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Abstract

This paper contributes to the empirical investigation of the causality relations between real GDP growth and the growth of three debt categories, namely public, foreign and private debt, in the universe of the 28 European Union countries during the past decade. By using panel Granger causality estimations, we find nonstatistically significant causality between foreign debt and economic growth and the limited importance of the causality between private debt and real GDP growth. On the contrary, the results obtained show statistically relevant bidirectional causality relations between public debt and economic growth, and this is true before and after the outbreak of the recent financial crisis. Moreover, there is clear evidence of economic growth's contribution to the decrease in public debt.

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Debt and economic growth in the European Union: what causes what?

1. Introduction

The recent global financial crisis increased concerns about the possible consequences of high debt levels on economic growth in many countries and regions around the world, especially in European Union countries. Authors such as Reinhart and Rogoff (2009, 2010) support that not only may financial crises contribute to the increase of debt, particularly public debt, but also the ways in which this debt builds up, as well as the defined payment strategies, can have important economic impacts, especially in cases of high debt levels, when they will constitute real restrictions to economic growth.

However, the issue of whether debt affects growth or, on the contrary, economic growth causes debt (or even if there is support for both directions of causality) is still far from consensus. Further, the possibility of existence and the direction of causality relations between debt and growth is still a timely object of theoretical discussion and empirically testing.

Most of the known empirical studies have concentrated on the importance of foreign debt in developing countries. Fewer works have empirically tested the influence of public debt on economic growth in advanced economies and their results are inconclusive (as well documented in Panizza and Presbitero, 2013). Some of these analyses are aware that reverse causality from low growth to high public debt may exist and that an endogeneity problem may arise, and they have attempted to overcome this problem by using the instrumental variable approach (see, among others, Pattillo et al., 2004; Cordella et al., 2005; Presbitero, 2010).

In what concerns the influence of private debt, Reinhart and Rogoff (2010) believe that for the years immediately following the crisis, private debt, in contrast to public debt, tended to shrink sharply for an extended period. Checherita-Westphal and Rother (2012) also consider that the stock of private debt is an important additional variable to keep in mind when investigating the relationship between public debt and economic growth. In particular, the negative impact of public debt on growth could conceivably be stronger in countries with high private debt burdens. Simultaneously, Nersisyan and Wray (2010) underline that we should not consider that "debt is debt" because there are important differences between private and public indebtedness, namely the fact that for a government with a sovereign currency, there is no imperative to borrow.

This paper seeks to contribute to the analysis of the causality relations between three different kinds of debt categories, namely public, foreign and private debt, and economic growth in the 28 member states of the EU during the past decade. It also analyses the possible differences after the outbreak of the recent financial crisis considering two panels: 2001–2012 and 2007–2012.

The main findings point to some clear differences in the Granger causality relations between the three considered debt categories and economic growth. The results confirm the statistically relevant bidirectional causality relations between public debt and economic growth. Moreover, for both time periods, the results obtained are stronger for the causality running from real GDP growth to the growth in public debt than for the reverse causality running from public debt to economic growth. Furthermore, there is evidence of some Keynesian effects documented by the clear positive causality running from public debt to economic growth and these effects were particularly strong for the years after the outbreak of the recent global financial crisis (here represented by 2007–2012).

The results obtained for foreign debt point to statistically weaker causality relations between this debt and the economic growth rate in EU countries but there is still a general tendency towards positive bidirectional causality relations between foreign debt and economic growth. Finally, for private debt the results point to its relevance for the economic growth of EU countries during the past decade and there is clear evidence of negative causality running from private debt to the real GDP growth rate for the entire time period (2001–2012).

The remainder of the paper is organised as follows: section 2 presents the relevant theoretical and empirical references; section 3 describes the adopted methodology and data; section 4 reports the main results obtained and section 5 concludes.

2. Relevant theoretical and empirical references

The theoretical literature mostly analyses the relationship between public debt and economic growth and tends to defend that, in the short run, and particularly at moderate levels of government debt, there are Keynesian effects, meaning that public expenses clearly contribute to economic growth (supported, among others, by Elmendorf and Mankiw, 1999).

However, in the long run and in the presence of high levels of government debt, non-Keynesian effects will take place. There are fears that the payment of this high debt will imply future increases in taxes, contributing to a reduction in private consumption and investment expenses and consequently slowing down economic growth, as supported by the neoclassical view (e.g. Modigliani, 1961; Diamond, 1965; Saint-Paul, 1992; Aizenman et al., 2007).

There is also another theoretical explanation, known as the Ricardian equivalence, which, in contrast with the two previous views, defends that public indebtedness does not affect economic growth. According to the Ricardian equivalence proposition (see, among others, Barro, 1989; Galí et al., 2007), an increase in public expenses may accelerate economic growth in one period. However, afterwards, economic agents will react and in the presence of tax rises and other austerity measures, they will decrease their consumption and investment expenses, slowing down economic growth and compensating for the effect of the public expenses increase on economic growth.

Empirically, few works have tested the relationship between debt and economic growth and their findings are far from conclusive. Most of the known empirical studies address the relationship between external debt and growth, focusing on developing countries. Among these works, for instance, Pattillo et al. (2004) use a panel dataset of 61 developing countries over the period 1969–1998 and conclude that, on average, for countries with high debt, doubling debt will reduce output growth by about 1 percentage point. At the same time, Cordella et al. (2005) analyse how the debt–growth relationship varies with indebtedness levels in an unbalanced panel of 79 developing countries over the period 1970–2002 and conclude that there is a negative marginal relationship between debt and growth at intermediate levels of debt, but not at very low debt levels. Schclarek (2004) applies the system generalised method of moments (GMM) dynamic panel econometric technique to a data set consisting of a panel of 59 developing countries and 24 industrialised countries with data averaged over each of the seven five-year periods between 1970 and 2002. For developing countries, the author finds that lower total external debt levels are associated with higher growth rates and that this negative relationship is driven by the incidence of public external debt, but not by private external debt. Moreover, the author does not find any support for an inverted U-

shaped relationship between external debt and growth. Further, particularly for industrialised countries, he finds no robust linear or nonlinear relationship between gross government debt and economic growth, suggesting that higher public debt levels are not necessarily associated with lower GDP growth rates in developed countries.

Pattillo et al. (2011), also using a panel for 1969–1998 but now of 93 developing countries, analyse the impact of external debt and debt reduction on growth, with different panel estimation techniques (i.e. fixed effects and dynamic system GMM). They find that the average impact of debt on per capita growth seems to become negative for debt levels above 30–40% of GDP but that the marginal impact becomes negative for debt levels around 15–20%. This study also concludes that, at low levels of external debt, the impact on economic growth seems to be positive.

In what concerns the empirically testing of public debt's influence on economic growth, Reinhart and Rogoff (2010) use simple correlation statistics to analyse the evolution of gross central government debt and the growth rate of long-term real GDP in a sample of 20 developed countries over a very long time period (1790–2009). They conclude that the relationship between public debt and economic growth depends on the level of indebtedness; more precisely, this relationship is relevant only in the presence of debt/GDP ratios above 90%. The same conclusion, pointing to the importance of the level of indebtedness, was obtained by Kumar and Woo (2010), who use econometric techniques to analyse a sample of emerging and advanced economies for 1970–2007 and also confirm the existence of a linear inverse relation between debt and economic growth.

Similar conclusions were obtained by Checherita-Westphal and Rother (2012), using data sourced from the AMECO database and considering a sample of 12 Eurozone countries for 1970–2011. They point to the existence of a concave, inverted U-shaped

relationship between public debt and the economic growth rate with the debt turning point at about 90–100% of GDP. Closely in line with this research, Baum et al. (2013), also using AMECO and data for 12 Eurozone countries but for the interval 1990–2010, conclude that the short-run impact of debt on GDP growth is positive and highly statistically significant, but decreases to around zero and loses significance beyond public debt-to-GDP ratios of around 67%. Furthermore, for debt to GDP ratios above 95%, additional debt has a negative impact on economic activity.

