Sovereign Risk in the Euro Area: Is it Mostly Fiscal or Financial?

Giovanni Caggiano* Luciano Greco†

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Abstract

We study the role of *fiscal* and *financial* conditions as determinants of movements of 10-years sovereign bond spreads (over the Bund benchmark) in the Eurozone from 2000 to 2009, relying on cross-country quarterly data panel analysis. We find that financial conditions, namely aggregate and idiosyncratic risk factors, are fundamental drivers of sovereign risk. In line with the literature, we show that risk factors directly determine spreads' dynamics. As original contribution of the paper, we identify also an indirect channel: the mid-2007 structural break in financial markets volatility strengthened the role of fiscal variables as drivers of sovereign risk, but also widened the set of macroeconomic determinants. In particular, the latter are shown to be mainly related to the dynamics of explicit and implicit government liabilities (e.g., level and structure of outstanding debt; fiscal balance; banking sector level, structure, and credit quality of assets; short-and-medium term growth perspectives). Our results are consistent with part of the literature documenting parameters' instability in sovereign-spreads econometric models.

Keywords: Sovereign default, Bond spreads, Fiscal policy, Financial Crisis, Refinancing risk, Regime switch, Cross-country Panel
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*E-mail address: giovanni.caggiano@unipd.it. Department of Economics and Management, University of Padua

†E-mail address: luciano.greco@unipd.it. Department of Economics and Management, University of Padua

1 Introduction

Sovereign default risk is the core of the latest stage of the global crisis in several developed countries and, particularly, in the Euro Area. In the build-up phase of the global crisis (August 2007 - August 2008), being part of the European monetary union (EMU) shielded countries with weakest fundamentals (i.e., Greece, Ireland, Italy, Portugal, and Spain) against perverse shocks to public finance and economy. After two years of fiscal overextension - due to worsening real economy as well as to fiscal packages aiming at banking sector recovery, unemployment relief, and economic stimulus - fiscal sustainability has become the main policy issue for the weakest countries of the EMU, and a challenge for the future of the European single currency.

The long-term driver of sovereign risk is fiscal sustainability, namely the mix of fiscal policy stance (e.g., debt-to-GDP and primary-deficit-to-GDP ratios, dynamics of age-related expenditures, other contingent liabilities) and growth perspectives (hence the proper functioning of economic institutions) of each country in the Area warranting the required primary surpluses to balance public liabilities (including implicit ones). Though fiscal (in)solvency has a structural macroeconomic nature, the short/medium-term credibility of fiscal policy stance (say, the probability that needed primary surpluses will be implemented given country-specific political, social and economic framework) is necessary to fulfil it: a sudden loss of credibility quickly translates into higher sovereign-risk premium embedded in bond yields, that in turn pumps up debt service.[1]

Why confidence in a country's fiscal sustainability may abruptly drop? The

[1] In turn, it is quite tricky to disentangle long-run (or structural) solvency from short-term financial troubles, as required by the recent Eurogroup (2010) statement.

arithmetics of fiscal solvency provides us a simple and daunting answer: any adverse shock to government future expenditures and revenues may flaw fiscal credibility. While some sources of fiscal risk - e.g., the impact of economic growth on public expenditures and revenues, or the effect of interest rate growth on debt service - are relatively easy to identify and quantify, a potentially large number of structural macroeconomic conditions, entailing a political need for public intervention, may affect sovereign risk. Such implicit and contingent government liabilities have been particularly relevant as determinants sovereign debt crises (Reinhart and Rogoff, 2010). Much in the same vein, the recently proposed reform of the European framework for preventive coordination and multilateral surveillance of public finances calls for a multi-indicator approach to the assessment countries' fiscal fragility (European Commission, 2010). Finally, the literature on the determinants of sovereign yield spreads (in the Eurozone) corroborates the view that both financial and structural variables drive sovereign risk, though - as we will discuss in the next section - a thorough analysis identifying the relevant structural variables, as well as their interplay with financial variables is still lacking.

