

Primary Balance and Debt Dynamics: The Role of Interest Payments

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In this *Focus*, we revisit the impact of interest payments on the public debt dynamics with a focus on the Eurozone. As is well known, debt sustainability (in the sense of the stabilization of the debt-to-GDP ratio) depends crucially on the difference between interest payments that increase government debt and the nominal growth rate that reduces the debt-to-GDP ratio. Recently, this difference has turned negative in most advanced economies, including euro area sovereigns. Several recent empirical papers (see Jordà *et al.*, 2017 and Mauro and Zhou, 2021) document that negative interest-growth differentials occur for prolonged periods in history in both advanced and emerging economies. An important implication is that the debt-to-GDP ratio can be stabilized or even decline without the government having to run a primary surplus. Some authors however (Mauro and Zhou, 2021; Debrun and Kinda, 2016) caution that growth and/or interest rate projections may be overoptimistic, thereby creating the illusion of a sustainable debt position, when the differential can quickly turn around, thus shutting countries out of financial markets.

Debt dynamics also depend on the actions of the government in control of the primary surplus. Bohn (1998) estimated a “fiscal reaction function” linking the primary budget balance to potential determinants, including the business cycle and (lagged) public debt. He demonstrates that a positive response of the primary balance to an increase in debt is a sufficient condition for solvency. In this note, we conduct an empirical exercise in the same spirit by testing a “fiscal reaction function” but with a focus on interest payments and the Eurozone. Our exercise is close to Debrun and Kinda (2016) who find that all else equal, including the debt level, a larger interest bill is associated with higher primary balances.

Their conclusion is that this result “mitigates the conventional interpretation of high and rising debt service as an indicator of a greater risk of default or debt restructuring”.

Our main results – based on data on the period 1995-2019 – are the following:

- In the Eurozone, an increase (decrease) of one percentage point of GDP of interest payments leads to an increase (decrease) in the primary balance of around 0.5 percentage point of GDP;
- The main driver of this result is the debt-to-GDP ratio rather than the interest rate component of the interest payments to GDP ratio;

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(1) SciencesPo, CEPR and French Council of Economic Analysis (CAE); French Council of Economic Analysis (CAE).

- This result also holds for the structural balance although with a slightly lower coefficient (0.4 rather than 0.5);
- The result holds whether interest payments increase or decrease, whether the total budget deficit is close to the 3% threshold or not. This suggests that the 3% deficit limit in the SGP is not at the source of the result. The SGP does not seem therefore to be a clear driver of the reaction function. The result does not seem different for countries such as Germany, France or Italy. This reaction function also seems specific to Eurozone countries among advanced economies;
- There is some (but weak) evidence that the reaction of the primary surplus to changes in interest payments is lower for high levels of interest payments;
- If governments seem to react systematically to a change in the interest payments ratio, this is not true for the a change in the debt-to-GDP reducing growth rate .

These results suggest therefore that the impact of a change in interest payments on debt dynamics may be smaller than suggested by the simple debt dynamics equation. If governments react systematically to declining (increasing) interest payments by deteriorating (improving) the primary balance, it implies a higher (lower) steady-state level of debt-to-GDP than one where the primary balance is independent of interest payments.

1. Conceptual framework

We start from the standard dynamics of public debt which gives a key role to the difference between the interest rate and the growth rate of GDP:

$$(1) \quad d_t - d_{t-1} = \frac{r_t - g_t}{1 + g_t} d_{t-1} - pb_t \approx (r_t - g_t) d_{t-1} - pb_t$$

with d_t the ratio of debt-to-GDP ratio, pb_t the ratio of the primary balance to GDP, r_t the average effective nominal interest rate on government debt and g_t the nominal growth rate. Debt-to-GDP dynamics depend on three forces: the debt-increasing “snowball” effect of interest payments, the debt-decreasing effect of the growth rate of the economy (affecting the denominator of the debt-to-GDP ratio) and the effect of the primary balance that can be debt-increasing or -decreasing. These equations are based on accounting and take fiscal policy measured by the primary balance pb_t as exogenous. In this note, in the spirit of Bohn (1998) and Debrun and Kinda (2016), we ask a simple question: what if pb_t itself responded to interest payments? More specifically suppose governments take into account the dynamics of interest payments when choosing fiscal policy (i.e. their primary balance as a share of GDP). Such a reaction function could take the following form:

$$(2) \quad pb_t = pb_{t-1} + \alpha r_t d_{t-1}$$

in which an $\alpha > 0$ indicates that governments respond to an increase (decrease) in the previous year’s interest payments by increasing (decreasing) their primary balance. This could be due to prudence (when interest payments increase) or to fiscal rules that constrain the total deficit but also may push governments to reduce the primary balance as interest payments fall. In equation 1, governments can also act on debt dynamics by reacting to changes of the growth rate of the economy that affects the debt-to-GDP ratio, i.e; to $g_t d_{t-1}$. Hence, a more general primary balance reaction function is:

$$(3) \quad pb_t = pb_{t-1} + \alpha r_t d_{t-1} + \beta g_t d_{t-1}$$

A $\beta < 0$ would illustrate government “prudence” as a fall in the debt-to-GDP ratio reducing growth rate would lead governments to increase their primary balance. In the following we will test equations 2 and 3. More precisely we use a LSDV regression with both country- and year-fixed effects, over the period 1995-2019, first on Eurozone countries only, then on a wider set of advanced economies (see the Appendix for the full list of countries).