At the same time, Afonso and Jales (2013), using a panel of 155 countries over the period 1970–2008, assess the links between economic growth, total factor productivity and government debt. They conclude that there is a general negative effect of government debt on growth. In particular, for the subsample including OECD countries, there is evidence that the average growth rates of the countries with low debt to GDP ratios (lower than 30%) are similar to those of countries with high debt ratios (higher than 90%).

Simultaneously, Égert (2013) tests the Reinhart and Rogoff (2010) dataset by using formal econometric methods in order to see whether public debt has a negative nonlinear effect on growth if public debt exceeds 90% of GDP. Égert (2013) concludes that the negative relationship between debt and growth is sensitive to modelling choices (including the time dimension, country coverage considered, data frequency and assumptions on the minimum number of observations required).

Concentrating on advanced economies, Panizza and Presbitero (2013) survey the recent literature on the links between public debt and economic growth and conclude that although most empirical works using simple back-of-the-envelope calculations suggest the existence of a negative effect on economic growth, this effect is likely to be small. Furthermore, when more sophisticated models are used, they yield uncertain results on

the relationship between debt and growth. In addition, in what concerns the correlations and possible causality relations between debt and growth, Panizza and Presbitero (2012, 2013) point to the fact that a negative correlation between debt and growth does not by itself imply causality because low economic growth leads to high levels of debt.

As regards the empirical estimations concentrating on the causality relations between debt and growth, recent empirical tests have provided some answers but they are still rather inconclusive. On one side, we have works supporting the (mostly negative) causality running from debt to economic growth. Among these contributions, Chowdhury (2001) uses panel causality tests to analyse the impact of foreign debt on growth in low and middle income countries, covering 1982–1999, and concludes that the causality runs from debt to growth, with a significant negative causal impact of debt on growth.

Pattillo et al. (2004) find evidence of a negative and significant causality effect running from total external debt to economic growth (even after accounting for the possible endogeneity of debt to the growth process). These authors also state that their results are shown to be compatible with a simultaneous significant effect of growth on debt ratios, as suggested, for instance, by Easterly (2001).

On the other side, some authors find empirical evidence that confirms the existence of causality occurring between output growth and debt ratios. Representing this strand of the literature, Easterly (2001) maintains that lower growth decreases tax revenues and primary surpluses, and without adjustment, debt ratios will explode, as occurred after the worldwide slowdown in growth in the 1970s. This growth slowdown was an important cause of the debt crises in middle income countries in the 1980s, the crisis in highly indebted poor countries in the 1980s and 1990s and the increased public debt burden of industrialised countries in the same decades.

Finally, there is also empirical support for both directions of causality between debt and growth. For instance, Abbas and Christensen (2007) use a specific public domestic debt database, covering 93 low income countries and emerging markets over 1975–2004, and apply Granger causality regressions and panel data methods to test the relationship between debt and economic growth. They conclude that there is bidirectional and statistically significant causality; public domestic debt has a strong positive impact on per capita income and although not as statistically strong, economic growth also has a clear positive impact on public domestic debt.

Jayaraman and Lau (2009) apply panel Granger causality estimations to examine the relationship between external/public debt and economic growth in six Pacific island countries during 1985–2004. Their empirical results indicate a lack of evidence of a long-run Granger causality relationship between real output and the external debt to GDP ratio or between the same output index and the budget deficit to GDP ratio; however, in the short run, there is a significant causal relationship running from external debt and also budget deficit to output. In regard to the reverse relationship, in the long run, the results also point to the absence of causality; and in the short run, there is evidence of Granger causality running from output to external debt but not from output to public deficit.

Butts (2009) also empirically tests the direction of the Granger causality relationship between economic growth and short-term external debt in 27 Latin American and Caribbean countries over the period 1970–2003. The main results of this work suggest the existence of bidirectional causality relationships between the two variables for several countries, which means that the performance of both variables is interrelated. There is also clear evidence that in the short and long run, Granger causality from

economic growth to short-term external debt is present in 13 Latin American and Caribbean countries.

Ferreira (2009) addresses the Granger causality relationship between public debt and GDP, more precisely between the growth in real GDP per capita and public debt, represented by the current primary surplus/GDP and gross government debt/GDP ratios. By using OECD annual data for 20 countries between 1988 and 2001, clear Granger bidirectional causality was found.

3. Methodology and data

We use a methodology based on panel Granger causality tests because we want to analyse the direction of the causality relations between economic growth and the different debt categories. More precisely, we want to test if the evolution of debt precedes economic growth or, on the contrary, if economic growth precedes the different kinds of debt (or even if these relationships are bidirectional).

We follow the conventional Granger causality test (Granger, 1969) as well as more recent approaches developed to analyse the existence of causality relationships among variables in panels by such authors as Nair-Reichert and Weinhold (2001), Kónya (2006) and Bangake and Eggoh (2011).

According to this Granger causality concept, correlation does not imply causality and a cause cannot come after its effect. This means that a variable, X, is said to Granger cause another variable Y, if the current value of this variable Y (Y_t) significantly depends on the past values of the variable X, that is, X_{t-1}, X_{t-2}, … (but not on its present value, X_t). Under these conditions, the starting point of our methodology is the estimation of a general linear panel Granger causality model with two equations:

$$y_{i,t} = \alpha_1 + \sum_{k=1}^{K} \gamma_{1,i,k} y_{i,t-k} + \sum_{k=1}^{K} \beta_{1,i,k} x_{i,t-k} + \varepsilon_{1,i,t} \quad (1)$$

$$x_{i,t} = \alpha_2 + \sum_{k=1}^{K} \gamma_{2,i,k} x_{i,t-k} + \sum_{k=1}^{K} \beta_{2,i,k} y_{i,t-k} + \varepsilon_{2,i,t} \quad (2)$$

where i = 1,...,N cross units; t = 1,...,T time periods; $\alpha_{1,2}$ = intercepts; k = 1,...K lags; $\varepsilon_{1,2}$ = error terms (including not only the disturbance terms, but also the individual cross-unit specific effects).

To test Granger noncausality from x to y in equation 1 (or from y to x in equation 2), the null hypothesis is $H_o : \beta_i = 0, \forall i = 1,...,N$. The alternative hypothesis states that there is a causality relationship from x to y (or from y to x) for at least one cross-unit of the panel: $H_1 : \beta_i = 0, \forall i = 1,..., N_1;\ \beta_i \neq 0, \forall i = N_1 + 1, N_1 + 2..., N;\ \ (0 \leq \frac{N_1}{N} \leq 1)$.

In order to ascertain the strength of the Granger causality relations in each estimated equation, it is possible to analyse the joint significance by using a Wald test of the obtained β_i for the different time lags (t-1, t-2,…).

Our data are sourced from the European Commission's AMECO dataset, which is based on a commonly agreed methodology that guarantees the time and country consistency of the provided statistical information. To represent economic growth (GROWTH), we use the series of the "Real GDP growth rate - 1 year % change". The considered debt categories are proxied by the three following series:

- "General government gross debt (Maastricht debt) as a % of GDP - annual data" representing public debt (PUBDEBT);
- The country's "Net external debt as a % GDP - annual data" representing foreign debt (FORDEBT);
- The "Private debt as a % of GDP - consolidated - annual data" representing private debt (PRIVDEBT).

The dataset consists of two balanced panels, both including all 28 EU countries. The first panel is for 2001–2012 and the second one only for the subinterval of 2007–2012, as we aim to analyse the possible changes provoked by the outbreak of the recent global financial crisis.

Before proceeding with our estimations, we need to test the stationarity of the used series. The number of observations in our panels does not recommend the application of single-unit root tests for time series. Therefore, we opt to use panel unit root tests, which not only increase the power of unit root tests due to the span of the observations, but also minimise the risks of structural breaks. Among the available panel unit root tests, here we choose to use the Levin et al. (2002) test and the Im et al. (2003) test.

