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THE RECENT SOVEREIGN DEBT CRISIS IN THE EURO ZONE: A MATTER OF FUNDAMENTALS?

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The idea that the Euro zone sovereign debt crisis was caused by structural weaknesses degenerating into fundamental macroeconomic imbalances in the peripheral countries prevails among international institutions such as the IMF, the ECB, and the European Commission. On the contrary, some economists believe that this crisis is the consequence of major deficiencies in the architecture of economic policy making in the Euro zone that did not allow a proper response to a global systemic crisis of the financial markets that started in the United States. The objective of this paper is to provide a better understanding of the public debt dynamics in the EU, differentiating the case of Euro zone peripheral countries. We used quarterly data from 2000 to 2011 to estimate a small-scale model that takes into account the interactions between key variables. Our results do not support entirely the official view. We conclude that the cause of the adverse debt dynamics unravelling after 2007 was a sharp GDP contraction, coupled with a substantial increase in the interest cost of debt finance due to higher self-fulfilling solvency risks perceived by creditors, interacting with a higher sensitiveness of Euro zone peripheral countries to fundamentals.

Keywords: Euro zone, macroeconomic imbalances, sovereign debt crisis

JEL classification indices: H2, H5, H6

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1. INTRODUCTION

The peripheral Euro zone countries are going through a severe crisis in their public finances. Greece, Ireland, Portugal, and Cyprus have been bailed out by the European Commission, the European Central Bank (ECB), and the International Monetary Fund (IMF), following a sharp increase in their sovereign bonds' yields. On the other hand, Spain and Italy were forced to apply austerity measures to avoid similar intervention.

The association between large stocks of public debt, due to irresponsible fiscal and budgetary policies, and key structural weaknesses has become the mainstream explanation for the problems of the Euro zone peripheral countries (see ECB 2012). According to the proponents of this view, which was adopted by the above-mentioned international institutions, the solution is to implement austerity measures (mainly on the government expenditures side) to quickly consolidate public budgets,[1] even if at the expense of a recession and of a substantial increase in the unemployment rate, alongside structural reforms, such as privatisation and liberalisation of goods and labour markets. These measures are viewed as necessary in order to regain the trust of the financial markets, and as a pre-condition for renewed sustainable real growth (see, e.g., Alesina et al. 2012).[2]

In contrast, other economists believe that the European crisis is the consequence of major deficiencies in the architecture of economic policy making in the Euro zone that did not allow for a proper response to a global systemic crisis of the financial markets that started in the United States (e.g., De Grauwe 2012 and Krugman 2012a). In this perspective, the European crisis did not result from excessive public indebtedness before the crisis,[3] or from inappropriate fiscal policy interventions adopted by peripheral countries in the wake of the financial crisis.[4]

The first major deficiency is that the Euro zone member states issue debt in a currency that they do not control, and for which they have no lender of last resort. When a country does not control the currency's issuing central bank, there is no

1 Austerity measures are a condition for provision of assistance to the Euro zone peripheral countries.

2 This idea has its roots in Giavazzi – Pagano (1990), who contend that a large and decisive deficit reduction by means of spending cuts can have expansionary effects.

3 With the possible exception of Greece, where major violations of the euro's fiscal rules did occur.

4 Indeed, according to the European Commission (2009b: 69), the fiscal stimulus was broadly in line with the distribution of EU member states' needs, and room of manoeuvre to apply fiscal policy. Notably, with the exception of Spain, the Euro zone peripheral countries that are presently facing a debt crisis applied a fiscal stimulus that was lower than the EU average (see European Commission 2009a, Table 2: 16).

guarantee that there will always be enough money to pay out the bond holders. In addition, there are no large and sustainable fiscal transfers among Euro zone countries to deal with asymmetric shocks that frequently occur in an area that is not an optimal currency area in a Mundellian (1961) sense (e.g., Krugman 2012b). Consequently, the debt of a country is not guaranteed by the other Euro zone members. Without these guarantees, bond markets are prone to liquidity crisis and contagion (as it happened with Ireland, Portugal, Italy, and Spain). Therefore, a market confidence crisis on a country's ability to fulfil its commitments as a debtor may actually lead to its default (even in the presence of sound fundamentals) and, in so being, expectations are self-fulfilling (see Obstfeld 1996). In this case, a country can become insolvent just because investors fear its insolvency (e.g., De Grauwe 2012 and Krugman 2012a). Moreover, in times of high uncertainty, investors typically prefer safer and more liquid assets (the flight-to-safety effect). In such cases, countries can become entrapped in a bad debt equilibrium, meaning that the increased debt service due to a higher risk premium,[5] with everything else equal, implies a higher probability of default or repudiation of sovereign debt (Calvo 1988).

The second major fragility is that there are no mechanisms in the Euro zone to prevent the accumulation of large external macroeconomic imbalances. Within a monetary union, a dynamic internal demand excessively biased towards non-tradable goods, in a context of a continuous appreciation of the real effective exchange rate for the peripheral countries, and fuelled by credit expansion, led these countries to experience growing current account deficits until 2007 (see *Figure 1f*) – matched by huge surpluses in Germany – and contributed to investors' fears about the ability of the Euro zone peripheral countries to finance the expansionary fiscal policies needed to compensate for the effects of the financial crisis, without endangering public finances (Krugman 2012a). This may well be the consequence of investors understanding the existence of a trilemma connected with the design of the Euro. In fact, in a context of no fiscal transfers, and no central bank acting as a lender of last resort, a country (like Germany) cannot have a perpetual trade surplus without bankrupting its trade partners (Bibow 2012).

Even if government economic policies produce improved external accounts, this might well worsen the country's creditworthiness if achieved at the cost of a severe recession, which makes the objectives of fiscal consolidation and reduction of current account deficits incompatible in the absence of the exchange rate

[5] Mody (2009) and Caceres et al. (2010) documented that general risk perception plays a major role in explaining government bond yields differentials.

instrument. This problem can be aggravated if central Euro zone countries simultaneously apply austerity measures (as they are currently doing), regardless of their fiscal stance, which deprive global demand (Krugman 2012a).

In the context of these two different perspectives regarding the causes of the Euro zone crisis, the objective pursued by this paper is to provide a better understanding of the public debt dynamics in the EU, and to uncover to what extent the Euro zone debt crisis was the result of bad economic fundamentals. We used data for the 27 Euro zone countries and studied if in this context there were different reactions of the debt to GDP ratio and long-term government bond yields to fundamentals in the Euro zone peripheral countries, which have a reduced influence over the monetary policy conceived and executed by the ECB, for which reason they are in a situation close to emerging countries that issue debt in foreign currencies, which they do not control.

We start by offering preliminary evidence on the relationship between a broad set of potential fundamental determinants of the Euro zone debt crisis on the eve of the international financial crisis (second quarter of 2007), the behaviour of the debt to GDP ratio, and the yields on long-term government bonds from 2007 to the present. After that, we analyse the dynamics of the debt to GDP ratio using a small-scale model estimated by the seemingly unrelated regression (SUR) method applied to panel data to account for interactions between the key variables. Both approaches are free of endogeneity problems.

The paper is organised as follows: Section 2 briefly describes the recent development of public debt to GDP ratio in the peripheral Euro zone countries in the context of the EU, and its relation with fundamentals on the eve of the financial crisis. Section 3 describes the model to be tested and the data set used. Section 4 presents and discusses the estimated results concerning the public debt dynamics, and Section 5 draws conclusions.

2. THE RECENT DEBT DYNAMICS IN THE EURO ZONE PERIPHERAL COUNTRIES

From the first quarter of 2000 to the second quarter of 2008, the debt to GDP ratio fell in most of the European Union countries *(Figure 1a).* These dynamics were most probably the outcome of good growth performance (in some cases, like Ireland and Spain, fuelled by a credit and real estate bubble) and low interest rates that kept debt servicing costs well below historical averages, but also the result of the Stability and Growth Pact that limits the size of annual budget deficit to GDP ratio at 3% and the debt to GDP ratio at 60%.