Our paper aims at filling this gap. As regards the assessment of structural variables influencing the long-term fiscal sustainability, we consider a rich set of fiscal and macroeconomic indicators[2]: public debt, share of short-term public debt, foreign public debt, banking exposure to foreign and domestic debtors, asset structure of the banking sector (outstanding debt, short-term debt, and so on), net borrowing of different sectors of the economy, short-term financing needs by sector. Such variables involve (or may involve) explicit or implicit liabilities on government, hence we will call them (broadly speaking) *fiscal* variables. In line with the literature, we also

[2]Much in the spirit of the exposure index proposed by Biraschi *et al.* (2010).

consider the main *financial* variables potentially affecting spreads' dynamics, such as risk and liquidity. To carry out the analysis, we rely on a panel data of relevant indicators and sovereign spreads (for 10-years bonds over German benchmark) for the Euro Area countries from 2000 to 2009. The main contribution of our paper reads as follow. In line with the literature, we find that financial markets volatility (measured in terms of stocks and bonds indexes) is *the* driving force of sovereign spreads; the novelty of our contribution is that we identify two transmission mechanisms from financial volatility to sovereign spreads: first, risk directly increases spreads; second, a (substantial) growth of financial volatility reinforces the impact of fiscal variables on spreads, and widens the set of the relevant fiscal variables.

The remainder of the paper is organized as follows. Section 2 briefly contrasts our work with the literature on sovereign spreads in the Eurozone. In Section 3 the empirical model and the methodology are discussed. A descriptive analysis of the data is carried out in Section 4, and the main results are presented and discussed in Section 5. Section 6 concludes.

2 Related Literature

The determinants of sovereign spreads have been widely analyzed by the economic literature, in particular for emerging countries - for example: Baldacci *et al.* (2008); Rocha and Moreira (2010); Hilscher and Nosbusch (2010) - where default has been historically more frequent (Reinhart and Rogoff, 2010). The contributions on sovereign yields and risk for European countries have thriven in the last decade, after the introduction of the European single currency. The number of contributions significantly increased in the last two years.

The determinants of sovereign yield spreads have been analyzed at different frequencies of observations (i.e., daily, weakly, monthly, and quarterly). Macroeconomic conditions, which are typically measured on a quarterly or - in few cases - monthly basis, are likely to determine the lower frequency movements of sovereign spreads. Thus, daily or weakly movements of sovereign spreads are intuitively more likely to be driven by financial conditions (such as liquidity and risk factors) that change and are measured more frequently. Papers that are more related to our main interest consider monthly or (as in our case) quarterly data (Codogno *et al.*, 2003; Attinasi *et al.*, 2009; Barrios *et al.*, 2009; Manganelli and Wolswijk, 2009; Moody, 2009; Sgherri and Zoli, 2009; Haugh *et al.*, 2009; Schuknecht *et al.*, 2010). Fewer papers cover (much of) the time span of the EMU.[3]

All contributions find that Eurozone sovereign spreads are driven by a common factor: global risk. Most papers measure this factor by the spread of US corporate bonds yields over government bonds. However, Gerlach *et al.* (2010) show that other measures (e.g., financial index volatility) bring to similar results. Analyzing the period between January 1999 and April 2008, Manganelli and Wolswijk (2009) find that the ECB policy rate may play a role as driver of aggregate risk perception. Among financial conditions, liquidity - measured by bid/ask spreads, trading volumes, or government bond market size - seems to play a limited role (Codogno *et al.*, 2003; Barrios *et al.*, 2009; Sgherri and Zoli, 2009; Gerlach *et al.*, 2010), and sometimes not statistically significant (Bernoth and Erdogan, 2010; Schuknecht *et al.*, 2010). Manganelli and Wolswijk (2009) find that - quite intuitively - liquidity is driven by the ECB policy rate.

