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

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Abstract: We analyse the nonlinear relationship between the debt to GDP ratio and real per capita GDP growth for euro area members and a broader set of industrial countries (including euro area) by distinguishing periods of sustainable and non-sustainable debt. Thresholds for debt are theory-driven and depend on the macroeconomic conditions. If the nominal interest rate exceeds nominal output growth, primary budget surpluses are required to achieve a sustainable government debt ratio. The negative impact of the debt to GDP ratio is limited to the euro area and similar for sustainable and non sustainable levels of public debt. In the broader panel of industrial countries, the negative effect of debt diminishes. This result is fairly robust and holds even for exogenous thresholds. Therefore, the evidence suggests that the participation in monetary union might entail an additional risk for its members.

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1 Introduction

During the financial crisis, 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. At the end of 2011, Japan's debt-to-GDP of 230 percent has been the highest for the developed countries. The US debt-to-GDP ratio reached 100 percent. In Europe, the prime example is Greece with a ratio exceeding 160 percent. Projections of government debt-to-GDP ratios look even worse, especially if demographic trends are taken into account. The ageing population will likely imply an increase in health and pension expenditures in many countries.

The rapid transformation of the financial crisis into a sovereign debt crisis especially in Europe called into question the medium and long run stability of the European Monetary Union. While the crisis originated in the periphery, even core euro area states like Italy have become affected. Policy actions at the EU wide level implemented financial instruments to support countries in emergency, such as the European Financial Stability Facility and the European Stability Mechanism. Funding is conditional on progress in fiscal consolidation and the implementation of structural reforms to improve competitiveness. However, the positive effects of these reforms are related to the long run. In the short run, the effects are negative. Therefore, these responses bear the risk of a longer period of stagnation. The debt crisis has revived the academic and policy interest on the economic impact of debt. While theoretical models often predict a negative impact of government debt on economic growth, supporting empirical evidence is still rather scarce.

According to the historical analysis of Reinhart and Rogoff (2009, 2010) carried out for 44 countries over 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. The creation of fiscal buffers might be an appropriate strategy to compensate for extraordinary shocks.

The magnitude of the debt threshold has been confirmed by other studies, more or less. Using threshold regression methods, Cechetti, Mohanti and Zampolli (2011) estimated a critical level of 85 percent for OECD countries beyond which public debt is harmful for growth. By employing a similar approach, Caner, Grennes, and Koehler-Geib (2010) and Elmeskov and Sutherland (2012) reported even lower tipping points of around 70 percent beyond which the impact of sovereign debt turns bad. In contrast, Chang and Chiang (2009) found 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. Panizza and Presbitero (2012) have argued that a negative correlation between government debt and growth does not imply causality, as lower growth can result in a higher public debt to GDP ratio.

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. In addition, 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 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 zero beyond debt to GDP ratios of 67 percent. For ratios exceeding 95 percent, additional debt has a negative impact on growth. Furthermore, 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 misguided, if they do not refer to macroeconomic conditions. If the debt to GDP ratio enters as an additional variable in regression models, it would be independent of this environment. When a model is fitted to the data, optimizing criteria are applied, i.e. the residual sum of squares is minimized. This has some curious implications. For example, the threshold will increase due to rising debt levels during the financial crisis. Such a result is counterintuitive, as risk perceptions of financial markets seem to 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, perspectives on output growth, and the primary public budget. If the interest rate exceeds nominal output growth, primary surpluses are required to stabilize debt relative to GDP, i.e. to achieve a sustainable debt ratio. This condition is applied in a nonlinear panel regression model with fixed effects for the euro area to investigate the impact of the debt to GDP ratio on real per capita GDP growth. A wider panel of industrial countries (including the euro area) is defined for comparison. The results indicate a negative impact of the debt to GDP ratio on real per capita GDP growth in the euro area panel, irrespectively whether debt is sustainable or not. For the broader panel, no negative impact of debt can be revealed. These results are fairly robust and hold even for exogenous thresholds in the style of Reinhart, Reinhart and Rogoff (2012). The participation in the European monetary union might therefore entail an additional risk for its members, probably due to deficits in the macroeconomic management of the euro area. The countries have agreed to fulfill the Maastricht criteria, the no bail out clause and the prohibition for the central banks to finance governments. Such an arrangement may increase the risk of a sovereign default, no matter, whether debt is in the sustainable region or not.

The paper is organized as follows: 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 additional capital inflows do not offset the public borrowing. Thus, a decline in consumption and investment is involved, but it will normally not compensate the expansionary effect (Hall, 2009). The positive effect in the short run might be disputed in periods of high debt. Increasing default risk could reduce the size of the fiscal multipliers and can even turn them negative.

In the long run, 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 operates through the channel of private investment demand for the German and the Italian economy, respectively. The impact will be reinforced if the reduction in public expenditures is implemented through a decrease in government investment. According to Kourtellos, Stengos and Tan (2012) institutions such as executive constraints crucially affect the relationship. If they are below a certain quality, higher public debt tends to lower economic growth.

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 their 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 than 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 that the government is able to repay its debt the default probability is zero. In this case, the interest rate for government debt is very close to risk-free rate. But 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. In this case, the interest rate is above the risk-free rate. If a default can be almost taken as 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 de-

mand for holding public bonds. The higher the interest rate the higher the probability of default. Romer (2006) stressed the relevance 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. This condition can be captured by a dummy variable. It 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 it is equal to zero, i.e.

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

By multiplying the debt ratio with the dummy variable, the effects of sustainable and non sustainable debt on GDP growth can be distinguished.

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 broader sample of 18 countries is defined for comparison. It includes the euro area member states, European countries which do not participate in the euro area (Denmark, Sweden, the United Kingdom, Turkey), the US and Japan. 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.