The Levin et al. (2002) test can be viewed as a pooled Dickey–Fuller test, or as an augmented Dickey–Fuller test, when lags are included and the null hypothesis is the existence of nonstationarity. This test is adequate for heterogeneous panels of moderate size, such as the panels used in this paper with fixed effects, and it assumes that there is a common unit root process. It implements an ADF regression

$$\Delta y_{it} = \delta_i y_{it-1} + \sum_{L=1}^{P_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad (3)$$

where i = 1,…N = cross-units of the panel; t = 1,…T = time series observations; L= 1,…, P = lag orders; d_{mt} = vector of deterministic variables, with α_m = the corresponding vector of coefficients for a particular model. Assuming that $\delta=1-\rho$ and $\rho_1 = \ldots = \rho_N$, the null hypothesis is H0: $\delta = 0$ and the alternative, H1: = $\delta < 0$.

The results presented in Table 1 allow us to reject the existence of the null hypothesis and to accept that the series are stationary.

Table 1 – Panel unit root Levin et al. (2002) test

PANEL I (2001–2012)		
Variables	**t-star**	**P > t**

"GROWTH" = First difference of the real GDP growth rate (1 year % change)	-16.37326	0.0000
"PUBDEBT" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data)	-7.57804	0.0000
"FORDEBT" = First difference of the net external debt as a % GDP - annual data	-14.87471	0.0000
"PRIVDEBT" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data)	-7.97828	0.0000
PANEL II (2007–2012)		
Variables	**t-star**	**P > t**
"GROWTH" = First difference of the real GDP growth rate (1 year % change)	-13.93477	0.0000
"PUBDEBT" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data)	-27.17360	0.0000
"FORDEBT" = First difference of the net external debt as a % GDP - annual data	-12.80286	0.0000
"PRIVDEBT" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data)	-21.25655	0.0000

The Im et al. (2003) test estimates the t-test for unit roots in heterogeneous panels and allows for individual unit root processes. It is based on the mean of the individual Dickey–Fuller t-statistics of each unit in the panel and it assumes that all series are nonstationary under the null hypothesis. The core equation, presented with this test, is the following:

$$\Delta y_{it} = \delta_i y_{it-1} + \sum_{L=1}^{P_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad (4)$$

where $\delta=1-\rho$ and ρ_i may vary across cross-sections. The null hypothesis is now H0: $\delta = 0$, for all i. The alternative, H1, considers that at least some of the individual processes might be stationary, thus, $\delta_i = 0$, for a subsample of the cross units ($i = 1, \ldots, N_j$); $\delta_i < 0$, for the rest of the cross units ($i = N_j, N_{j+1}, \ldots N$). Table 2 reports the results obtained with this test, which tend to confirm the rejection of nonstationarity.

Table 2 – Panel unit root Im et al. (2003) test

PANEL I (2001–2012)

PANEL I (2001-2012)		
Variables	**W[t-bar]**	**P-value**

"GROWTH" = First difference of the real GDP growth rate (1 year % change)	-11.462	0.000
"PUBDEBT" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (in % of GDP - annual data)	-4.140	0.000
"FORDEBT" = First difference of the net external debt in % GDP - annual data	-9.919	0.000
"PRIVDEBT" = First difference of the natural logarithm of the private debt in % of GDP (consolidated, annual data)	-4.823	0.000
PANEL II (2007-2012)		
Variables	**W[t-bar]**	**P-value**
"GROWTH" = First difference of the real GDP growth rate (1 year % change)	-2.377	0.009
"PUBDEBT" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (in % of GDP - annual data)	-8.574	0.000
"FORDEBT" = First difference of the net external debt in % GDP - annual data	-1.656	0.049
"PRIVDEBT" = First difference of the natural logarithm of the private debt in % of GDP (consolidated, annual data)	-5.206	0.000

Appendix I presents, for both panels, the summary statistics of the defined variables and the values of the correlations between economic growth and the proxies for the debt categories.

4. Results

In order to analyse the causality relations between economic growth (GROWTH) and the three debt categories presented in the previous section, we use panel estimations, which are particularly adequate for cross-section studies, in our case, covering short or medium time periods. As stated before, our dataset includes two balanced panels, both including the 28 EU countries, but one for 2001–2012 and the second for 2007–2012. Here, we compare the results obtained, for both panels, with three panel estimations, namely panel random-effects estimations (which the Hausman test shows are preferred

to panel fixed-effects estimations [1]), ordinary least squares (OLS) robust panel estimations and dynamic GMM panel estimations, which control for the potential endogeneity of the explanatory variables and reduce the potential bias in the estimated coefficients. Next, we present the results obtained for the panel Granger causality relations between economic growth and the three debt proxies.

4.1. Panel Granger causality between economic growth and public debt

Appendix II reports the obtained results with random-effects, OLS robust and dynamic GMM two-step system robust panel estimates for the causality relations between the growth of the proxy chosen to represent public debt and the real GDP growth rate.

In what concerns the causality running from public debt to economic growth, according to the results presented in the first half of Appendix II (II-A), there is evidence that the growth in public debt contributes positively to the increase in the real GDP growth rate. In general, the results are statistically more significant for Panel 2, which considers only the years after the outbreak of the recent financial crisis (2007–2012). Furthermore, for both panels, the statistically more solid results are obtained with the dynamic GMM two-step system robust panel estimates, confirming the potential adequacy and qualities of this estimation method in this kind of model and with the used variables.

On the other side, for the causality running from economic growth to public debt, the results reported in the second half of Appendix II (II-B) clearly show that, for both panels, the increase in the real GDP growth rate contributes negatively to public debt growth, although this effect is statistically stronger in the short time (t-1) than afterwards (t-2).

[1] The results obtained by using the panel fixed-effects estimations and Hausman test are not reported in the paper but they are available on request.

The estimation results presented in Appendix II are summarised in Tables 3 and 4. Table 3 clearly shows that in spite of the positive values of the Granger coefficients, representing the sums of the betas obtained with the estimation of equation (1), for Panel 1 (which considers 2001–2012) the influence of public debt on economic growth is statistically significant only when we use the dynamic GMM two-step system robust panel estimates. Moreover, in this case the Wald tests indicate that not only the growth of "PUBDEBT"$_{t-1}$ alone but also the joint influence of "PUBDEBT"$_{t-1}$ and "PUBDEBT"$_{t-2}$ are relevant to the evolution of the real GDP annual growth rate.

In what concerns Panel 2 (for 2007–2012), and still according to the values of the Granger coefficients and the Wald test results reported in Table 3, there is clear and statistically strong evidence that the growth in public debt (in t-1 and jointly in t-1 and t-2) contributes positively to the increase in the real GDP growth rate. Moreover, this is true for the results obtained with all three panel estimation methods.

TABLE 3 – CAUSALITY RUNNING FROM PUBLIC DEBT TO ECONOMIC GROWTH

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
GROWTH t-1	- ***	-	- ***
GROWTH t-2	- ***	- ***	- ***
PUBDEBT t-1	+	+	- **
PUBDEBT t-2	+	+	+ **
Constant	-	+	-
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.00 Prob > chi2 = 0.9630	F(1, 264) = 0.15 Prob > F = 0.7033	chi2(1) = 3.82 Prob > chi2 = 0.0508
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.28 Prob > chi2 = 0.8710	F(2, 264) = 0.09 Prob > F = 0.9148	chi2(2) = 9.29 Prob > chi2 = 0.0096
GRANGER COEFFICIENT	**0.3946005**	**0.2847271**	**5.66531**

PANEL 2 (2007–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
GROWTH t-1	- ***	-	- ***
GROWTH t-2	- ***	- ***	- ***

PUBDEBT t-1	+ **	+ *	+ ***
PUBDEBT t-2	+ ***	+ ***	+ ***
Constant	- **	-	-
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 3.67 Prob > chi2 = 0.0553	F(1, 102) = 3.60 Prob > F = 0.0607	chi2(1) = 6.33 Prob > chi2 = 0.0119
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 36.56 Prob > chi2 = 0.0000	F(2, 102) = 7.52 Prob > F = 0.0009	chi2(2) = 15.60 Prob > chi2 = 0.0004
GRANGER COEFFICIENT	**5.258781**	**4.497878**	**15.58635**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.
Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**PUBDEBT**" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data)

In Table 4, we summarise the results presented in Appendix II (II-B) for the causality running from real GDP growth to the growth in public debt. In all situations, namely for all panel estimation methods and for both panels, there is clear evidence of the statistically significant negative influence of economic growth on public debt. The comparison of the Wald test results reported in Tables 3 and 4 also allows us to conclude that the Granger panel causality running from economic growth to public debt is statistically much stronger that that running from public debt to economic growth.