In spite of a high average initial debt to GDP ratio, Portugal, Ireland, Italy, Greece, and Spain also experienced the same downward movement as a group *(Figure 1a).* Actually, there was a sharp reduction of the public debt to GDP ratio in Spain, Ireland, and also in Greece, a downward trend with some ups and downs in Italy; whereas in Portugal there was no downward trend and the best one observes is a stabilisation of the variable between 2005 and the public assertion of the crisis, after an upward trend dating back from 2000.

From the first quarter of 2000 to the second quarter of 2008, the Euro zone peripheral countries' debt to GDP ratio trend was similar to that of the non-peripheral countries. Moreover, the data reveal that, at least in some cases, maximum observed values for the debt to GDP ratio in the Euro zone peripheral countries in the first quarter of 2011 were below or close to those of member states where a sovereign debt crisis did not unfold. For example, Spain's ratio of 65.7% was below that of Belgium (114.1%), Austria (74.8%), Germany (83.2%), France (85.4%), and the UK (80%), and close to Sweden's (61.6%) and Denmark's (56.1%). The same is true for Italy in comparison to Belgium.

In addition, the sudden increase of the debt to GDP ratio in the second quarter of 2008 is not a phenomenon limited to the Euro zone peripheral countries, but rather an international event observed in many EU economies and in the United States, although without the same implications. In the period from the second quarter of 2008 to the second quarter of 2011, sovereign debt in the EU increased from 43% of GDP to 63% on average, whereas the primary budget to GDP ratio decreased from 0.9% to –2.1% *(Figure 1b).*[6] Given the severity of the financial and economic crises starting in August 2007, the sudden and substantial increase in the debt to GDP ratio starting in the second quarter of 2008 can be directly linked to the sudden slowdown of GDP growth in the European Union *(Figure 1c)* and the parallel rise in the unemployment rate *(Figure 1d).* It is worth noting that the behaviour of the average values of the debt to GDP ratio, primary surplus to GDP ratio, GDP growth, and average unemployment rates among peripheral and non-peripheral EU countries are very similar prior to 2010 and quite dissimilar thereafter. And the same is true for long-term yields on government bonds *(Figure 1e).*

The observed increase of sovereign debt as a proportion of GDP might be rationalised under three possible reasons. Firstly, GDP adjusts far more quickly than debt, in such a way that in the face of a GDP contraction, governments have no means to lower debt in the same proportion. *Ceteris paribus,* that ratio would necessarily go up but, on top of this, automatic stabilisers at the country level lead to a decrease in fiscal revenues and to an increase in primary expenditures,

[6] We are relying on data from IMF – International Financial Statistics.

mainly in the form of social transfers related to unemployment subsidies and the like, implying a deterioration of the budget balance. This transmission mechanism is, indeed, in line with the findings by Reinhart – Rogoff (2009), according to whom public debt increases more than 80% after a deep financial crisis due to a slower real growth rate, or even recession. Therefore, a drop in the real growth rate can explain why debt stocks sustainable under the previous growth regime become unsustainable under a low growth regime (Easterly 2001).[7] Second, the discretionary fiscal policies executed at the beginning of the financial crisis to stimulate real GDP[8] and promote bank recapitalisations also added to the public debt to GDP ratio. Finally, this dynamic was exacerbated by real interest rate increases on sovereign bonds, mainly among Southern European countries, but also in Ireland.

Thus, the question arises: why did such a crisis blow up among what are now known as Euro zone peripheral countries immediately after the announcement of the new Pasok leader in October 2009 that the budget deficit and the debt levels of Greece were much higher than had been previously reported, and why were other countries with similar debt to GDP ratios spared?

To provide preliminary evidence on the role of fundamentals on the sovereign debt crisis in the Euro zone, we start by analysing the bi-variate relationship between some macroeconomic fundamentals on the eve of the financial crisis (second quarter of 2007), and the variation in the public debt to GDP ratio from the second quarter of 2007 to the second quarter of 2012.[9]

We consider the most common fundamental variables found in the literature, grouped in indicators of (a) expected insolvency; (b) liquidity; (c) external competitiveness; and (d) structural weaknesses. We focus on three indicators of expected insolvency:[10] (i) the stock of debt to GDP ratio; (ii) the primary budget balance to GDP ratio; and (iii) the average real rate of growth of GDP.[11] We take

[7] This is in line with the European Commission (2009b) that concludes that the increase in public debt following crisis periods can be attributed, to a great extent, to the effects of the crisis itself, irrespective of the problems in the banking sector or the fiscal stimulus packages applied by governments.

[8] According to the European Commission (2009b: 148), about one-third of the deterioration of the fiscal balance was due to discretionary fiscal measures, and the rest was attributable to the automatic stabilisers. The European Commission (2009b) added that over the short term, interest payments were expected to increase only slightly (which obviously did not happen for many EU countries).

[9] In this way, we avoid completely the problem of endogeneity.

[10] See, e.g., Eaton – Gersovitz (1981); McFadden et al. (1985) and Reignhart – Rogoff (2009).

[11] In the case of the rate of growth of real GDP, we consider the average value from the first quarter of 2000 to the second quarter of 2007.

the share of short-run debt on total public debt as a proxy for liquidity.[12] We consider as indicators of external competitiveness: (a) the current account balance as a proportion of GDP; (b) the real effective exchange rate; and (c) the employment in the construction sector.[13] As a proxy for labour market rigidity, we use the 2007 Employment Rigidity Index from the World Bank – Doing Business indicators. We also consider private indebtedness captured by the mortgage debt to GDP ratio.

Data for most of the fundamentals are from IMF – International Financial Statistics. Data for employment in the construction sector and for the mortgage debt to GDP ratio are from the European Commission (2009c, Table IV.1.1: 170).

The results in *Figure 2* show that the variation in the public debt to GDP ratio is positively and significant correlated only with the employment in the construction sector and with the mortgage debt to GDP ratio. We repeated the bi-variate analysis for the variation of the long-term yields on government bonds. In this case, only the current account balance to GDP ratio and the employment in the construction sector are significant fundamentals. There is a negative correlation between the current account balance and the long-term yields on government bonds, and a positive correlation between employment in construction and government yields.

From the analysis of the macroeconomic fundamentals as carried out in this section, only those related to countries' external competitiveness have an effect on long-term real interest rates, thus supporting Krugman's position (2012a).[14]

3. MODEL AND DATA SET

The background of our empirical model for debt dynamics is the government budget constraint equation in each period *t*:

$$D_t = PB_t + (1 + i) \times D_{t-1} - \Delta BM_t. \quad (1)$$

According to equation (1), total public debt at period *t*, D_t, is a function of the period's primary budget balance, PB_t, of the public stock of debt at the beginning of t, D_{t-1}, plus interest payments on it, $i \times D_{t-1}$, and of changes of the monetary

[12] See, e.g., Frank – Cline (1971); Detragiache – Spilimbergo (2001).
[13] See, e.g., Krugman (2012a).
[14] See also OECD (2009: 168).

base, ΔBM_t. We now rewrite equation (1) as a fraction of GDP, Y_t, and we neglect debt monetisation:[15]

$$\frac{D_t}{Y_t} = \frac{PB_t}{Y_t} + (1+i) \times \frac{D_{t-1}}{Y_t}. \quad (2)$$

It is standard to write the government budget constraint in terms of changes in the debt to GDP ratio from one period to the next. Defining lower case variables as their corresponding upper case variables in proportion to GDP, and bearing in mind that $Y_t = (1+y) \times Y_{t-1}$, with *y* the rate of growth of GDP, we rewrite equation (2) as the public debt dynamics equation:[16]

$$d_t - d_{t-1} = pb_t + \times \frac{i-y}{1+y} d_{t-1}. \quad (3)$$

Thus, the change in public debt to GDP depends on three components: (i) the primary budget balance, pb_t; (ii) the nominal interest rate, i; and (iii) the GDP growth rate, y. Accordingly, the public debt to GDP ratio increases whenever the primary balance deteriorates, or/and as the result of the 'automatic debt dynamics' determined by the interest rate paid on public debt and the GDP growth rate.

