or non sustainable (ns) range, and u is a white noise error term. Cross section correlation due to the presence of common shocks is taken into account.

The sign of the regressors is in line with theoretical predictions (Tables 1 and 2). In line with the neoclassical growth model, the investment rate exerts a positive effect on real per capita GDP growth, in contrast, population growth exerts a negative impact for the euro area and no effect for the non euro area. In addition, growth should depend on openness in a positive way, as intensified trade leads to a more efficient allocation of resources. According to the empirical estimates, this effect is pronounced in the euro area. Due to its adverse effect on aggregate demand, a rise in the real interest rate is expected to dampen economic activity.

-Tables 1 and 2 about here-

More important is the nonlinear response of real per capita GDP growth to the debt to GDP ratio. While no significant impact can be observed in the non euro area panel, non-sustainable debt regimes have a negative impact for the euro area members. The respective parameter has increased over the recent period of the financial and government debt crisis. Overall, the monetary union implies an additional risk for its participants. The countries agreed to fulfill the Maastricht criteria, the no bail out and the probihition for the central banks to finance the government. Such an arrangement may increase the risk of a sovereign default.

4 Conclusion

Nonlinear panel models indicate a negative impact of the debt to GDP ratio on per capita real GDP growth, especially in periods of non-sustainable debt ratios in the euro area.

This suggests that the participation in monetary union might entail an additional risk for its members, probably due to deficits in the macroeconomic management of the euro area. The path towards a fiscal union with a common liability for national debt positions might be an appropriate strategy to overcome the crisis.

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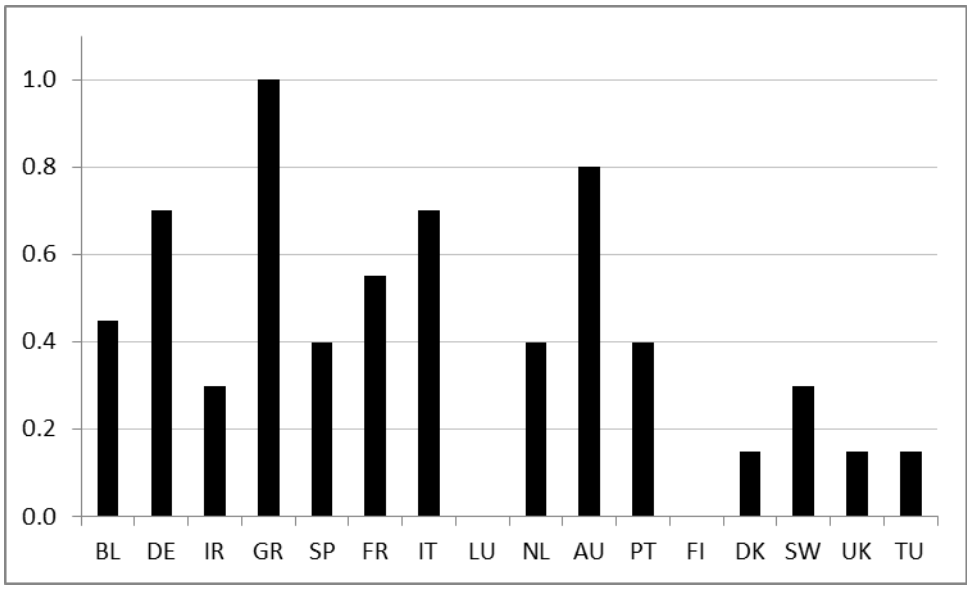
Figure 1: Share of non-sustainable debt ratios



Note: BL=Belgium, DE=Germany, IR=Ireland, GR=Greece, SP=Spain, FR=France, IT=Italy, LU=Luxembourg, NL=Netherlands, AU=Austria, PT=Portugal, FI=Finland, DK=Denmark, SW=Sweden, UK=United Kingdom, TU=Turkey.

Table 1: Pooled regression for the euro area members

	1991-2011	1991-2007
Constant	-0.015 (0.005)	0.004 (0.003)
Sustainable Debt	-0.005 (0.003)	0.001 (0.003)
Non sustainable debt	-0.013 (0.003)	-0.004 (0.002)
Investment share	0.173 (0.021)	0.069 (0.007)
Population growth	-1.341 (0.176)	-0.681 (0.115)
Openness	0.009 (0.001)	0.013 (0.001)
Real interest rate	-0.037 (0.018)	-0.041 (0.009)

Table 2: Pooled regression for the non euro area members

	1991-2011	1991-2007
Constant	-0.030 (0.028)	-0.013 (0.025)
Sustainable Debt	-0.006 (0.027)	0.017 (0.025)
Non sustainable debt	-0.009 (0.019)	0.012 (0.019)
Investment share	0.569 (0.180)	0.394 (0.172)
Population growth	-0.076 (1.027)	-0.066 (1.073)
Openness	-0.065 (0.018)	-0.053 (0.019)
Real interest rate	-0.080 (0.015)	-0.063 (0.015)

Note: Standard errors in parantheses.