TABLE 4 – CAUSALITY RUNNING FROM ECONOMIC GROWTH TO PUBLIC DEBT

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
PUBDEBT t-1	-	-	-
PUBDEBT t-2	+	+	+
GROWTH t-1	- ***	- ***	- ***
GROWTH t-2	-	-	-
Constant	+ ***	+ *	+ ***
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 22.43 Prob > chi2 = 0.0000	F(1, 264) = 7.47 Prob > F = 0.0067	chi2(1) = 27.25 Prob > chi2 = 0.0000
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 22.43 Prob > chi2 = 0.0000	F(2, 264) = 4.14 Prob > F = 0.0169	chi2(2) = 61.24 Prob > chi2 = 0.0000
GRANGER COEFFICIENT	**-0.0135857**	**-0.0164532**	**-0.0248126**

PANEL 2 (2007–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
PUBDEBT t-1	- **	-	- ***
PUBDEBT t-2	- ***	-	- ***

GROWTH t-1	- ***	- ***	- ***
GROWTH t-2	-	+	- **
Constant	+ ***	-	+ ***
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 7.83 Prob > chi2 = 0.0051	F(1, 102) = 7.32 Prob > F = 0.0080	chi2(1) = 14.52 Prob > chi2 = 0.0001
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 8.88 Prob > chi2 = 0.0118	F(2, 102) = 5.85 Prob > F = 0.0039	chi2(2) = 14.57 Prob > chi2 = 0.0007
GRANGER COEFFICIENT	**-0.0055294**	**-0.0084994**	**-0.0208284**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.
Dependent variable: "**PUBDEBT**" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).

4.2. Panel Granger causality between economic growth and foreign debt

Appendix III presents the results of the random-effects, OLS and GMM robust panel estimations of the Granger causality relations between economic growth and the proxy used to represent the growth in "FORDEBT" (net external debt as a percentage of GDP).

In what regards the Granger causality running from "FORDEBT" to GDP, the results reported in Table III-A of Appendix III, show that, in general terms, and for both time panels, the impact of external debt on economic growth is not statistically relevant. On the other side, for the reverse causality running from economic growth to foreign debt, the estimation results presented in Table III-B of Appendix III allow us to conclude that, although not statistically strong, there is evidence of a positive causality relation running from the real GDP growth rate to the growth in "FORDEBT" as all Granger coefficients are positive.

Tables 5 and 6 summarise the estimation results presented in Appendix III. For the panel Granger causality running from the growth rate of foreign debt to the real GDP growth rate, Table 5 clearly shows that with one exception (OLS estimations of Panel 2 and

only in the short run) this causality is not statistically strong. For Panel 2, the values of the Granger coefficients point to a positive causality but the results for Panel 1 are rather ambiguous.

TABLE 5 – CAUSALITY RUNNING FROM FOREIGN DEBT TO ECONOMIC GROWTH

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
GROWTH t-1	-***	-	-***
GROWTH t-2	-***	-***	-***
FORDEBT t-1	-	+	-
FORDEBT t-2	+	+	+
Constant	-	+	-**
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.06 Prob > chi2 = 0.8054	F(1, 264) = 0.23 Prob > F = 0.6316	chi2(2) = 1.67 Prob > chi2 = 0.4334
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.57 Prob > chi2 = 0.7508	F(2, 264) = 0.88 Prob > F = 0.4163	chi2(1) = 1.41 Prob > chi2 = 0.2356
GRANGER COEFFICIENT	**-0.0005013**	**0.0010242**	**-0.0094345**

PANEL 2 (2007–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
GROWTH t-1	-***	-	-***
GROWTH t-2	-***	-***	-***
FORDEBT t-1	+	+***	+
FORDEBT t-2	-	-	+
Constant	-**	+	-
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 1.07 Prob > chi2 = 0.3006	F(1, 102) = 33.98 Prob > F = 0.0000	chi2(2) = 0.64 Prob > chi2 = 0.7278
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 1.09 Prob > chi2 = 0.5800	F(2, 102) = 24.33 Prob > F = 0.0000	chi2(1) = 0.56 Prob > chi2 = 0.4560
GRANGER COEFFICIENT	**0.001083**	**0.0008487**	**0.0115659**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.
Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**FORDEBT**" = First difference of the net external debt as a % GDP (annual data).

The results obtained for the panel Granger causality running from real GDP to foreign debt ("FORDEBT") are summarised in Table 6. According to the values of the Granger coefficients, in all situations, economic growth has a positive impact on the growth in

"FORDEBT". This positive impact is statistically more relevant in the short run (for t-1) in Panel 1 when we opt to use the GMM estimations and in both panels when using the random-effects estimations.

TABLE 6 – CAUSALITY RUNNING FROM ECONOMIC GROWTH TO FOREIGN DEBT

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
FORDEBT t-1	-	-	-
FORDEBT t-2	-**	-	-*
GROWTH t-1	+***	+	+
GROWTH t-2	+	+	-
Constant	-	-	-
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 7.47 Prob > chi2 = 0.0063	F(1, 264) = 0.76 Prob > F = 0.3855	chi2(1) = 2.07 Prob > chi2 = 0.1501
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 7.71 Prob > chi2 = 0.0211	F(2, 264) = 0.51 Prob > F = 0.6029	chi2(2) = 2.71 Prob > chi2 = 0.2582
GRANGER COEFFICIENT	**2.030623**	**2.290539**	**17.64606**

PANEL 2 (2007–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
FORDEBT t-1	-*	-	+***
FORDEBT t-2	+***	+	-
GROWTH t-1	+*	-	+**
GROWTH t-2	+	+	-**
Constant	+	-	-**
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 3.50 Prob > chi2 = 0.0612	F(2, 102) = 1.60 Prob > F = 0.2061	chi2(1) = 3.70 Prob > chi2 = 0.0543
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 3.65 Prob > chi2 = 0.1616	F(1, 102) = 0.02 Prob > F = 0.8824	chi2(2) = 4.38 Prob > chi2 = 0.1120
GRANGER COEFFICIENT	**2.1559861**	**2.920993**	**20.71023**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.
Dependent variable: "**FORDEBT**" = First difference of the net external debt as a % GDP (annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).

4.3. Panel Granger causality between economic growth and private debt

The details of the estimation results of equations 1 and 2 presented in section 3 using the three estimations are presented in Appendix IV. As before, as well as in the first part of Appendix IV (Table IV-A), we report the results obtained for the panel Granger causality running from the growth rate of the ratio of private debt to GDP to the real GDP growth rate. These results are neither unanimous nor statistically strong but there is a general tendency pointing to the negative causality of private debt on GDP. In what concerns the reverse causality from GDP to private debt, the results obtained are presented in the second part of Appendix IV (Table IV-B). In most situations, the results are not statistically strong, showing that the real GDP growth rate is not a relevant cause of the growth rate of private debt as a percentage of GDP.