[3]Notably: Manganelli and Wolswijk (2009); Sgherri and Zoli (2009); Barrios *et al.* (2009); Gerlach *et al.* (2010); Schuknecht *et al.* (2010).

Several contributions have pointed out the role of macroeconomic conditions as explanatory variables of credit default risk. The fiscal policy stance - as represented by debt-to-GDP and deficit-to-GDP - is included in most of these studies[4]. Some studies consider the expected evolution of the fiscal deficit (Attinasi *et al.*, 2009; Haugh *et al.*, 2009; Sgherri and Zoli, 2009; Gerlach *et al.*, 2010). However, fewer studies have focussed on the role of other macroeconomic conditions underlying (typically implicit) liabilities on government, that have historically proven to be quite conducive to fiscal crises (Reinhart and Rogoff, 2010). The relevance of implicit liabilities related to the financial and banking sector has been assessed by Attinasi *et al.* (2009), Sgherri and Zoli (2009), and more directly by Gerlach *et al.* (2010). Haugh *et al.* (2009) have also considered population-ageing-related liabilities.

Some studies pointed out the existence of nonlinearities in the behavior of some macroeconomic and financial variables. In particular, global risk is found to increase premia for weak macroeconomic conditions, for example to increase the cost of having a higher public debt-to-GDP ratio (Barrios *et al.*, 2009; Haugh *et al.*, 2009; Gerlach *et al.*, 2010). Moreover, time-switching regimes in parameters are documented, notably after the outset of the crisis, by Sgherri and Zoli (2009) and Schuknecht *et al.* (2010). Bernoth and Erdogan (2010) show that the way public debt-to-GDP ratio affects sovereign spreads changes significantly over time; moreover, they show that the coefficients of global risk and deficit-to-GDP ratios also changed - at least after the crisis.[5]

[4] Codogno *et al.* (2003); Moody (2009); Sgherri and Zoli (2009); Attinasi *et al.* (2009); Barrios *et al.* (2009); Haugh *et al.* (2009); Ceceres *et al.* (2010); Gerlach *et al.* (2010); Schuknecht *et al.* (2010).

[5] Though point-estimates of coefficients for global risk, deficit-to-GDP and liquidity change over time, the width of confidence intervals does not allow to reject the hypothesis that these changed only once, or - in the case of liquidity - were never significantly different from zero.

3 The Empirical Model

We want to empirically investigate what have been the major determinants of bond yield spreads in the Euro Area since the beginning of the EMU.[6] As discussed in the introduction, our main interest is to investigate the role of fiscal fragility and its interplay with financial conditions as drivers of sovereign yields of Eurozone countries. Thus, we focus on the analysis of the determinants of bond yield spread for EMU countries in terms of deviations from the German benchmark, that is the safest issuer in the Euro Area (Bernoth and Erdogan, 2010). We assume that bond yield spreads are determined by two broad categories of variables, describing the country's macroeconomic and financial conditions. Macroeconomic determinants potentially include all variables that influence the country's fiscal position, such as implicit liabilities (e.g., banking sector dimension). Financial conditions include liquidity and risk factors (both global and idiosyncratic) affecting the functioning of sovereign bond markets.

The bond yield spread of a given country, $s_{it} = r_{it} - r_{dt}$ (where r_{it} is country's i yield and r_{dt} is the Bund yield), changes (and is measured) on a daily basis, featuring quite high persistency (Attinasi *et al.*, 2009; Ceceres *et al.*, 2010; Gerlach *et al.*, 2010). Thus, a general empirical model of bond yield spreads can be written as:

$$s_{it} = \rho \cdot s_{it-1} + (1 - \rho) \cdot s^*_{it} + u_{it} \tag{1}$$

where ρ is the autoregressive coefficient, u_{it} are the residuals, and

$$s^*_{it} = \mathbf{b}'_1 \cdot \mathbf{Y}_{it} + \mathbf{b}'_2 \cdot \mathbf{Z}_{it} + \mathbf{b}'_3 \cdot \left(\mathbf{Z}^*_{it} \bigotimes \mathbf{Y}^*_{it} \right) + \mathbf{b}'_4 \cdot (d_t \cdot \mathbf{Y}_{it}) + \mathbf{b}'_5 \cdot (d_t \cdot \mathbf{Z}_{it})$$