To account for interactions among key variables, we specify a small-scale simultaneous equation model (along the line of Favero – Marcekkino 2005; Casadio et al. 2012). Our model consists of four equations (4 to 7) and four endogenous variables. The coefficients are identified with sub- and superscript indexes. The superscript is the number of the equation where the coefficient belongs. For example, coefficient β_1^4 is the coefficient β_1 in equation (4).

Debt dynamics equation:

$$\Delta DEBT_{i,t} = \beta_0^4 + \beta_1^4 DEBT_{i,t-1} + \beta_2^4 PSURPLUS_{i,t} + \beta_3^4 RIR_{i,t} + \beta_4^4 GDPGR_{i,t} + \gamma^4 \mathbf{X}_{i,t}^4 + \mu_{i,t}^4. \quad (4)$$

Primary budget equation:

$$PSURPLUS_{i,t} = \beta_0^5 + \beta_1^5 PSURPLUS_{i,t-1} + \beta_2^5 DEBT_{i,t-1} + \beta_3^5 \Delta U_{i,t} + \beta_4^5 \Delta EXP_{i,t} + \gamma^5 \mathbf{X}_{i,t}^5 + \mu_{i,t}^5. \quad (5)$$

[15] This simplification is acceptable as the European Union Framework for conducting monetary policy restricts the direct monetisation of public debt by national central banks, and by the ECB.

[16] The same relation holds if the variables are measured in real terms, by using the GDP deflator. Following Casadio et al. (2012), we use this assumption in our estimation.

GDP growth equation:

$$GDPGR_{i,t} = \beta_0^6 + \beta_1^6 GDPR_{i,t-1} + \beta_2^6 RIR_{i,t} + \beta_3^6 PSURPLUS_{i,t} + \beta_4^6 EU17GDPGR_t + \gamma^6 \mathbf{X}_{i,t}^6 + \mu_{i,t}^6. \quad (6)$$

Long-term yields on government bonds equation:

$$RIR_{i,t} = \beta_0^7 + \beta_1^7 RIR_{i,t-1} + \beta_2^7 GDPGR_{i,t} + \beta_3^7 DEBT_{i,t} + \beta_4^7 PSURPLUS_{i,t} + \beta_5^7 CA_{i,t} + \gamma^7 \mathbf{X}_{i,t}^7 + \mu_{i,t}^7. \quad (7)$$

The first equation is the debt dynamics equation mentioned above. It specifies the variation of the total amount of public debt as a percentage of GDP in country *i* at period *t*, $\Delta DEBT_{i,t}$, as a function of the public debt as a percentage of GDP at the end of the previous period, $DEBT_{i,t-1}$; the primary government surplus as percentage of GDP, $PSURPLUS_{i,t}$; the long-term real yields on government bonds, $RIR_{i,t}$; and the real rate of GDP growth $GDPGR_{i,t}$. According to our analysis of equation (3) mentioned before, we expect $\beta_2^4 < 0$, $\beta_3^4 > 0$, and $\beta_4^4 < 0$. The sign of the coefficient associated to the lagged value of the debt to GDP ratio, β_1^4, can be interpreted as indicator of debt sustainability. If positive, it means that an increase of the debt to GDP ratio in the previous period originates an increase of the debt to GDP ratio in the current period, implying that debt can enter into an unsustainable dynamic. If negative, it means that an increase of the debt to GDP ratio in the previous period implies a correction in the current period, which indicates sustainability (Bohn 1998).

The second equation specifies the primary budget as a function of its first lag, to capture primary budget persistence, the debt to GDP ratio in the previous period, and of the non-debt determinants such as a business cycle indicator – the variation of the unemployment rate, $\Delta U_{i,t}$, and temporary government spending variable – the variation of government expenditures as a percentage of GDP, $\Delta EXP_{i,t}$, as in Barro (1979) and Bohn (1998). The sign of the coefficient of the lagged debt to GDP ratio depends on how governments react to the accumulation of debt. If governments apply corrective measures when the debt to GDP starts to rise in order to contain future increases in debt, β_2^5 should be positive. If governments let debt grow without taking corrective measures, β_2^5 should be negative. Thus, a $\beta_2^5 > 0$ can also be viewed as an indicator of debt sustainability in the sense of being consistent with an intertemporal budget constraint, regardless of the relationship between interest rates and GDP growth rates (Bohn 1998: 960). The response of the deficit to the business cycle indicator partly corresponds to the automatic stabiliser property of the tax system, by which government revenues rise and deficit falls with income (Barro 1979). Here, we use the unemployment rate as an alternative to the output gap. In fact, the unemployment rate has several advantages (Fernandes – Mota 2011): it is more objective in its quantification; it is available

to the public in general on a monthly basis; and it is awaited by the markets as a good indicator of the state of the economy and of the ensuing economic policy decisions. Moreover, since it directly affects voters' well-being and their opinions on the government, politicians feel compelled to respond to it by means of appropriate discretionary fiscal policy measures. Consequently, we expected $\beta_3^5 < 0$. Finally, we expect the primary budget to GDP ratio to decrease in periods of abnormal high government spending, implying that β_4^5 should also be negative.

The third equation specifies the real rate of growth of GDP as a function of its own lag, to capture GDP growth persistence; the current yield on long-term government bonds; the primary budget to GDP ratio that captures the stance of the fiscal policy; and the average real rate of growth of the Euro zone member states, $EU17GDPGR_t$, to capture the influence of the international business cycle (we follow Favero – Marcellino 2005). High government bond yields imply higher funding costs causing real economic costs, therefore β_2^6 should be negative. A rise in the primary budget to GDP ratio due, for example, to a fiscal consolidation should have a negative impact on economic growth (at least in the short run) through the negative effect on aggregate demand. Consequently, we expect $\beta_3^6 < 0$. Note, however, that this effect can be counterbalanced by a positive effect if fiscal consolidation signals lower future public debt and taxes, leading consumers to expect an increase in their life time income, and therefore leading to an increase in consumption. The average real rate of growth of Euro zone member states is also included as a proxy for the effects of external demand, thus β_4^6 should be positive.

The fourth equation specifies the long-term yields on government bonds as a function of its own first lag, to account for interest rate persistence, and as a function of indicators on solvency (such as the debt to GDP ratio, the primary budget to GDP ratio,[17] and the growth rate of real GDP) and competitiveness – such as the current account balance to GDP ratio, $CA_{i,t}$. Macroeconomic variables such as the real rate of output growth have been the focus of attention by authors such as McFadden et al. (1985). Their argument is that high growth countries are expected to be more creditworthy, everything else being constant. In the same line of reasoning, Reignhart – Rogoff (2009) defend that a sustainable level of economic growth is a very important determinant of a country's borrowing capacity. Therefore, β_2^7 should be negative. Also, we consider expected insolvency as a fundamental determinant of a debt crisis. A deteriorated fiscal position captured by indicators such as the debt to GDP ratio, and the budget balance are a source

[17] We include the primary balance instead of the total deficit because it separates the effect of interest rates on expenditures, capturing better autonomous change in fiscal policy (Ardagna et al. 2006).

of vulnerability to a debt crisis (see, e.g., Eaton – Gersovitz 1981 and McFadden et al. 1985). As this vulnerability is expected to increase the credit risk premium and government bond yields, we expect $\beta_3^7 > 0$ and $\beta_4^7 < 0$. Competitiveness can also be a source of debt crises when countries have no access to exchange rate changes. Krugman (2012a) asserts that this explanation is the most important for the current situation of the peripheral Euro zone countries. Here, we have included the current account balance as a proportion of GDP, CA_i, as an indicator of external competitiveness. We expect $\beta_5^7 < 0$ as a high current account balance to GDP ratio decreases the risk of insolvency, and consequently the risk premium paid on government bonds.