Tables 7 and 8 summarise the results presented in Appendix IV. Table 7 shows that the values of the Ganger coefficients (representing the sum of the betas obtained with the estimation of equation 1) indicate that, with only one exception, a negative influence of private debt growth on the real GDP growth rate. According to the Wald tests obtained with the dynamic GMM estimates, that is, the ones that can reduce the potential bias of the estimated coefficients and control for potential endogeneity, "PRIVDEBT", not only in the previous year (in t-1) but also in t-1 and t-2, is relevant for explaining the evolution of economic growth.

TABLE 7 – CAUSALITY RUNNING FROM PRIVATE DEBT TO ECONOMIC GROWTH

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**

GROWTH t-1	- ***	-	- ***
GROWTH t-2	- ***	- ***	- ***
PRIVDEBT t-1	-	-	- ***
PRIVDEBT t-2	- ***	+ ***	-
Constant	-	+	+
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 2.00 Prob > chi2 = 0.1573	F(1, 264) = 1.20 Prob > F = 0.2736	chi2(1) = 7.68 Prob > chi2 = 0.0056
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 12.95 Prob > chi2 = 0.0015	F(2, 264) = 7.21 Prob > F = 0.0009	chi2(2) = 10.33 Prob > chi2 = 0.0057
GRANGER COEFFICIENT	**-3.401978**	**-2.2254673**	**-51.634869**

PANEL 2 (2007–2012)

Explanatory variables	**RE**	**OLS**	**GMM**
GROWTH t-1	- ***	-	- ***
GROWTH t-2	- ***	- ***	- ***
PRIVDEBT t-1	- *	-	- *
PRIVDEBT t-2	+ *	+	+ *
Constant	- **	+	-
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 2.89 Prob > chi2 = 0.0892	F(1, 102) = 1.02 Prob > F = 0.3142	chi2(1) = 3.07 Prob > chi2 = 0.0796
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 6.41 Prob > chi2 = 0.0405	F(2, 102) = 0.87 Prob > F = 0.4221	chi2(2) = 5.50 Prob > chi2 = 0.0640
GRANGER COEFFICIENT	**0.229842**	**-0.2906386**	**-28.27636**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.
Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**PRIVDEBT**" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data).

Concerning the causality running from the real GDP growth rate to the growth rate of the private debt to GDP ratio, the results summarised in Table 8 show that although not statistically strong, in the majority of the estimations, we obtain positive Granger coefficients. This finding shows the general tendency towards the positive causality of economic growth on the growth of the private debt to GDP ratio. In addition, the results of the Wald tests clearly validate this conclusion, at least for Panel 1 (considering 2001–2012) when we opt to use the dynamic GMM, two-step system, robust panel estimations.

TABLE 8 – CAUSALITY RUNNING FROM ECONOMIC GROWTH TO PRIVATE DEBT

PANEL 1 (2001–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
PRIVDEBT t-1	+	-	+ ***
PRIVDEBT t-2	-	-	+
GROWTH t-1	+	-	+ ***
GROWTH t-2	+	-	+
Constant	+ ***	-	+ ***
Number of observations	306	306	306
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.01 Prob > chi2 = 0.9320	F(1, 264) = 0.34 Prob > F = 0.5625	chi2(1) = 19.96 Prob > chi2 = 0.0000
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.27 Prob > chi2 = 0.8722	F(2, 264) = 0.17 Prob > F = 0.8415	chi2(2) = 22.72 Prob > chi2 = 0.0000
GRANGER COEFFICIENT	**0.0008489**	**-0.0016982**	**0.0139963**

PANEL 2 (2007–2012)			
Explanatory variables	**RE**	**OLS**	**GMM**
PRIVDEBT t-1	+	+	+
PRIVDEBT t-2	-	-	-
GROWTH t-1	+	- ***	+
GROWTH t-2	+	+	-
Constant	+ ***	-	+ *
Number of observations	138	138	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.29 Prob > chi2 = 0.5915	F(1, 102) = 6.63 Prob > F = 0.0115	chi2(1) = 1.21 Prob > chi2 = 0.2718
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.46 Prob > chi2 = 0.7942	F(2, 102) = 5.89 Prob > F = 0.0038	chi2(2) = 1.88 Prob > chi2 = 0.3915
GRANGER COEFFICIENT	**0.0015719**	**-0.0021887**	**0.0041108**

+ Positive effect; - negative effect. * Statistically significant at 10%; ** statistically significant at 5%; *** statistically significant at 1%.

Dependent variable: "**PRIVDEBT**" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).

5. Concluding remarks

This paper contributes to the debate on the possible panel Granger causality relations between three debt categories (public, foreign and private debt) and economic growth in the 28 EU countries during the past decade for 2001 and 2012 and, in particular, after the outbreak of the recent global financial crisis (2007–2012).

The empirical results were obtained through three panel estimations: first, random-effects estimations (which, according to the Hausman tests are preferred to fixed-effects estimations); second, OLS robust estimations; and third, dynamic GMM robust estimations, which allow us to correct for the endogeneity problem.

The results obtained prove the existence of statistically significant bidirectional Granger causality relations between growth in public debt and the real GDP growth rate. More precisely, the analysis finds evidence of some Keynesian effects as there is a positive impact of public debt on economic growth, which is particularly clear after the outbreak of the global financial crisis (our second panel). Moreover, the results obtained for both time panels (before and after the crisis) show that reverse causality (running from economic growth to public debt) is not only negative but statistically stronger, allowing us to conclude that if EU countries increase their real GDP growth rate, they should not worry about the consequences of this increase on public debt.

Our panel Granger causality empirical estimations also confirm that foreign debt was not particularly relevant for the real GDP growth of the 28 EU countries during the past decade. The obtained Granger coefficients in general point to positive bidirectional causality between foreign debt and economic growth but the results are not statistically strong.

Regarding private debt, there is evidence of the relevance of the negative impact of its growth on real GDP growth throughout the decade (2001–2012). For the reverse causality running from economic growth to private debt, the results are not unanimous or statistically strong, but economic growth seems to contribute positively to private debt.

Summarising, our results are in line with those that underline that we should never consider that “debt is debt”. They confirm that during the past decade, for the universe

of the 28 EU countries, public debt was relevant to economic growth but, at the same time and with even more strength, economic growth had clear negative causality effects on the growth in public debt. Furthermore, these effects were statistically more relevant after the outbreak of the global financial crisis, when some EU countries faced problems with their sovereign debt.

Not surprisingly, our estimates confirm that foreign debt is not a central issue for the economic growth of developed countries. Further, not as clearly as for public debt but with statistically higher relevance than for foreign debt, the results obtained for private debt showed the negative causality effects running from this debt to economic growth as well as a general tendency towards positive causality from economic growth to the growth in the private debt to GDP ratio.

Further research is needed for a better understanding of the links between the relevant EU countries' debt levels and economic growth as well as the possible individual differences among member states as they had and still have to face different levels of indebtedness and do not evolve with the same growth rate.