[6] Due to incomplete data we cannot include in the data set 1999 and 2010.

is the (short-term) equilibrium spread, depending on a $(k \times 1)$ vector of macroeconomic variables $\mathbf{Y}_{it}$, and on a $(m \times 1)$ vector of financial variables $\mathbf{Z}_{it}$ (where $\mathbf{b}_1$ and $\mathbf{b}_2$ are parameters' vectors). To account for potential nonlinearities, we introduce an interaction term ($\mathbf{Z}^*_{it} \bigotimes \mathbf{Y}^*_{it}$, with a $(pq \times 1)$ vector of parameters $\mathbf{b}_3$, where $\mathbf{Z}^*_{it}$ is $(p \times 1)$ vector including a subset of $p \leq m$ financial variables, $\mathbf{Y}^*_{it}$ is a $(q \times 1)$ vector including a subset of $q \leq k$ of macroeconomic variables, and $\bigotimes$ is the Kronecker product) to catch the impact of changing risk conditions on the role of macroeconomic variables. By time dummies we also consider the possible switch in the effect of macroeconomic ($d_t \cdot \mathbf{Y}_{it}$, with vector of parameters $\mathbf{b}'_4$) and financial ($d_t \cdot \mathbf{Z}_{it}$, with vector of parameters $\mathbf{b}'_5$) variables, where d_t is a dummy variable which takes value of 1 for $t = 2007Q3, \ldots, 2009Q4$.

We employ a large set of macroeconomic, fiscal, and banking indicators to measure potential sources of country-specific default risk: debt to GDP, fiscal deficit, expected GDP growth, real effective exchange rate. We also use common variables which can affect the bond yield spreads over time, i.e. the German debt to GDP ratio and the European Central Bank (ECB) policy rate. Importantly, we distinguish between long and short term debt. The contribution of the banking system to the determination of the credit default risk has been proxied with measures of assets and liabilities of monetary and financial institutions for each country.

As regards the financial variables, we considered two common risk factors, namely the volatility of the European stock market and the volatility of one-year Euribor spread over the ECB policy rate. We also considered idiosyncratic risk factors, measured by the extra volatility of each country's sovereign spread with respect to the Euribor spread. Another financial variable we take into account is an indirect measure of bond markets liquidity, namely the size of each country's sovereign se-

curity market. The ECB policy rate plays a role also as determinant of financial conditions, namely of risk appetite of financial operators and liquidity on the market (Manganelli and Wolswijk, 2009).

The interaction terms are intended to capture potential nonlinear effects of the main idiosyncratic drivers of the yield spreads' dynamics: the idea is that, for example, the impact of debt-to-GDP of country i on its sovereign spread is larger when the perception of risk is greater, both at a global level and for that specific country. As documented in the literature, the global crisis has probably changed the pricing of credit default risk components (i.e., macroeconomic conditions), we try to investigate this point by analyzing pre-crisis and crisis sub-samples as well as by introducing time dummies in the full sample.

The estimation of equation (1) is potentially affected by parameters' heterogeneity (Gerlach *et al.*, 2010). Thus, pooling the data would give inconsistent results in a dynamic setting (Pesaran and Smith, 1995). The dynamic model should then be estimated by a GMM procedure (Arellano and Bond, 1991). Alternatively, a GLS estimator can be applied to a dynamic model with random effect, which allows for parameters' heterogeneity but imposes that the parameters must be drawn from the same distribution.