$X_{i,t}^j$ is a vector of other control variables for equation j, and $\mu_{i,t}^j$ is a random disturbance term in equation j. $X_{i,t}^4$ and $X_{i,t}^5$ include the degree of openness of the economy at current prices, measured as total trade (sum of imports and exports) as a percentage of GDP, $OPEN_t$; net foreign direct investment as percentage of GDP, FDI_t; and a dummy variable, $ELECT_{i,t}$, that is (1) if there is a parliamentary election in country *i* at a quarter that belongs to an election year, and (0) otherwise. $X_{i,t}^6$ and $X_{i,t}^7$ only include $OPEN_t$ and FDI_t. Trade openness is a variable very often present in fiscal policy models since early times (see, e.g., Myrdal 1960; Cameron 1978). A first line of reasoning considers that open economies are exposed to world market fluctuations out of their control and, therefore, are subject to increased volatility during business cycles. A way to manage this higher risk is through increased government intervention in the economy, with particular emphasis on the social sector. However, this analysis abstracts from the implications of increased international economic integration, and the progressive dismantling of tariff barriers, which tear down the effectiveness of attempts to insulate national economies from unfavourable outside events. Therefore, these other circumstances could reduce both tax revenues and public expenditures as economies become increasingly more open (Vernon 1974). Additionally, openness should have a positive effect on economic growth, which contributes to the reduction of the debt to GDP ratio (Berg – Krueger 2003). The reason to include FDI_t is that it supposedly improves the fundamentals, mainly leading to an increase of productivity and consequently to a decrease in the debt to GDP ratio. The election dummy is included to verify the so-called political budget cycles where fiscal variables are manipulated for political purposes (Alesina – Roubini 1992; Shi – Svensson 2006). The empirical literature on this hypothesis remains, however, rather inconclusive (Schneider 2010).

To account for the structural break after 2007 caused by the recent financial crisis, we add to the system of equations (4) to (7) an interaction term between the explanatory variables and a dummy variable, $CRISIS_{i,t}$, that takes the value of (1) for all quarters after 2007:03, and (0) for all quarters before 2007:03.

Finally, given that the Euro zone peripheral countries, sometimes called PIIGS (Portugal, Ireland, Italy, Greece, and Spain), have experienced seriously unbalanced public finances and face actual or market anticipated insolvency crises, in order to test for the possibility of a different reaction of the debt to GDP ratio in this group of countries, we have introduced in the system a multiplicative dummy variable, $PIIGS_{i,t}$, which takes the value of (1) for Portugal, Ireland, Italy, Greece, and Spain, and (0) for the remaining countries.

The system of panel data equations (4) to (7) is estimated using the Seemingly Unrelated Regression (SUR) method (Zellner 1962). This method provides an efficient estimation of a system of equations in the case where disturbances of the system are contemporaneously correlated, as is the case where equations have endogeneity problems, or are serially correlated (Parks 1967), and allows the four dependent variables to have different sets of explanatory variables. The SUR method estimates the parameters of the four equations simultaneously, implying that the parameters of each individual equation take into account the information provided by the other equations. Thus, the regression coefficient estimators are at least asymptotically more efficient than those obtained by an equation-by-equation application of least squares (Zellner 1962: 348).

4. THE ESTIMATED RESULTS

We begin by testing for panel unit roots. We consider the Levin, Lin, Chu (LLC) common root test, and the Im, Oesaran, Shin (IPS) individual root test.[18] The results in *Table 1* show that both LLC and IPS tests fail to reject the null of a unit root only for the debt to GDP ratio, $DEBT_{i,t}$, current account to GDP ratio, $CA_{i,t}$, and the degree of openness, $OPEN_{i,t}$. Consequently, we estimate the model with the first difference of $CA_{i,t}$ and $OPEN_{i,t}$. Concerning $DEBT_{i,t}$, we took the Bohn (1998) approach that argues that unit root tests for the debt to GDP ratio are inconsistent and misleading because they do not adjust for fluctuations in GDP and in government spending. The implication is that mean-reversion is difficult to detect. A positive response of the primary balance to the debt to GDP ratio implies that the former is mean-reverting, which has implications for the time series properties of public debt (Bohn 2011: 954). Thus, we include the lagged value of the debt to GDP ratio in the debt dynamics equation and in the primary balance equation.

Table 2 reports the estimated results of the baseline system of equations (4) to (7). The residual diagnostic tests for no autocorrelation (Portmanteu tests) and

[18] Common root indicates that the tests are estimated using common AR structures for the series. Individual root is used for tests which allow for different AR coefficients in each series.

normality (Jarque-Bera test) are also reported, and in general they do not reject the null hypothesis (of no autocorrelation and normality of the residuals, respectively). The debt dynamics equation is overall significant and the signs of the main explanatory variables are as expected: when the primary budget balance and the real GDP growth rate increase, the debt to GDP ratio falls. The long-term yields on government bonds do not have a significant impact on the debt to GDP ratio. The one period lagged debt has a negative effect on the variation of the debt to GDP ratio, which is an indicator of debt sustainability. Among the control variables, only $FDI_{i,t}$ is negative and significant (as expected). Concerning the primary budget equation, the coefficient on lagged public debt is non-significant, which shows, together with the result for the lagged debt to GDP ratio in the debt dynamics equation, that public debt sustainability is not clear in the whole period of analysis. As expected, the estimated coefficients on changes in the unemployment rate and in public expenditures as a percentage of GDP are both negative and significant, implying debt financing in periods of rising unemployment as well as of expenditures in general. None of the control variables is significant. From equation (6), we find that an increase in the long-term yields on sovereign bonds contributes to a decrease in the GDP real rate of growth, and an increase in the Euro zone's rate of growth leads to an increase of the individual countries' GDP rate of growth. Both results are as expected. It is worth mentioning that the coefficient associated with the primary balance is not significant, which supports the idea that the causality runs from GDP to primary balance and not the opposite. Regarding the equation for long-term yields on government bonds paid on public debt, we find that when primary budget balances and real GDP growth rates increase, yields fall (the coefficient on debt to GDP ratio is not significant[19]). Surprisingly, the current account balance to GDP ratio is positively related to the long-term yields on government bonds.

Table 3 reports the estimated results of the system of equations (4) to (7) considering a structural break in the third semester of 2007 caused by the financial crisis. In the debt dynamics equation, we find that the coefficient of the lagged public debt to GDP ratio turns positive after 2007:03 (–0.008 + 0.014 = 0.006), whereas it was negative before 2007:03 (–0.008), meaning that the debt entered in an unsustainable dynamics after the financial crisis. This result is indeed compatible with the idea that a debt to GDP ratio can be sustainable under a certain GDP growth regime, and suddenly unsustainable under a lower GDP growth regime

[19] We have also estimated the equation on government bonds long-term yields with the terms $DEBT_{i,t}$ and $(DEBT_{i,t})^2$ to capture the possibility of a non-linear relationship between the yields and the debt to GDP ratio. The estimated coefficients (not reported) are non-significant.