The first equation we test has the following form:

$$(4) \quad pb_{i,t} = \alpha i p_{i,t-1} + \gamma X_{t,i} + \delta_i + \delta_t + \varepsilon_{t,i}$$

where $i p_{i,t-1}$ are interest payments as a share of GDP of country i in year $t-1$ (that correspond to $r_t d_{t-1}$ in equation 2), δ_i country fixed effects and δ_t year fixed effects. This specification implies that we identify the effect of a larger than average interest payments ratio on the primary balance for a given country, taking into account cyclical components common to all countries. We also add various controls $X_{t,i}$, such as lagged primary deficit and GDP.

The second equation we test has the following form:

$$(5) \quad pb_{i,t} = \alpha i p_{i,t-1} + \beta g_{i,t-1} d_{i,t-1} + \gamma X_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t}$$

For the interest payments the lag structure is important in that, as quite intuitively governments react in year t to interest payments of year $t-1$.

2. Empirical results

The results for equation (4) are given in Table 1. A Breusch-Pagan test of our baseline model indicates cross-sectional dependence in the error terms. Therefore, we correct all standard errors following Beck and Katz (1995). In model (1), for Eurozone countries, the coefficient α is significant and positive. Governments react to an increase (decrease) in interest payments by increasing (decreasing) the primary balance. α is estimated around 0.7. However, controlling for lagged primary deficit the coefficient falls to around 0.5 (model 2). Controlling for the debt-to-GDP ratio as in Bohn (1998) (model 3), the ten-year interest rate (model 4) and the lagged average implicit interest rate (model 5) reduces further the coefficient or makes it insignificant. This is to be expected given that interest payments as a ratio of GDP is the factor of the debt-to-GDP ratio and the average implicit interest rate. Regressions (3), (4) and (5) suggest that debt-to-GDP dynamics rather than interest rates drive the result on the reaction function of the primary balance.

In regression (6), we check whether the reaction function is linear. We find some weak evidence (the coefficient is statistically significant only at the 10% level) that the reaction is less strong for high interest payment ratios. In regression (7), we run the same regression as regression (2) but with the structural primary balance (based on the European Commission estimates). Taking into account temporary influences on the budget, including the economic cycle and one-off expenditure or revenue items reduces the coefficient to 0.4 but it remains very significant.

In Table 2, we first check whether this estimated reaction in the Eurozone differs for the largest economies, namely Germany, France and Italy. This does not seem to be the case. We then test whether the government reaction depends on the direction of interest payment movements, namely if it increases its primary balance when $i p_{i,t-1}$ goes up, as much as it declines it when $i p_{i,t-1}$ goes down. To do so, we interact $i p_{i,t-1}$ with a dummy for when it goes up: as such, the isolated coefficient indicates the $pb_{i,t}$ response when interest payments decline, and the interaction coefficient, when $pb_{i,t}$ increases. Resting on a potential asymmetric effect, we also check if the relation holds only near the binding of fiscal rules, namely when the deficit is close to 3%. On both tests, we find no evidence (model 2). Varying the threshold of what 'close to 3%' means (between 2.5 and 3%) does not yield significant results. In regression (3) we test equation 5, i.e. we test whether Eurozone governments react not only to the interest payments to GDP ratio but also to the second determinant of debt dynamics i.e. the variable nominal growth times debt-to-GDP ratio. Although significant and positive, the estimated coefficient is estimated close to zero. We have tested various lag structures on the growth times debt-to-GDP ratio, and none yield results different from zero.

Finally, in regression (4) we test whether this reaction function is specific to Eurozone countries among advanced economies. This indeed seems to be the case as the coefficient is not significant for non-Eurozone advanced economies in both regressions (4) and (5).

3. Conclusion

To conclude, Euro-area governments react to the differential $r_t d_{t-1} - g_t d_{t-1}$ by adjusting their primary balance. But within this differential, it is mostly the interest payments component that drive this adjustment.