In our main analysis, we ignore the lagged dependent variable term, on the basis that for a variable like bond yield spread the relevance of autoregressive component diminishes when observations have lower frequency (Attinasi *et al.*, 2009).[7] This is consistent with our main research issue: high-frequency movements of sovereign spreads may have a limited impact on public debt service. Conversely, lower fre-

[7] However, we consider an extended model including the autoregressive term in our robustness checks.

quency changes in sovereign spreads are more likely to induce movements in debt service and, by this channel, to the financial sustainability of public liabilities. Therefore, we estimate the following model:

$$s_{it} = \boldsymbol{\beta}_1' \cdot \mathbf{Y}_{it} + \boldsymbol{\beta}_2' \cdot \mathbf{Z}_{it} + \boldsymbol{\beta}_3' \cdot \left(\mathbf{Z}_{it}^* \bigotimes \mathbf{Y}_{it}^* \right) + \boldsymbol{\beta}_4' \cdot (d_t \cdot \mathbf{Y}_{it}) + \boldsymbol{\beta}_5' \cdot (d_t \cdot \mathbf{Z}_{it}) + \epsilon_{it} \quad (2)$$

where ϵ_{it} is the (possibly autocorrelated) residual term.[8]

4 Data

Our sample includes quarterly data from 2000Q1 to 2009Q4 for the 12 countries which originally formed the Euro Area, excluding Luxembourg (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain).[9] We focus on bonds with initial maturity of 10 years, which are the staple of public debt management in all the considered countries. As standard in the literature, we use Germany as the benchmark to calculate 10-years bond yield spreads (Figure **??**).

[FIGURE 1]

We considered, in the first place, a wide set of variables that can potentially affect bond yield spreads, much in the spirit of the scoreboard approach recently proposed by the European Commission (2010).[10] We considered in our initial data set the following variables: government debt and debt structure by maturity and

[8] We correct the estimation of parameters $(\beta_1, \beta_2, \beta_3, \beta_4, \beta_5)$ to compensate for the autocorrelation of error terms.

[9] Some important variables are not available for 1999 and 2010. Greek yields in 2000 include also a small exchange rate premium, given that Greece joined the Euro in 2001.

[10] Which indicators should be part of the scoreboard is a matter of future discussion, in our investigation we were inspired by the rich scoreboard proposed by Biraschi *et al.* (2010).

instruments, both in euro and GDP shares (source: Eurostat), interest payments on debt (source: OECD), real effective exchange rate (source: IMF), expected growth in the next two years and in the next 3 to 5 years (source: IFO WES), net lending and borrowing by national account sectors (source: National accounts), cyclically adjusted net lending and primary balance (source: OECD), international investment position in terms of assets and liabilities (source: IMF), monetary and financial institutions (MFI) external and internal assets and liabilities (source: ECB), Euribor and ECB main refinancing operation rate (source: ECB), Euro Stoxx index (source: Datastream).

The variables that proved significant - at least in some specifications of model (2) - are: the debt-to-GDP ratio, divided into debt with maturity greater than one year-to-GDP ratio and debt with maturity less than one year (Eurostat), the cyclically adjusted net lending (OECD), the expected GDP growth rate 3-5 years (IFO WES), the real effective exchange rate (IMF), MFI debt securities and loans to domestic (corporations and households) and foreign debtors (ECB), the ECB main refinancing operation rate (ECB), the Euro Stoxx index (Datastream). When data are available on a higher frequency than quarterly (e.g., daily or monthly), the last available observation of each quarter is considered.

[FIGURE 2]

As shown in Figures **??** and **??**, after an initial phase of strong convergence in the early years of EMU, probably related to fiscal stress of Germany (Bernoth and Erdogan, 2010), sovereign spreads differences were quite stable until the onset of the financial crisis (August 2007). Spreads widened dramatically in the second phase of the global crisis, after September 2008 (Ceceres *et al.*, 2010). By the end of 2009

(beyond our sample that does not include the Greek crisis), sovereign spreads soared for some countries (Greece, Ireland, Portugal, Spain).