(in line with Easterly 2001). Also, it lends support to the idea that the increase of the debt to GDP ratio was an outcome of the crisis itself, and not the opposite. We do not find a different reaction of changes in the debt to GDP ratio to the other explanatory variables after 2007. Concerning the primary deficit equation, we find that the coefficient of the lagged debt to GDP ratio, not significant before the crisis, turned negative and significant afterwards, which is contrary to debt sustainability. Moreover, the negative reaction of primary deficits to unemployment variations increased after 2007:03 due to the reinforcement of the automatic stabilisers. Regarding the equation for the long-term yields on government bonds, we find that its sensibility to the fundamentals increased significantly after the crisis, which we interpret as meaning that markets did not price macroeconomic fundamentals before August 2007, but started to penalise fiscal and macroeconomic imbalances much more heavily after the crisis (a result in line with the one obtained by von Hagen 2011 and De Grauwe 2012). In fact, our results reveal that fiscal fundamentals (the debt and the primary balance to GDP ratios) are not significant before the crisis, but turn significant, and with the expected signs, afterwards. The impact of the GDP growth rate is positive before the crisis (which is not expected), but turns negative (0.02 – 0.04 = 0.02) as expected after the crisis. This structural change supports the idea that time dependent risk perceptions driven by international factors (unrelated to the fundamentals) play an important role in explaining the unfolding of the debt crisis (again in line with von Hagen 2011 and De Grauwe 2012).

Finally, we looked at the hypothesis of a different debt to GDP ratio response to the explanatory variables in PIIGS comparatively to non-PIIGS (the results are shown in *Table 4*). The one period lagged debt has a negative effect on the variation of the debt to GDP ratio in both PIIGS and non-PIIGS countries, which runs in favour of sustainability. We also find that even though the variation of the debt to GPD ratio responds negatively to improvements in the primary budget balance, and in the real GDP growth rate this reaction is much stronger among PIIGS. Therefore, we come to the very important conclusion that the debt to GDP ratio is much more sensitive to real economic growth among PIIGS. We can hardly interpret the causality on the other way round, i.e., that it was the increase in the public debt to GDP ratio that caused the decline of the GDP growth rate. Actually, *Figures 1a* and *1c* show that the fall of the GDP growth rate led to the increase in the debt to GDP ratio.[20] Furthermore, the coefficient on the long-term yields on government bonds, non-significant in non-PIIGS countries, is positive and significant in PIIGS, meaning that the debt to GDP variation is sensitive to the yields in this group of countries. In the primary budget equation, we find a higher persist-

[20] See also European Commission 2009b for the root causes of the crisis.

ence of the primary budget balance to GDP among PIIGS, and a greater impact of the variation of government expenditures on the primary balance, which we might interpret as the consequence of a less efficient use of government spending in this group of countries. Concerning the long-term yields on government bonds dynamics, we find that interest rates are insensitive to fundamentals in non-PIIGS countries, but the opposite is true for PIIGS. For this group of countries, except for the debt to GDP ratio, all the fundamentals are significant and the coefficients have the expected sign. Curiously enough, it is the estimate for the current account to GDP ratio that is positive and significant for non-PIIGS, but negative ($0.02 - 0.06 = -0.04$) for PIIGS. This result is in line with De Grauwe (2012)'s fragility hypothesis that postulates that fiscal variables have a greater impact on long-term yields on government bonds in countries that issue debt in a currency they do not control, and for that reason they are more exposed to a self-fulfilling liquidity crisis. These findings also give support to the idea that in the Monetary Union, the current account balance to GDP ratio is an important factor that drives the sovereign yields in the Euro zone peripheral countries.

5. CONCLUSIONS

Our results are compatible with the explanation that the crisis in the Euro zone peripheral countries is mainly the consequence of the attitude of investors towards risk interacting with a higher sensitiveness to fundamentals that result from the deficiencies in the architecture of the EMU.

We find that: (a) while there is no clear evidence that before 2008 the debt to GDP ratio was unsustainable for the European Union countries as a whole, it entered into an unsustainable dynamics after that due to the sharp GDP contraction – in this regard there is no difference between Euro zone peripheral countries and the other countries; (b) the debt to GDP ratio is more sensitive to economic growth in the Euro zone peripheral countries; (c) the sensitiveness of long-term sovereign yields to fundamentals increased significantly after the crisis, which we interpret as the result of higher perceived self-fulfilling solvency risks by creditors; (d) the long-term sovereign yields are more responsive to fundamentals in the Euro zone peripheral countries; and (e) external competitiveness is a significant fundamental determinant of the Euro zone peripheral countries debt crisis.

Our findings have important policy implications. The insistence of the Euro zone in keeping the deficit rule imposed by the Stability and Growth Pact stands as a pro-cyclical fiscal policy, which deepened the recession, and also led to high

unemployment rates, deteriorating budget balances and increasing debt to GDP ratios in the peripheral countries.

Moreover, although external competitiveness is important, the attempts to replicate exchange rate devaluation by means of internal devaluation are strongly depressing internal demand leading to declining tax revenues in spite of increasing tax rates, making it impossible to simultaneously achieve fiscal consolidation and an improvement of the current account balance.

In the *medium-long run,* the solution should be economic growth focused towards external demand in the peripheral countries and to domestic demand in central countries such as Germany, and moderate inflation that lowers the real value of the debt. In the *short run,* the ECB should act as a lender of last resort also for governments, allowing peripheral countries to issue debt at reasonable interest rates.

On the contrary, the austerity measures that turn the unemployment rate dependent on the state of confidence are not solving the problem. The consequences have been a deep recession and high unemployment rates that raise doubts about the capacity of these countries to pay their debts. In fact, the evidence gives no support to the view that when monetary policy effectiveness is constrained (when short-term interest rates reach or are close to the lower zero bound) due to the severity of the crisis, as it happens in the USA, but also in the EU, contractionary fiscal policy is expansionary. On the contrary, it is by now well established that fiscal consolidation is typically contractionary in the short run (see IMF 2010). According to the IMF (2010: 110), when countries cannot rely on the exchange rate channel to stimulate exports (as is the case in Euro zone countries), when monetary policy is ineffective because the zero lower bond for interest rates is binding, and when many countries are implementing fiscal contractionary measures, the output costs of fiscal consolidations are larger.

Nonetheless, some lack of consensus still remains about the effects in the *long run.* For some, fiscal consolidation will increase investor's confidence and will have positive effects on the growth rate of the output in the long run. We think, on the contrary, that austerity measures that harm growth in the present will have negative effects in the future due to hysteresis mechanisms.

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Table 1

Unit Root Test Results
(Null hypothesis: the series have a unit root)

Variables	LLC *t*-statistics (assumes common unit root process)	*P*-Value	IPS *W*-statistics (assumes individual unit root process)	*P*-Value
$\Delta DEBT_{i,t}$	–5.962	0.000	5.578	1.000
$DEBT_{i,t-1}$	3.572	0.999	–10.752	0.000
$PSURPLUS_{i,t}$	–1.700	0.090	–3.565	0.000
$GDPGR_{i,t}$	–3.362	0.000	–6.391	0.000
$RIR_{i,t}$	–1.937	0.026	–1.563	0.059
$\Delta U_{i,t}$	–8.350	0.000	–11.932	0.000
$\Delta EXP_{i,t}$	–20.166	0.000	–29.070	0.000
$EU17GDPGR_t$	–3.431	0.000	–9.937	0.000
$CA_{i,t}$	1.305	0.904	0.310	0.621
$\Delta CA_{i,t}$	–11.726	0.000	–21.199	0.000
$OPEN_{i,t}$	–0.564	0.286	–2.411	0.008
$\Delta OPEN_{i,t}$	–11.454	0.000	–14.618	0.000
$FDI_{i,t}$	–12.458	0.000	–15.254	0.000