Table 1. Main empirical results

	<i>Dependent variable</i>						Structural Prim. Balance, t
	Primary Balance, t (1) to (6)						
	(1)	(2)	(3)	(4)	(5)	(6)	
Interest Payments (% GDP), $t-1$	0.742 ^(***) (0.251)	0.511 ^(***) (0.133)	0.333 ^(**) (0.137)	0.151 (0.145)	0.271 ^(*) (0.141)	0.931 ^(***) (0.275)	0.436 ^(**) (0.203)
Primary Balance (% GDP), $t-1$		0.568 ^(***) (0.039)	0.600 ^(***) (0.040)	0.612 ^(***) (0.044)	0.626 ^(***) (0.041)	0.577 ^(***) (0.039)	
Debt (% GDP), $t-1$			0.025 ^(***) (0.009)	0.035 ^(***) (0.009)	0.028 ^(***) (0.008)		
Interest Rate (10-year), $t-1$				-0.126 (0.082)			
Implicit Interest Rate, $t-1$					0.030 (0.104)		
Squared Interest Paym. (% GDP), $t-1$						-0.042 ^(*) (0.024)	
Structural Prim. Balance (% GDP), $t-1$							0.389 ^(***) (0.085)
GDP (current prices)	-0.001 (0.002)	-0.0004 (0.001)	-0.0002 (0.001)	0.0003 (0.001)	0.00004 (0.001)	-0.0002 (0.001)	0.001 (0.001)
Country –and Year– Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Eurozone	Eurozone	Eurozone	Eurozone	Eurozone	Eurozone	Eurozone
Observations	478	478	447	351	431	478	215
R ²	0.553	0.708	0.731	0.746	0.741	0.710	0.841
Adjusted R ²	0.506	0.676	0.700	0.710	0.710	0.678	0.801

Notes: (*) $p < 0.1$; (**) $p < 0.05$; (***) $p < 0.01$.

Source: All standard errors are panel-corrected following Beck and Katz (1995).

Table 2. Additional results with interaction terms

	Dependent variable				
	Primary Balance (% GDP), <i>t</i>				
	(1)	(2)	(3)	(4)	(5)
Interest Payments (% GDP), <i>t-1</i>	0.526 ^(***) (0.136)	0.398 ^(**) (0.128)	0.450 ^(***) (0.133)	0.115 (0.075)	0.097 (0.095)
Primary Balance (% GDP), <i>t-1</i>	0.558 ^(***) (0.038)	0.492 ^(**) (0.035)	0.567 ^(***) (0.043)	0.762 ^(**) (0.024)	0.768 ^(**) (0.025)
Interest Paym. (% GDP), <i>t-1</i> x France	-0.399 (1.101)				
Interest Paym. (% GDP), <i>t-1</i> x Germany	-1.747 (1.063)				
Interest Paym. (% GDP), <i>t-1</i> x Italy	-0.326 (0.256)				
Interest Paym. (% GDP), <i>t-1</i> x d.Increase		-0.125 (0.273)			
Interest Paym. (% GDP), <i>t-1</i> x d.BB < -2.5%		0.094 (0.137)			
Interest Paym. (% GDP), <i>t-1</i> x d.BB < -2.5% x d.Increase		0.414 (0.369)			
Interest Paym. (% GDP) <i>t-1</i> x d.Eurozone				0.264 ^(**) (0.102)	0.240 ^(**) (0.119)
Debt, <i>t-1</i> * Growth, <i>t-1</i>			0.001 ^(***) (0.0003)		-0.0003 ^(*) (0.0002)
Debt, <i>t-1</i> * Growth, <i>t-1</i> x d.Eurozone					0.001 ^(**) (0.0004)
GDP (current prices)	-0.003	-0.0002	-0.0004	-0.0001 ^(**)	-0.0001 ^(***)
Country –and Year– Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	478	478	447	840	791
Sample	Eurozone	Eurozone	Eurozone	Adv. economies	Adv. economies
R ²	0.711	0.735	0.729	0.744	0.756
Adjusted R ²	0.678	0.703	0.698	0.728	0.740

Notes: (*) $p < 0.1$; (**) $p < 0.05$; (***) $p < 0.01$.

Source: All standard errors are panel-corrected following Beck and Katz (1995).

Appendix

List of countries used in the analysis

Euro Country: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain.

Non-Euro Advanced Economies: Albania, Australia, Bulgaria, Canada, Croatia, Czechia, Denmark, Hungary, Iceland, Japan, Korea, Mexico, Montenegro, New Zealand, North Macedonia, Norway, Poland, Romania, Serbia, Sweden, Switzerland, Turkey, United Kingdom, United States.

Data details and sources

Variable	Unit	Source
Primary Balance	% of GDP	European Commission (AMECO)
Structural Primary Balance	% of potential GDP	European Commission (AMECO)
Interest Payments	% of GDP	European Commission (AMECO)
GDP	Millions Euros	European Commission (AMECO)
Debt Interest Rate	% of GDP Percentage	IMF (World Economic Outlook) Macrobonds

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