Interestingly, between 2003 and 2005, the spreads of high debt-to-GDP (and deficit-to-GDP) countries, like Italy or Greece, were exceptionally low (around six basis point); Ireland - recently bailed out by European institutions and the IMF - traded at a lower yield than Germany. More generally, the evolution of sovereign spreads during the last decade shows that traditional fiscal solvency parameters (i.e., debt and deficit) are unable to describe short-term financial constraints faced by Eurozone governments (see Figures **??** and **??**); financial conditions play a crucial role.

[FIGURE 3 AND 4]

As regards the macroeconomic variables, fiscal conditions are proxied by debt and deficit relative to GDP. More precisely, unlike most of the literature on the subject, we distinguish between short and long-term debt as a percentage of GDP. This distinction is particularly important to account for refinancing needs of countries. In distressed periods, the remaining maturity of outstanding debt might have a great impact on sovereign spreads. To take into account the competition among sovereign bond issuers in the Eurozone, we also add German short-term debt-to-GDP ratio. The fiscal deficit is measured by the cyclically adjusted budget balance: positive values reflect a surplus, once the cyclical component has been accounted for, whereas negative values reflect fiscal deficit. Besides traditional measures of the fiscal position we take into consideration also the banking system exposure, which involves implicit liabilities for the public sector (Gerlach *et al.*, 2010; Reinhart and Rogoff, 2010). In particular, we considered the structure of MFI assets and

liabilities. Importantly, we distinguish between loans on the basis of the borrowing sector (corporations, households, foreigners) as a proxy of different quality of banking assets.[11] We accounted for market expectations about future macroeconomic and fiscal position of each country by including in the analysis the expected medium term (i.e., 3 to 5 years) growth rate and a measure of countries' competitiveness (for EMU countries), i.e. the real effective exchange rate. Though we do not explicitly take into consideration the expected fiscal position of each country - as it is common in the literature - this information is embedded in growth expectations and refinancing needs.

As regards financial conditions, a first important variable is the main refinancing operation rate of the ECB which plays a role as driver of liquidity conditions on bond markets. A lower policy rate reduces the liquidity risk associated to long positions on the bond market, which in turns lowers yields and compresses spreads. Manganelli and Wolswijk (2009) identify another role of the main ECB policy rate as driver of risk propensity of financial operator: a low policy rate improves economic perspectives and provides (financial) incentives for managers to take risk positions. Descriptive analysis suggests that the latter function of the ECB policy rate has been ineffective during the crisis (see Figure **??**). We considered another variable indirectly measuring sovereign bond markets liquidity, namely the size of the market itself (in absolute terms or as share of the total sovereign market in the Eurozone). As pointed out by several contributions in the literature, risk is a crucial common factor driving sovereign spreads. We distinguish between aggregate and idiosyncratic risk. To this aim, we proxy aggregate risk by the European stock market

[11] For example, loans to households may have an higher credit merit than other assets, explained by higher collateralization.

volatility, i.e. the variance of the Euro Stoxx index, and by the volatility in the interbank sector, i.e. the variance of the Euribor-Repo spread. Country-specific risk is measured by the variance of the bond yield spread. We expect that both common and idiosyncratic uncertainty affect the sovereign spread; moreover, we expect that the impact of macroeconomic conditions driving the credit risk is magnified by the perceived global and idiosyncratic risk.[12]

5 Results

Table 1 shows our main results, obtained by estimating a static panel data model with fixed effects by Feasible GLS. The estimated standard error are robust to within cross-section serial correlation.

[TABLE 1]

Model A-D is our baseline model estimated for the full sample, the pre-crisis (before 2007Q2) period, the stability period (2002Q1-2007Q2) and the crisis period (2007Q3-2009Q4). Model E shows results after inclusion of interaction terms and time dummies to account for the financial crisis.[13] Several interesting features are worth mentioning. Most variables have high explicative power in the full sample and in the crisis period but have had no impact in the stability period, characterized by stable and very low spreads.