Table 2

SUR Estimates of EU27 Debt Dynamics (baseline system)

$$\Delta DEBT_{i,t} = \beta_0^4 + \beta_1^4 DEBT_{i,t-1} + \beta_2^4 PSURPLUS_{i,t} + \beta_3^4 RIR_{i,t} + \beta_4^4 GDPGR_{i,t} + \gamma_1^4 \Delta OPEN_{i,t} + \\ + \gamma_2^4 FDI_{i,t} + \gamma_3^4 ELECT_{i,t} + \mu_{i,t}^4$$

(debt dynamics equation)

β_0^4	β_1^4	β_2^4	β_3^4	β_4^4	γ_1^4	γ_2^4	γ_3^4	$\bar{R}^2$	DW	JB *P*-Value
1.12***	–0.004**	–0.21***	–0.04	–0.17***	–2.12	–0.005**	–0.12	0.28	2.02	0.14
(5.10)	(–2.00)	(–16.35)	(–1.17)	(–12.92)	(–2.46)	(–2.16)	(–1.00)			

$$PSURPLUS_{i,t} = \beta_0^5 + \beta_1^5 PSURPLUS_{i,t-1} + \beta_2^5 DEBT_{i,t-1} + \beta_3^5 \Delta U_{i,t} + \beta_4^5 \Delta EXP_{i,t} + \gamma_1^5 \Delta OPEN_{i,t} \\ + \gamma_2^5 FDI_{i,t} + \gamma_3^5 ELECT_{i,t} + \mu_{i,t}^5$$

(primary balance equation)

β_0^5	β_1^5	β_2^5	β_3^5	β_4^5	γ_1^5	γ_2^5	γ_3^5	$\bar{R}^2$	DW	JB *P*-Value
0.08	0.74***	–0.001	–0.55***	–0.29***	–0.23	–0.004	–0.20	0.59	2.39	0.51
(0.51)	(39.34)	(–0.33)	(–4.80)	(–12.14)	(–0.17)	(–1.04)	(–1.16)			

$$GDPGR_{i,t} = \beta_0^6 + \beta_1^6 GDPGR_{i,t-1} + \beta_2^6 RIR_{i,t} + \beta_3^6 PSURPLUS_{i,t} + \beta_4^6 EU17GDPGR_t + \gamma_1^6 \Delta OPEN_{i,t} + \\ + \gamma_2^6 FDI_{i,t} + \mu_{i,t}^6$$

(output growth equation)

β_0^6	β_1^6	β_2^6	β_3^6	β_4^6	γ_1^6	γ_2^6	$\bar{R}^2$	DW	JB *P*-Value
0.35	0.81***	–0.07**	0.004	1.38***	1.10	0.006**	0.80	2.01	0.30
(1.97)	(60.52)	(–2.13)	(0.26)	(15.37)	(1.14)	(2.41)			

$$RIR_{i,t} = \beta_0^7 + \beta_1^7 RIR_{i,t-1} + \beta_2^7 GDPGR_{i,t} + \beta_3^7 DEBT_{i,t} + \beta_4^7 PSURPLUS_{i,t} + \beta_5^7 \Delta CA_{i,t} + \gamma_1^7 \Delta OPEN_{i,t} + \\ + \gamma_2^7 FDI + \mu_{i,t}^7$$

(long-term yield on government bonds equation)

β_0^7	β_1^7	β_2^7	β_3^7	β_4^7	β_5^7	γ_1^7	γ_2^7	$\bar{R}^2$	DW	JB *P*-Value
0.15	0.96***	–0.001	0.00	–0.01***	0.01**	0.06	–0.00	0.91	1.23	0.41
(2.41)	(106.5)	(–0.35)	(1.30)	(–3.49)	(2.52)	(2.40)	(–0.05)			

Notes: *t*-statistics in brackets. ***, **, and * indicate significance at 1, 5 and 10%, respectively.
Source: Authors' calculations.

System Residual Portmanteu Tests for Autocorrelations

	Q-Stat Lag 1	Q-Stat Lag 2	Q-Stat Lag 3	Q-Stat Lag 4
P-Value	0.498	0.760	0.658	0.000

Table 3

SUR Estimates of EU27 Debt Dynamics (with structural break at 2007:02*)*

$$\Delta DEBT_{i,t} = \beta_0^4 + \beta_1^4 DEBT_{i,t-1} + \beta_2^4 PSURPLUS_{i,t} + \beta_3^4 RIR_{i,t} + \beta_4^4 GDPGR_{i,t} + \beta_5^4 DEBT_{i,t-1} \times CRISIS_{i,t} + \beta_6^4 PSURPLUS_{i,t} \times CRISIS_{i,t} + \beta_7^4 RIR_{i,t} \times CRISIS_{i,t} + \beta_8^4 GDPGR_{i,t} \times CRISIS_{i,t} + \gamma_1^4 \Delta OPEN + \gamma_2^4 FDI + \gamma_3^4 ELECT + \mu_{i,t}^4$$

(debt dynamics equation)

β_0^4	β_1^4	β_2^4	β_3^4	β_4^4	γ_1^4	γ_2^4	γ_3^4	R^2	DW	JB *P*-Value
0.82***	–0.008***	–0.16***	–0.01	–0.13***	–2.49***	–0.005**	–0.11	0.32	2.10	0.12
(3.77)	(–3.53)	(–8.81)	(–0.37)	(–5.87)	(–2.94)	(–2.13)	(–0.94)			

β_5^4	β_6^4	β_7^4	β_8^4
0.014***	–0.03	0.03	0.003
(4.26)	(–1.23)	(0.84)	(0.09)

$$PSURPLUS_{i,t} = \beta_0^5 + \beta_1^5 PSURPLUS_{i,t-1} + \beta_2^5 DEBT_{i,t-1} + \beta_3^5 \Delta U_{i,t} + \beta_4^5 \Delta EXP_{i,t} + \beta_5^5 PSURPLUS_{i,t-1} \times CRISIS_{i,t} + \beta_6^5 DEBT_{i,t-1} \times CRISIS_{i,t} + \beta_7^5 \Delta U_{i,t} \times CRISIS_{i,t} + \beta_8^5 \Delta EXP_{i,t} \times CRISIS_{i,t} + \gamma_1^5 \Delta OPEN + \gamma_2^5 FDI + \gamma_3^5 ELECT + \mu_{i,t}^5$$

(primary balance equation)

β_0^5	β_1^5	β_2^5	β_3^5	β_4^5	γ_1^5	γ_2^5	γ_3^5	R^2	DW	JB *P*-Value
0.02	0.77***	0.004	–0.31**	–0.25***	–0.92	–0.003	–0.24	0.61	2.35	0.47
(0.09)	(30.05)	(1.45)	(–2.15)	(–8.05)	(–0.73)	(–1.03)	(–1.46)			

β_5^5	β_6^5	β_7^5	β_8^5
–0.16***	–0.02***	–0.45*	–0.07
(–3.94)	(–5.56)	(–1.90)	(–1.34)

$$GDPGR_{i,t} = \beta_0^6 + \beta_1^6 GDPGR_{i,t-1} + \beta_2^6 RIR_{i,t} + \beta_3^6 PSURPLUS_{i,t} + \beta_4^6 EU17GDPGR_t + \beta_5^6 GDPGR_{i,t-1} \times CRISIS_{i,t} + \beta_6^6 RIR_{i,t} \times CRISIS_{i,t} + \beta_7^6 PSURPLUS_{i,t} \times CRISIS_{i,t} + \beta_8^6 EU17GDPGR_t \times CRISIS_{i,t} + \gamma_1^6 \Delta OPEN + \gamma_2^6 FDI + \mu_{i,t}^6$$

(output growth equation)

β_0^6	β_1^6	β_2^6	β_3^6	β_4^6	γ_1^6	γ_2^6		R^2	DW	JB *P*-Value
0.60***	0.79***	–0.04	–0.02	0.83***	1.11	0.005**		0.81	2.01	0.32
(3.29)	(35.34)	(–1.17)	(–1.17)	(5.06)	(1.16)	(2.25)				