Government debt has been non sustainable for the huge euro area countries (Germany, France and Italy) for 70 percent of the 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. The share in the UK

is similar to the German and French level. In contrast, the fiscal stance has been more sustainable for smaller economies. This can be also observed for the Southern euro area countries at the center of the current debt crisis, with the exception of Portugal. For Japan, almost all periods are plagued by non sustainable debt.

-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. Panel regressions with country fixed effects are based on a nonlinear approach

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

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. The distinction between the two debt regimes is based on macroeconomic conditions specified in equation (4). For robustness, the results are also reported for an exogenous threshold. According to the results of Reinhart, Reinhart and Rogoff (2012), the latter is set equal to 0.9. In all models, cross section correlation of

errors is taken into account, as common shocks might hit the individual countries in a simutanous way.

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. In addition, growth should depend on openness in a positive way, as intensified trade leads to a more efficient allocation of resources. This effect is more 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. Non-sustainable debt regimes have a negative impact on growth in the euro area member states. This impact might be also detected for sustainable debt regimes, although the latter finding cannot be confirmed in the exogenous threshold model. Hence, there is some indication that debt is harmful for growth in any case in the monetary union. In contrast, the impact of debt on real per capita GDP growth is positive in the broader panel of industrial countries. Thus, the monetary union seems to generate an additional risk for its participants[2]. The countries agreed to fulfill the Maastricht criteria and on the prohibition to bail out financially distressed governments. Such an arrange-

[2] It is worth to mention that this conclusion also holds for different levels of the exogenous threshold. In particular, almost the same results can be obtained if the threshold shifts between 0.6 (Maastricht criterion) and 0.9.

ment may increase the risk of a sovereign default, implying that the impact of debt to GDP is negative.

4 Conclusion

We analyse the nonlinear relationship between the debt to GDP ratio and real per capita GDP growth for euro area members and a broader set of industrial countries (including euro area) by distinguishing periods of sustainable and non-sustainable debt. Thresholds for debt are theory-driven and depend on the macroeconomic conditions. If the nominal interest rate exceeds nominal output growth, primary budget surpluses are required to achieve a sustainable government debt ratio. The negative impact of the debt to GDP ratio is limited to the euro area and similar for sustainable and non sustainable levels of public debt. In the broader panel of industrial countries, the negative effect of debt diminishes. This result is fairly robust and holds even for exogenous thresholds. Therefore, the evidence suggests that the participation in monetary union might entail an additional risk for its members. This might point to serious gaps in the macroeconomic management of the euro area. Eventually, the path towards a fiscal union with a common liability for national debt positions could be an appropriate strategy to overcome these deficits.

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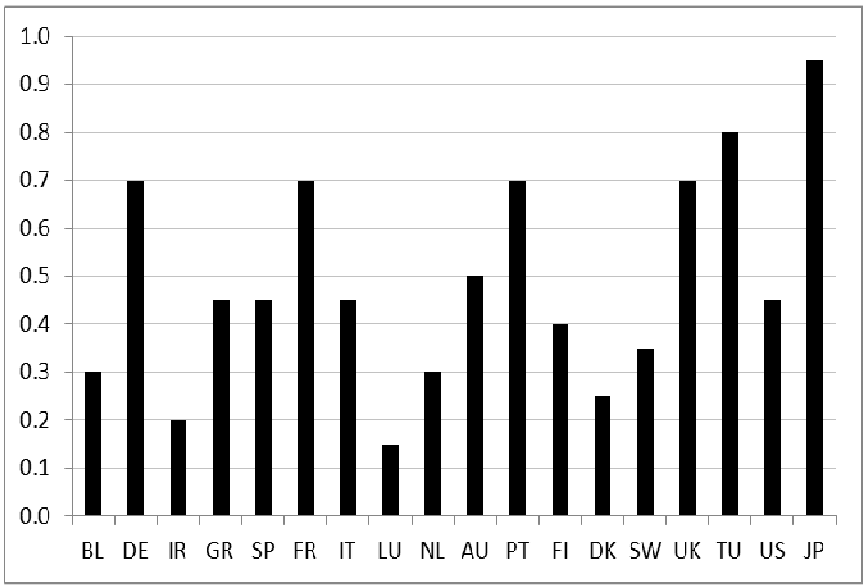
Figure 1: Share of non-sustainable debt ratios



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, US=United States, JP=Japan.

Table 1: Panel regression for the euro area members

	Economic condition	Exogenous threshold
Sustainable Debt	-0.012 (0.005)	-0.002 (0.005)
Non sustainable debt	-0.013 (0.005)	-0.014 (0.004)
Investment share	0.562 (0.034)	0.547 (0.032)
Population growth	-3.446 (0.179)	-3.416 (0.168)
Openness	0.016 (0.005)	0.012 (0.005)
Real interest rate	-0.038 (0.012)	-0.041 (0.011)

Table 2: Panel regression for industrial countries

	Economic condition	Exogenous threshold
Sustainable Debt	0.014 (0.001)	0.023 (0.001)
Non sustainable debt	0.018 (0.001)	0.004 (0.001)
Investment share	0.660 (0.011)	0.602 (0.008)
Population growth	-3.110 (0.056)	-3.138 (0.037)
Openness	0.005 (0.002)	0.002 (0.002)
Real interest rate	-0.067 (0.002)	-0.065 (0.001)

Note: Panel regression with country fixed effects, 1991-2011. Standard errors in parantheses. Economic condition defined in equation (4), exogenous threshold equal to 0.9 according to Reinhart, Reinhart and Rogoff (2012) finding.