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APPENDIX I – Summary Statistics and Correlations

PANEL 1 (2001–2012)

SUMMARY STATISTICS:

Variable	Mean	Std. Dev.	Min	Max	Observations
"**GROWTH**":					
overall	-.2899351	4.095345	-17.7	16.7	N = 308
between		.2284929	-.9636364	.0818182	n = 28
within		4.089174	-17.71721	16.62825	T = 11
"**PUBDEBT**":					
overall	.0345482	.1723199	-1.216305	1.232953	N = 308
between		.0452536	-.1156258	.112433	n = 28
within		.1664722	-1.207529	1.24173	T = 11
"**FORDEBT**":					
Overall	.2782466	54.50055	-421.8999	754.8	N = 308
Between		5.353607	-16.9	6.281818	n = 28
Within		54.24558	-418.3671	758.3328	T = 11
"**PRIVDEBT**":					
overall	.0460892	.0971858	-.5458403	.8897047	N = 308
between		.0298247	-.0165463	.1366998	n = 28
within		.0926528	-.5487262	.8868188	T = 11

CORRELATIONS BETWEEN ECONOMIC GROWTH AND THE THREE PROXIES OF DEBT

	"**PUBDEBT**"	"**FORDEBT**":	"**PRIVDEBT**"
"**GROWTH**"	-0.2913	-0.0761	-0.2398

PANEL 2 (2007–2012)

SUMMARY STATISTICS:

Variable	Mean	Std. Dev.	Min	Max	Observations
"**GROWTH**":					
overall	-1.007857	5.80108	-17.7	16.	N = 140
between		.4470923	-1.98	-.36	n = 28
within		5.784323	-17.48786	16.61214	T = 5
"**PUBDEBT**":					
overall	.1101316	.1622219	-.2275136	.7884574	N = 140
between		.0842311	-.0102063	.3101438	n = 28
within		.1393744	-.249131	.6402113	T = 5
"**FORDEBT**":					
Overall	1.317857	79.26713	-421.8999	754.8	N = 140
Between		12.94104	-36.94	46.76001	n = 28
Within		78.23444	-467.3421	709.3579	T = 5
"**PRIVDEBT**":					
overall	.0253331	.100566	-.2479162	.8897047	N = 140
between		.0349167	-.0527914	.1321813	n = 28
within		.0944956	-.270133	.7828565	T = 5

CORRELATIONS BETWEEN ECONOMIC GROWTH AND THE THREE PROXIES OF DEBT

	"**PUBDEBT**"	"**FORDEBT**":	"**PRIVDEBT**"
"**GROWTH**"	-0.3800	-0.0691	-0.4060

APPENDIX II – CAUSALITY BETWEEN ECONOMIC GROWTH AND PUBLIC DEBT

II - A - FROM "PUBDEBT TO "GROWTH"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.2233602	-4.08	0.000	-.4050385	-6.59	0.000
GROWTH t-2	-.346336	-6.31	0.000	-.4495522	-7.63	0.000
PUBDEBT t-1	.0324406	0.05	0.963	1.317386	1.92	0.055
PUBDEBT t-2	.3621599	0.52	0.601	3.941395	5.65	0.000
Constant	-.2603777	-1.20	0.231	-.7935379	-2.37	0.018
R-squared within	0.1618			0.6243		
R-squared between	0.2470			0.0001		
R-squared overall	0.1571			0.5605		
	Wald chi2(4) = 56.09 Prob > chi2 = 0.0000			Wald chi2(4) = 169.59 Prob > chi2 = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.00 Prob > chi2 = 0.9630			chi2(1) = 3.67 Prob > chi2 = 0.0553		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.28 Prob > chi2 = 0.8710			chi2(2) = 36.56 Prob > chi2 = 0.0000		
GRANGER COEFFICIENT	**0.3946005**			**5.258781**		

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
GROWTH t-1	-.1320992	-1.26	0.210	-.1106989	-1.09	0.280
GROWTH t-2	-.2842081	-3.59	0.000	-.3050545	-3.39	0.001
PUBDEBT t-1	.1487306	0.38	0.703	2.067587	1.90	0.061
PUBDEBT t-2	.1359965	0.28	0.783	2.430291	3.67	0.000
Constant	.4487097	0.56	0.574	-.4175678	-0.52	0.604
R-squared	0.7046			0.8102		
	F (41, 264) = 10.67 Prob > F = 0.0000			F(35, 102) = 11.68 Prob > F = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 0.15 Prob > F = 0.7033			F(1, 102) = 3.60 Prob > F = 0.0607		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 0.09 Prob > F = 0.9148			F(2, 102) = 7.52 Prob > F = 0.0009		
GRANGER COEFFICIENT	**0.2847271**			**4.497878**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.590364	-3.63	0.000	-.6336308	-8.09	0.000
GROWTH t-2	-.4085589	-9.88	0.000	-.3597416	-8.05	0.000
PUBDEBT t-1	-11.06192	-1.95	0.051	3.93417	2.52	0.012
PUBDEBT t-2	16.72723	2.76	0.006	11.65218	3.95	0.000
Constant	-.1672583	-0.86	0.390	-.4046984	-0.55	0.585

	Wald chi2(4) = 113.47 Prob > chi2 = 0.000	Wald chi2(4) = 133.62 Prob > chi2 = 0.000
Arellano-Bond test for AR(1) in first differences	z = -2.20 Pr > z = 0.028	z = -2.94 Pr > z = 0.003
Arellano-Bond test for AR(2) in first differences	z = 1.17 Pr > z = 0.242	z = 0.52 Pr > z = 0.605
Sargan test of overid. restrictions	chi2(16) = 54.41 Prob > chi2 = 0.000	chi2(4) = 6.39 Prob > chi2 = 0.172
Number of observations	306	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 3.82 Prob > chi2 = 0.0508	chi2(1) = 6.33 Prob > chi2 = 0.0119
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 9.29 Prob > chi2 = 0.0096	chi2(2) = 15.60 Prob > chi2 = 0.0004
GRANGER COEFFICIENT	**5.66531**	**15.58635**

Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**PUBDEBT**" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data).

II - B – FROM "GROWTH" TO "PUBDEBT"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
PUBDEBT t-1	-.0230818	-0.75	0.453	-.0534819	-2.05	0.040
PUBDEBT t-2	.04638	1.52	0.128	-.0702985	-2.65	0.008
GROWTH t-1	-.0114307	-4.74	0.000	-.0064314	-2.80	0.005
GROWTH t-2	-.002155	-0.89	0.373	.000902	0.41	0.683
Constant	.0371361	3.88	0.000	.1117	7.75	0.000
R-squared within	0.0768			0.2313		
R-squared between	0.0856			0.0003		
R-squared overall	0.0754			0.1484		
	Wald chi2(4) = 24.54 Prob > chi2 = 0.0001			Wald chi2(4) = 26.11 Prob > chi2 = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 22.43 Prob > chi2 = 0.0000			chi2(1) = 7.83 Prob > chi2 = 0.0051		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 22.43 Prob > chi2 = 0.0000			chi2(2) = 8.88 Prob > chi2 = 0.0118		
GRANGER COEFFICIENT	**-0.0135857**			**-0.0055294**		

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
PUBDEBT t-1	-.0773213	-1.10	0.273	-.0718823	-1.21	0.230
PUBDEBT t-2	.0110968	0.50	0.615	-.0456426	-1.22	0.227
GROWTH t-1	-.0134003	-2.73	0.007	-.011594	-2.71	0.008
GROWTH t-2	-.0030529	-0.66	0.512	.0030946	0.52	0.602
Constant	.07121	1.80	0.072	-.0061548	-0.15	0.883
R-squared	0.3264			0.4677		
	F(41, 264) = 6.07 Prob > F = 0.0000			F(35, 102) = 10.85 Prob > F = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 7.47 Prob > F = 0.0067			F(1, 102) = 7.32 Prob > F = 0.0080		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 4.14 Prob > F = 0.0169			F(2, 102) = 5.85 Prob > F = 0.0039		
GRANGER COEFFICIENT	**-0.0164532**			**-0.0084994**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
PUBDEBT t-1	-.2369149	-1.57	0.116	-.4713857	-4.04	0.000
PUBDEBT t-2	.030208	0.30	0.767	-.3362134	-3.69	0.000
GROWTH t-1	-.0195997	-5.22	0.000	-.0105937	-3.81	0.000
GROWTH t-2	-.0052129	-0.54	0.590	-.0102347	-2.15	0.031
Constant	.037641	4.30	0.000	.1201127	3.53	0.000
	Wald chi2(4) = 74.61 Prob > chi2 = 0.000			Wald chi2(4) = 42.88 Prob > chi2 = 0.000		
Arellano-Bond test for AR(1) in first differences	z = -1.53 Pr > z = 0.127			z = 1.20 Pr > z = 0.230		
Arellano-Bond test for AR(2) in first differences	z = 0.10 Pr > z = 0.920			z = 1.98 Pr > z = 0.048		
Sargan test of overid. restrictions	chi2(16) = 202.42 Prob > chi2 = 0.000			chi2(4) = 27.00 Prob > chi2 = 0.000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 27.25 Prob > chi2 = 0.0000			chi2(1) = 14.52 Prob > chi2 = 0.0001		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 61.24 Prob > chi2 = 0.0000			chi2(2) = 14.57 Prob > chi2 = 0.0007		
GRANGER COEFFICIENT	**-0.0248126**			**-0.0208284**		

Dependent variable: "**PUBDEBT**" = First difference of the natural logarithm of the general government gross debt, Maastricht debt, (as a % of GDP - annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).