β_5^6	β_6^6	β_7^6	β_8^6
0.03	–0.09***	0.03	0.65***
(0.85)	(2.98)	(1.18)	(3.47)

$$RIR_{i,t} = \beta_0^7 + \beta_1^7 RIR_{i,t-1} + \beta_2^7 GDPGR_{i,t} + \beta_3^7 DEBT_{i,t} + \beta_4^7 PSURPLUS_{i,t} + \beta_5^7 \Delta CA_{i,t} + \beta_6^7 RIR_{i,t-1} \times CRISIS_{i,t} + \beta_7^7 GDPGR_{i,t} \times CRISIS_{i,t} + \beta_8^7 DEBT_{i,t} \times CRISIS_{i,t} + \beta_9^7 PSURPLUS_{i,t} \times CRISIS_{i,t} + \beta_{10}^7 \Delta CA_{i,t} \times CRISIS_{i,t} + \gamma_1^7 \Delta OPEN + \gamma_2^7 FDI + \mu_{i,t}^7$$

(long-term yield on government bonds equation)

β_0^7	β_1^7	β_2^7	β_3^7	β_4^7	β_5^7	γ_1^7	γ_2^7	R^2	DW	JB *P*-Value
0.06	0.96***	0.02***	0.001	0.001	0.008	0.18	0.0002	0.92	1.29	0.29
(0.86)	95.2	(3.11)	(1.19)	(0.09)	(0.98)	(0.72)	(0.29)			

β_6^7	β_7^7	β_8^7	β_9^7	β_{10}^7
–0.02	–0.04***	0.002**	–0.03***	0.05***
(1.52)	(–4.89)	(2.55)	(–3.31)	(2.98)

Notes: t-statistics in brackets. ***, **, and * indicate significance at 1, 5 and 10%, respectively.
Source: Authors' calculations.

System Residual Portmanteu Tests for Autocorrelations

	Q-Stat Lag 1	Q-Stat Lag 2	Q-Stat Lag 3	Q-Stat Lag 4
P-Value	0.301	0.540	0.130	0.000

Table 4

SUR Estimates of EU27 Debt Dynamics (with dummies for PIIGS)

$$\Delta DEBT_{i,t} = \beta_0^4 + \beta_1^4 DEBT_{i,t-1} + \beta_2^4 PSURPLUS_{i,t} + \beta_3^4 RIR_{i,t} + \beta_4^4 GDPGR_{i,t} + \beta_5^4 DEBT_{i,t-1} \times PIIGS_{i,t} + \beta_6^4 PSURPLUS_{i,t} \times PIIGS_{i,t} + \beta_7^4 RIR_{i,t} \times PIIGS_{i,t} + \beta_8^4 GDPGR_{i,t} \times PIIGS_{i,t} + \gamma_1^4 \Delta OPEN_{i,t} + + \gamma_2^4 FDI_{i,t} + \gamma_3^4 ELECT + \mu_{i,t}^4$$

(debt dynamics equation)

β_0^4	β_1^4	β_2^4	β_3^4	β_4^4	γ_1^4	γ_2^4	γ_3^4	R^2	DW	JB *P*-Value
1.26***	–0.009***	–0.16***	–0.05	–0.15***	–2.42***	–0.004*	–0.11	0.33	2.09	0.12
(5.73)	(–3.61)	(–10.92)	(–1.59)	(–11.24)	(–2.88)	(–1.77)	(–0.98)			

β_5^4	β_6^4	β_7^4	β_8^4
–0.001	–0.08***	0.17***	–0.22***
(–0.19)	(–2.83)	(2.68)	(–5.68)

$$PSURPLUS_{i,t} = \beta_0^5 + \beta_1^5 PSURPLUS_{i,t-1} + \beta_2^5 DEBT_{i,t-1} + \beta_3^5 \Delta U_{i,t} + \beta_4^5 \Delta EXP_{i,t} + \beta_5^5 PSURPLUS_{i,t-1} \times PIIGS_{i,t} + \beta_6^5 DEBT_{i,t-1} \times PIIGS_{i,t} + \beta_7^5 \Delta U_{i,t} \times PIIGS_{i,t} + \beta_8^5 \Delta EXP_{i,t} \times PIIGS_{i,t} + \gamma_1^5 \Delta OPEN_{i,t} + \gamma_2^5 FDI_{i,t} + \gamma_3^5 ELECT + \mu_{i,t}^5$$

(primary balance equation)

β_0^5	β_1^5	β_2^5	β_3^5	β_4^5	γ_1^5	γ_2^5	γ_3^5	R^2	DW	JB *P*-Value
0.007	0.71***	0.002	–0.47***	–0.23***	0.11	–0.004	–0.21	0.60	2.38	0.60
(0.041)	(32.29)	(0.56)	(–3.88)	(–7.94)	(0.08)	(–1.30)	(–1.23)			

β_5^5	β_6^5	β_7^5	β_8^5
0.09**	–0.003	–0.35	–0.20***
(2.19)	(–1.04)	(–1.03)	(–3.80)

$$GDPGR_{i,t} = \beta_0^6 + \beta_1^6 GDPGR_{i,t-1} + \beta_2^6 RIR_{i,t} + \beta_3^6 PSURPLUS_{i,t} + \beta_4^6 EU17GDPGR_t + \beta_5^6 GDPGR_{i,t-1} \times PIIGS_{i,t} + \beta_6^6 RIR_{i,t} \times PIIGS_{i,t} + \beta_7^6 PSURPLUS_{i,t} \times PIIGS_{i,t} + \beta_8^6 EU17GDPGR_t \times PIIGS_{i,t} + \gamma_1^6 \Delta OPEN_{i,t} + \gamma_2^6 FDI_{i,t} + \mu_{i,t}^6$$

(output growth equation)

β_0^6	β_1^6	β_2^6	β_3^6	β_4^6	γ_1^6	γ_2^6	R^2	DW	JB *P*-Value
0.44**	0.81***	–0.07**	–0.003	1.41***	0.88	0.006**	0.80	2.02	0.30
(2.44)	(57.87)	(–2.37)	(–0.21)	(14.64)	(0.92)	(2.37)			

β_5^6	β_6^6	β_7^6	β_8^6
–0.02	–0.04	0.01	–0.27
(–0.52)	(–3.31)	(0.39)	(–1.26)

$$RIR_{i,t} = \beta_0^7 + \beta_1^7 RIR_{i,t-1} + \beta_2^7 GDPGR_{i,t} + \beta_3^7 DEBT_{i,t} + \beta_4^7 PSURPLUS_{i,t} + \beta_5^7 \Delta CA_{i,t} + \beta_6^7 RIR_{i,t-1} \times PIIGS_{i,t} + \beta_7^7 GDPGR_{i,t} \times PIIGS_{i,t} + \beta_8^7 DEBT_{i,t} \times PIIGS_{i,t} + \beta_9^7 PSURPLUS_{i,t} \times PIIGS_{i,t} + \beta_{10}^7 \Delta CA_{i,t} \times PIIGS_{i,t} + \gamma_1^7 \Delta OPEN_{i,t} + \gamma_2^7 FDI_{i,t} + \mu_{i,t}^7$$

(long-term yield on government bonds equation)

β_0^7	β_1^7	β_2^7	β_3^7	β_4^7	β_5^7	γ_1^7	γ_2^7	R^2	DW	JB *P*-Value
0.18***	0.96***	0.000	–0.0005	–0.004	0.02***	0.03	0.0002	0.92	1.29	0.39
(2.76)	(107.2)	(0.01)	(–0.72)	(–0.91)	(2.83)	(0.14)	(0.42)			

β_6^7	β_7^7	β_8^7	β_9^7	β_{10}^7
0.05**	–0.02*	–0.0002	–0.02**	–0.06**
(2.27)	(–1.87)	(–0.15)	(–2.25)	(–2.03)

Notes: t-statistics in brackets. ***, **, and * indicate significance at 1, 5 and 10%, respectively.
Source: Authors' calculations.