[12] Other measures of aggregate risk are commonly used in the literature. Gerlach *et al.* (2010) show that their qualitative results are not affected by the specific measure they use.

[13] Though we have not yet carried out a comprehensive analysis of the timing of parameters' switch, our preliminary results - based on a sensitivity analysis on the time span of the pre-crisis and crisis samples - strongly support the intuitive break, corresponding to the third quarter of 2007.

Regardless of the sample, we find that the long-term debt-to-GDP ratio is always significant. Its impact on the sovereign spread, however, has become remarkably larger after the financial crisis: our results show that, on average in the Euro Area, a 1% increase in the long-term debt-to-GDP ratio implies, ceteris paribus, about 2 basis point growth of spreads. In addition, the role of short-term debt is non negligible, apart from the stability period between 2002 and mid-2007. The importance of short-term debt-to-GDP ratio for sovereign spreads is half the weight of its long-term counterpart and is an important explicative variable of spread dynamics especially - after the financial crisis - for riskier countries. The German debt is another an important explicative variable, particularly since the start of the crisis: an increase in the short run German debt, as expected, reduces the sovereign spreads in the Euro Area. The deficit also plays an important role in explaining the spreads' dynamics, except in the 2002-2007 period. Looking at other macroeconomic conditions, both the expected GDP growth rate and, to a lesser degree, the real effective exchange rate affect sovereign spreads.[14] In particular, the impact of more favourable expectations about medium-to-long term growth is substabtial in the crisis period: an expected increase of 1% in GDP growth rates for a given country implies, on average, a decrease of 14 basis point of its sovereign spread. The impact of the banking sector's exposure on spreads' dynamics is less clear-cut. Interestingly, different categories of banking assets determine different effects on sovereign spreads: loans to foreign debtors induce higher spreads while loans to households (which are perceived as less risky) reduce spreads, particularly in the crisis period.

[14]The coefficient estimated with the model D is quite puzzling. A possible explanation is that the crisis sample is characterized by a generalized price stagnation in the Eurozone.

As regards the financial conditions, the ECB repo rate turns out to be robustly significant across sector: typically, an increase of 100 basis point in the repo rate implies an increase of about 5 basis point in the sovereign spreads, although in the crisis period the relationship is reversed. This could be explained by the fact that ECB policy rate cuts, in the acute phase of the crisis, were caused by worsening global financial and real conditions, and in turn by increased global risk (see Figure **??**). As in other contributions, risk measures turn out to be significant. Interestingly, the sign of the relationship between our measure of risk and sovereign spreads has changed over time: a negative sign in the pre-crisis period, which indicates a premium for yields of relatively risky countries, has been replaced by a strong positive sign in the crisis period, perhaps indicating a flight-to-quality effect, similar to what documented at higher frequencies (Beber *et al.*, 2009).

Finally, Model E shows that there are clear signs of a potential regime switching after 2007Q2: most interaction dummies are significant implying that the impact of our explicative variables on sovereign spreads has changed. Model E has also been augmented with interaction terms between the variables included in the model and the country-specific variance of sovereign spreads to identify potential nonlinearities due to the presence of idiosyncratic risk components. Detailed results have not been reported for the sake of parsimony. However, we have found a significant impact for: short-term debt, MFI debt, MFI loans to corporations, MFI loans to foreign debtors, variance of euribor-repo rate spread, and variance of Euro Stoxx. These significant interactions, all positively signed, indicate the presence of nonlinear effects in addition to the switch in the regime of parameters. For example, a country with higher idiosyncratic risk pays more for the refinancing risk associated to greater short-term debt or banking exposure towards riskier sectors. Moreover, the global

risk factors hit harder these countries.

Lastly, the Tables **??** and **??** show the predictive power of the estimated model for the full sample and for the crisis period. Results show that, on average, the model performs extremely well in fitting the observed spread.