APPENDIX III – CAUSALITY BETWEEN ECONOMIC GROWTH AND FOREIGN DEBT

III - A - FROM "FORDEBT" TO "GROWTH"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.2208268	-4.24	0.000	-.3851439	-6.27	0.000
GROWTH t-2	-.3549143	-6.81	0.000	-.5865605	-9.55	0.000
FORDEBT t-1	-.0002568	-0.25	0.805	.0011909	1.04	0.301
FORDEBT t-2	.0007581	0.71	0.476	-.0001079	-0.09	0.927
Constant	-.261676	-1.20	0.228	-.8783332	-2.33	0.020
R-squared within	0.1624			0.4635		
R-squared between	0.3255			0.0478		
R-squared overall	0.1579			0.4442		
	Wald chi2(4) = 56.44 Prob > chi2 = 0.0000			Wald chi2(4) = 106.29 Prob > chi2 = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.06 Prob > chi2 = 0.8054			chi2(1) = 1.07 Prob > chi2 = 0.3006		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.57 Prob > chi2 = 0.7508			chi2(2) = 1.09 Prob > chi2 = 0.5800		
GRANGER COEFFICIENT	**-0.0005013**			**0.001083**		

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			PANEL 2 (2007–2012)		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
GROWTH t-1	-.1351227	-1.28	0.203	-.1083542	-0.91	0.363
GROWTH t-2	-.2951691	-3.69	0.000	-.4631949	-4.49	0.000
FORDEBT t-1	.0001754	0.48	0.632	.0013813	5.83	0.000
FORDEBT t-2	.0008488	1.31	0.192	-.0005326	-1.14	0.255
Constant	.5585865	0.69	0.488	.7868381	0.89	0.376
R-squared	0.7060			R-squared = 0.7822		
	F(41, 264) = 10.49 Prob > F = 0.0000			F(35, 102) = 14.25 Prob > F = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 0.23 Prob > F = 0.6316			F(1, 102) = 33.98 Prob > F = 0.0000		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 0.88 Prob > F = 0.4163			F(2, 102) = 24.33 Prob > F = 0.0000		
GRANGER COEFFICIENT	**0.0010242**			**0.0008487**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS

	PANEL 1 (2001–2012)			PANEL 2 (2007–2012)		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.2702041	-3.16	0.002	-.4725111	-6.02	0.000
GROWTH t-2	-.4487575	-16.52	0.000	-.7426212	-15.33	0.000
FORDEBT t-1	-.0147765	-1.19	0.236	.0101219	0.75	0.456
FORDEBT t-2	.0083305	1.25	0.212	.0014447	0.21	0.837
Constant	-.2303014	-2.05	0.040	-.8220535	-1.15	0.251
	Wald chi2(4) = 521.88 Prob > chi2 = 0.000			Wald chi2(4) = 364.25 Prob > chi2 = 0.000		
Arellano-Bond test for AR(1) in first differences	z = -2.21 Pr > z = 0.027			z = -1.72 Pr > z = 0.086		
Arellano-Bond test for AR(2) in first differences	z = 0.65 Pr > z = 0.514			z = 2.74 Pr > z = 0.006		
Sargan test of overid. restrictions	chi2(16) = 125.28 Prob > chi2 = 0.000			chi2(4) = 57.45 Prob > chi2 = 0.000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(2) = 1.67 Prob > chi2 = 0.4334			chi2(2) = 0.64 Prob > chi2 = 0.7278		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(1) = 1.41 Prob > chi2 = 0.2356			chi2(1) = 0.56 Prob > chi2 = 0.4560		
GRANGER COEFFICIENT	**-0.0094345**			**0.0115659**		

Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**FORDEBT**" = First difference of the net external debt as a % GDP (annual data).

III - B – FROM "GROWTH" TO "FORDEBT"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			PANEL 2 (2007–2012)		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
FORDEBT t-1	-.0114182	-0.77	0.440	-.0353006	-1.77	0.077
FORDEBT t-2	-.0339712	-2.25	0.024	.0540131	2.65	0.008
GROWTH t-1	2.016653	2.73	0.006	1.9971	1.87	0.061
GROWTH t-2	.0134947	0.02	0.985	.1588861	0.15	0.882
Constant	-.1662664	-0.05	0.957	1.295007	0.20	0.843
R-squared within	0.0506			0.1177		
R-squared between	0.0721			0.3113		
R-squared overall	0.0433			0.1020		

	Wald chi2(4) = 13.61 Prob > chi2 = 0.0086	Wald chi2(4) = 15.10 Prob > chi2 = 0.0045
Number of observations	306	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 7.47 Prob > chi2 = 0.0063	chi2(1) = 3.50 Prob > chi2 = 0.0612
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 7.71 Prob > chi2 = 0.0211	chi2(2) = 3.65 Prob > chi2 = 0.1616
GRANGER COEFFICIENT	**2.030623**	**2.1559861**

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
FORDEBT t-1	-.0189398	-1.10	0.271	-.0140472	-0.44	0.661
FORDEBT t-2	-.0443514	-1.59	0.114	.0877555	1.13	0.263
GROWTH t-1	1.154316	0.87	0.385	-.1995168	-0.15	0.882
GROWTH t-2	1.136223	0.75	0.454	3.120511	1.41	0.161
Constant	-19.28817	-1.14	0.253	-24.26261	-0.80	0.423
R-squared	0.0778			0.1817		
	F(41, 264) = 0.81 Prob > F = 0.7925			F(35, 102) = 1.74 Prob > F = 0.0169		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 0.76 Prob > F = 0.3855			F(2, 102) = 1.60 Prob > F = 0.2061		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 0.51 Prob > F = 0.6029			F(1, 102) = 0.02 Prob > F = 0.8824		
GRANGER COEFFICIENT	**2.290539**			**2.920993**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
FORDEBT t-1	-.0872123	-0.80	0.424	.1733591	2.62	0.009
FORDEBT t-2	-.1307113	-1.74	0.082	-.0059937	-0.13	0.893
GROWTH t-1	20.96321	1.44	0.150	36.52501	1.92	0.054
GROWTH t-2	-3.317715	-0.61	0.543	-15.81478	-1.93	0.053
Constant	-2.820197	-0.60	0.551	-13.95315	-2.33	0.020
	Wald chi2(4) = 180.32 Prob > chi2 = 0.000			Wald chi2(4) = 37.06 Prob > chi2 = 0.000		
Arellano-Bond test for AR(1) in first differences	z = -1.28 Pr > z = 0.200			z = -1.87 Pr > z = 0.062		
Arellano-Bond test for AR(2) in first differences	z = -1.33 Pr > z = 0.183			z = -1.86 Pr > z = 0.063		
Sargan test of overid. restrictions	chi2(16) = 37.92 Prob > chi2 = 0.002			chi2(4) = 4.41 Prob > chi2 = 0.354		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 2.07 Prob > chi2 = 0.1501			chi2(1) = 3.70 Prob > chi2 = 0.0543		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 2.71 Prob > chi2 = 0.2582			chi2(2) = 4.38 Prob > chi2 = 0.1120		
GRANGER COEFFICIENT	**17.64606**			**20.71023**		

Dependent variable: "**FORDEBT**" = First difference of the net external debt as a % GDP (annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).