System Residual Portmanteu Tests for Autocorrelations

	Q-Stat Lag 1	Q-Stat Lag 2	Q-Stat Lag 3	Q-Stat Lag 4
P-Value	0.150	0.200	0.150	0.000

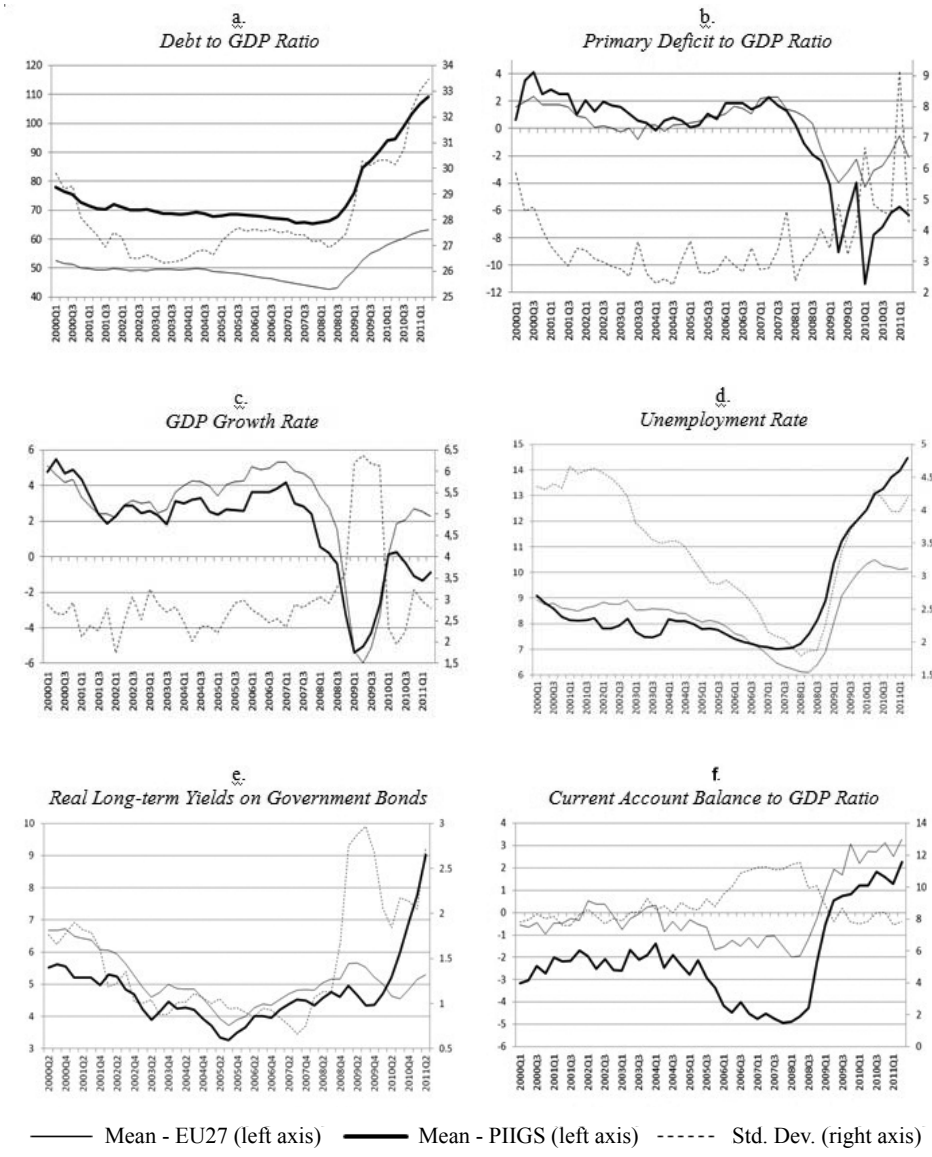
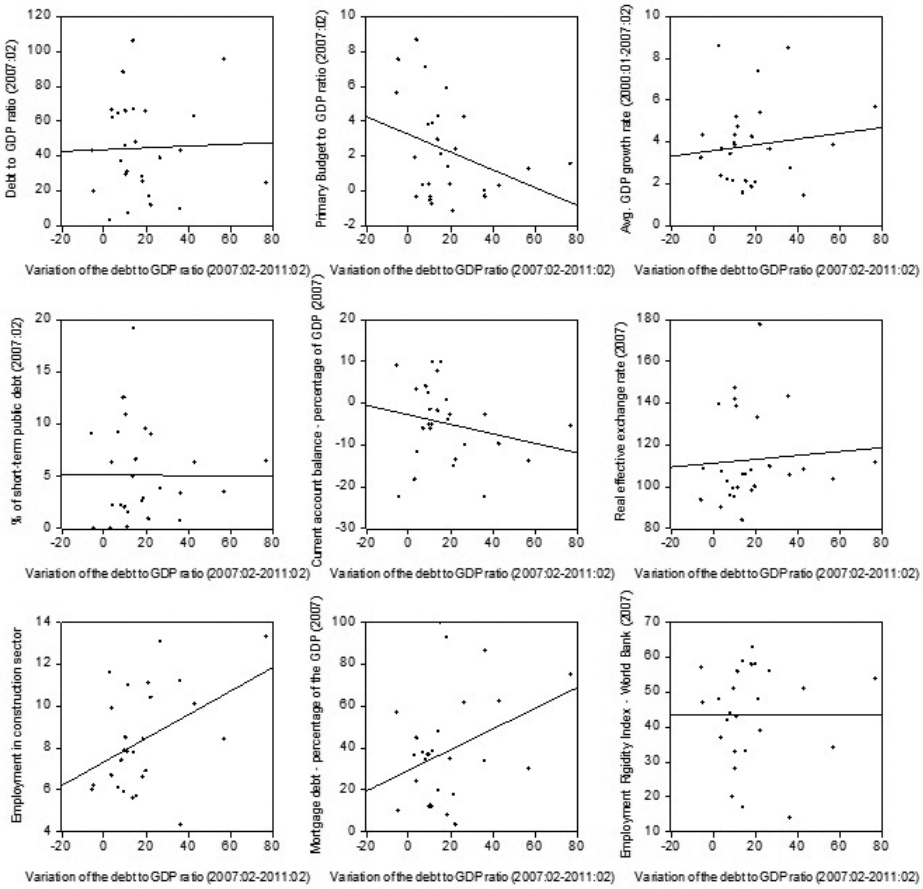


Figure 1. Average value of fundamentals across EU27

Source: IMF – international Financial Statistics and autors' calculations.



	Debt to GDP ratio (2007:02)	Primary budget to GDP ratio (2007:02)	Avg. GDP growth rate (2000:01–2011:02)	% of short-term public debt (2007:02)	Current account balance – percentage of GDP (2007)	Real effective exchange rate (2007)	Employment in the construction sector (2007)	Mortgage debt – % of GDOP (2007)	Employment rigidity index – World Bank (2007)
Variation of debt to GDP ratio (2007:02–2011:02)	0.11 (0.52)	–0.28 (–1.38)	0.044 (0.21)	0.01 (0.04)	–0.20 (–0.98)	0.02 (0.09)	0.43** (2.29)	0.36* (1.86)	0.002 (0.01)

Figure 2. Bi-variate relationship between public debt variation and fundamentals

Notes: t-statistics in brackets.

***, **, and * indicate significance at 1, 5 and 10%, respectively.