APPENDIX IV – CAUSALITY BETWEEN ECONOMIC GROWTH AND PRIVATE DEBT

IV - A - FROM "PRIVDEBT" TO "GROWTH"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.2581099	-4.86	0.000	-.4027601	-6.44	0.000
GROWTH t-2	-.4035555	-7.58	0.000	-.5578443	-8.94	0.000
PRIVDEBT t-1	-1.021367	-1.41	0.157	-2.043061	-1.70	0.089
PRIVDEBT t-2	-2.380611	-3.29	0.001	2.272903	1.89	0.059
Constant	-.2487082	-1.17	0.243	-.8678609	-2.35	0.019
R-squared within	0.1984			0.4849		
R-squared between	0.1489			0.0574		
R-squared overall	0.1911			0.4654		
	Wald chi2(4) = 71.11 Prob > chi2 = 0.0000			Wald chi2(4) = 115.79 Prob > chi2 = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 2.00 Prob > chi2 = 0.1573			chi2(1) = 2.89 Prob > chi2 = 0.0892		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 12.95 Prob > chi2 = 0.0015			chi2(2) = 6.41 Prob > chi2 = 0.0405		
GRANGER COEFFICIENT	**-3.401978**			**0.229842**		

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
GROWTH t-1	-.1436103	-1.31	0.190	-.1405647	-1.17	0.245
GROWTH t-2	-.3357991	-3.99	0.000	-.4529828	-4.16	0.000
PRIVDEBT t-1	-.4015023	-1.10	0.274	-1.060862	-1.01	0.314
PRIVDEBT t-2	-1.823965	-3.80	0.000	.7702234	0.70	0.486
Constant	.7586146	0.94	0.350	.7490947	0.82	0.412
R-squared	0.7165			0.7801		
	F(41, 264) = 10.86 Prob > F = 0.0000			F(35, 102) = 9.80 Prob > F = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 1.20 Prob > F = 0.2736			F(1, 102) = 1.02 Prob > F = 0.3142		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 7.21 Prob > F = 0.0009			F(2, 102) = 0.87 Prob > F = 0.4221		
GRANGER COEFFICIENT	**-2.2254673**			**-0.2906386**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
GROWTH t-1	-.7351267	-6.01	0.000	-.8081409	-4.37	0.000
GROWTH t-2	-.6027265	-9.65	0.000	-.4417446	-3.41	0.001
PRIVDEBT t-1	-49.98507	-2.77	0.006	-49.20136	-1.75	0.080
PRIVDEBT t-2	-1.649799	-0.96	0.335	20.925	1.84	0.066
Constant	.0946618	0.14	0.886	-.0289164	-0.03	0.974
	Wald chi2(4) = 178.95 Prob > chi2 = 0.000			Wald chi2(4) = 366.41 Prob > chi2 = 0.000		

Arellano-Bond test for AR(1) in first differences	z = -1.27 Pr > z = 0.205	z = -1.75 Pr > z = 0.081
Arellano-Bond test for AR(2) in first differences	z = -1.44 Pr > z = 0.151	z = 0.26 Pr > z = 0.793
Sargan test of overid. restrictions	chi2(16) = 14.36 Prob > chi2 = 0.572	chi2(4) = 4.41 Prob > chi2 = 0.353
Number of observations	306	138
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 7.68 Prob > chi2 = 0.0056	chi2(1) = 3.07 Prob > chi2 = 0.0796
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 10.33 Prob > chi2 = 0.0057	chi2(2) = 5.50 Prob > chi2 = 0.0640
GRANGER COEFFICIENT	**-51.634869**	**-28.27636**

Dependent variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change); explanatory variable: "**PRIVDEBT**" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data).

IV - B - FROM "GROWTH" to "PRIVDEBT"

RANDOM-EFFECTS ESTIMATIONS

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
PRIVDEBT t-1	.0100897	0.53	0.594	.0347807	1.25	0.210
PRIVDEBT t-2	-.0294696	-1.55	0.120	-.0324014	-1.17	0.242
GROWTH t-1	.0001189	0.09	0.932	.0007738	0.54	0.591
GROWTH t-2	.00073	0.52	0.601	.0007981	0.55	0.579
Constant	.0463948	8.31	0.000	.0238753	2.80	0.005
R-squared within	0.0136			0.0305		
R-squared between	0.0001			0.0002		
R-squared overall	0.0122			0.0265		
	Wald chi2(4) = 3.73 Prob > chi2 = 0.4437			Wald chi2(4) = 3.63 Prob > chi2 = 0.4589		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 0.01 Prob > chi2 = 0.9320			chi2(1) = 0.29 Prob > chi2 = 0.5915		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 0.27 Prob > chi2 = 0.8722			chi2(2) = 0.46 Prob > chi2 = 0.7942		
GRANGER COEFFICIENT	**0.0008489**			**0.0015719**		

OLS ROBUST ESTIMATIONS (*)

	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**t**	**P>|t|**	**coef.**	**t**	**P>|t|**
PRIVDEBT t-1	-.0065275	-0.49	0.625	.0191238	0.33	0.745
PRIVDEBT t-2	-.0519649	-1.35	0.179	-.0323067	-1.03	0.306
GROWTH t-1	-.0013251	-0.58	0.563	-.0041618	-2.58	0.011
GROWTH t-2	-.0003731	-0.14	0.892	.0019731	1.11	0.271
Constant	-.0328288	-1.10	0.274	-.012064	-0.50	0.621
R-squared	0.3178			0.4352		
	F(41, 264) = 5.97 Prob > F = 0.0000			F(35, 102) = 6.73 Prob > F = 0.0000		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	F(1, 264) = 0.34 Prob > F = 0.5625			F(1, 102) = 6.63 Prob > F = 0.0115		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	F(2, 264) = 0.17 Prob > F = 0.8415			F(2, 102) = 5.89 Prob > F = 0.0038		
GRANGER COEFFICIENT	**-0.0016982**			**-0.0021887**		

(*)Year and country dummies are included in these OLS estimations and their specific results are available on request.

DYNAMIC GMM, TWO-STEP SYSTEM, ROBUST ESTIMATIONS						
	PANEL 1 (2001–2012)			**PANEL 2 (2007–2012)**		
	coef.	**z**	**P>|z|**	**coef.**	**z**	**P>|z|**
PRIVDEBT t-1	.0846625	2.59	0.010	.4919798	0.68	0.499
PRIVDEBT t-2	.0319225	1.15	0.248	-.6365268	-0.68	0.498
GROWTH t-1	.0116363	4.47	0.000	.0059178	1.10	0.272
GROWTH t-2	.002346	0.73	0.464	-.001807	-0.18	0.859
Constant	.0401988	6.08	0.000	.0198653	1.71	0.087
	Wald chi2(4) = 33.62 Prob > chi2 = 0.000			Wald chi2(4) = 74.96 Prob > chi2 = 0.000		
Arellano-Bond test for AR(1) in first differences	z = -1.58 Pr > z = 0.114			z = -0.70 Pr > z = 0.485		
Arellano-Bond test for AR(2) in first differences	z = -1.39 Pr > z = 0.164			z = 0.10 Pr > z = 0.918		
Sargan test of overid. restrictions	chi2(16) = 177.53 Prob > chi2 = 0.000			chi2(4) = 10.42 Prob > chi2 = 0.034		
Number of observations	306			138		
WALD TEST ($\beta_{t-1} = 0$)	chi2(1) = 19.96 Prob > chi2 = 0.0000			chi2(1) = 1.21 Prob > chi2 = 0.2718		
WALD TEST ($\beta_{t-1} = \beta_{t-2} = 0$)	chi2(2) = 22.72 Prob > chi2 = 0.0000			chi2(2) = 1.88 Prob > chi2 = 0.3915		
GRANGER COEFFICIENT	**0.0139963**			**0.0041108**		

Dependent variable: "**PRIVDEBT**" = First difference of the natural logarithm of private debt as a % of GDP (consolidated, annual data); explanatory variable: "**GROWTH**" = First difference of the real GDP growth rate (1 year % change).