[TABLES 2 AND 3]

6 Conclusion

Our analysis shows a marked break in operators perception of sovereign risk determinants driven by a dramatic change in markets volatility. With the outburst of the financial crisis, investors have rewarded quality. Our baseline model seems to work reasonably well throughout the sample but the impact of some variables is non-linear, for example the short-term debt-to-GDP ratio: their importance becomes greater when the perception of country-specific risks is greater. We showed that an articulated description of structural macroeconomic conditions - including variables like the maturity of outstanding debt, the structure of banking assets by borrowing sector, and growth perspectives - as well as the inclusion of idiosyncratic risk are quite important for the understanding of spreads dynamics. While the literature has correctly pointed out the role of variables like debt-to-GDP or banking assets, we clarify the relevance of their structure for an adequate interpretation of sovereign default risk components. This is particularly important given that the interaction with risk factors and the switch of parameters affect in different ways these components over time.

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Figure 1: *Sovereign Yield Spreads of Eurozone countries*

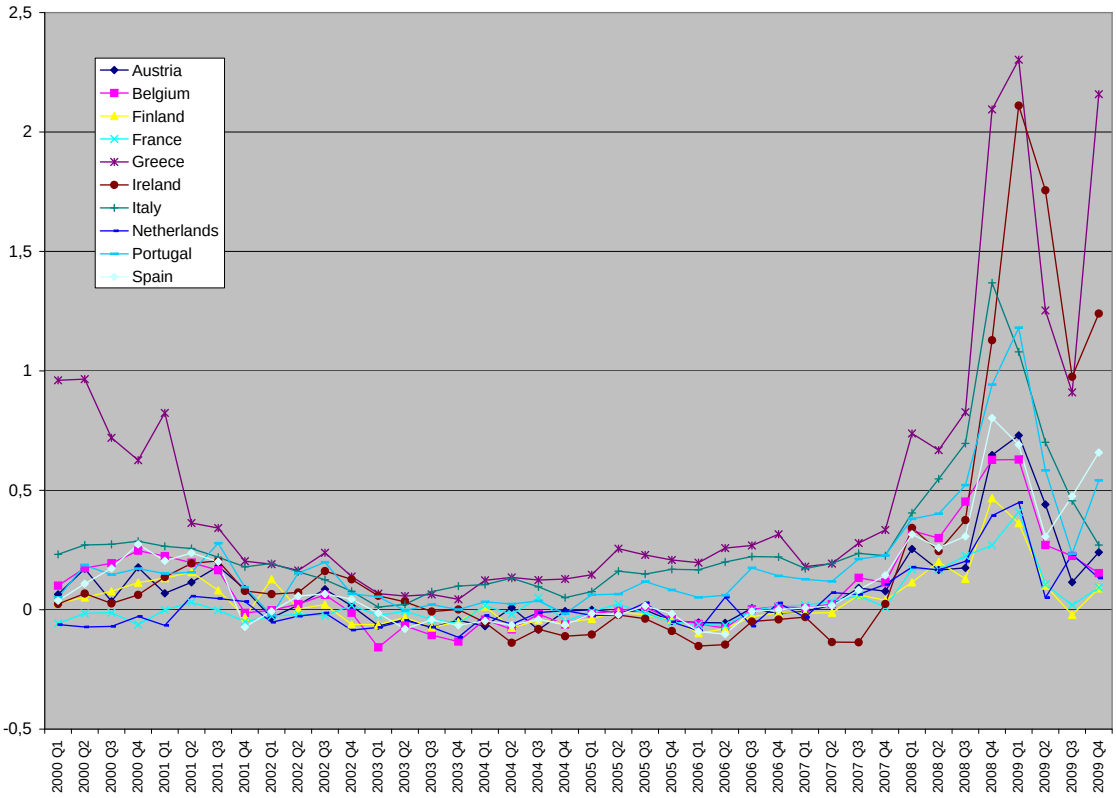

Figure 2: *Volatility of Spreads and Monetary Policy*

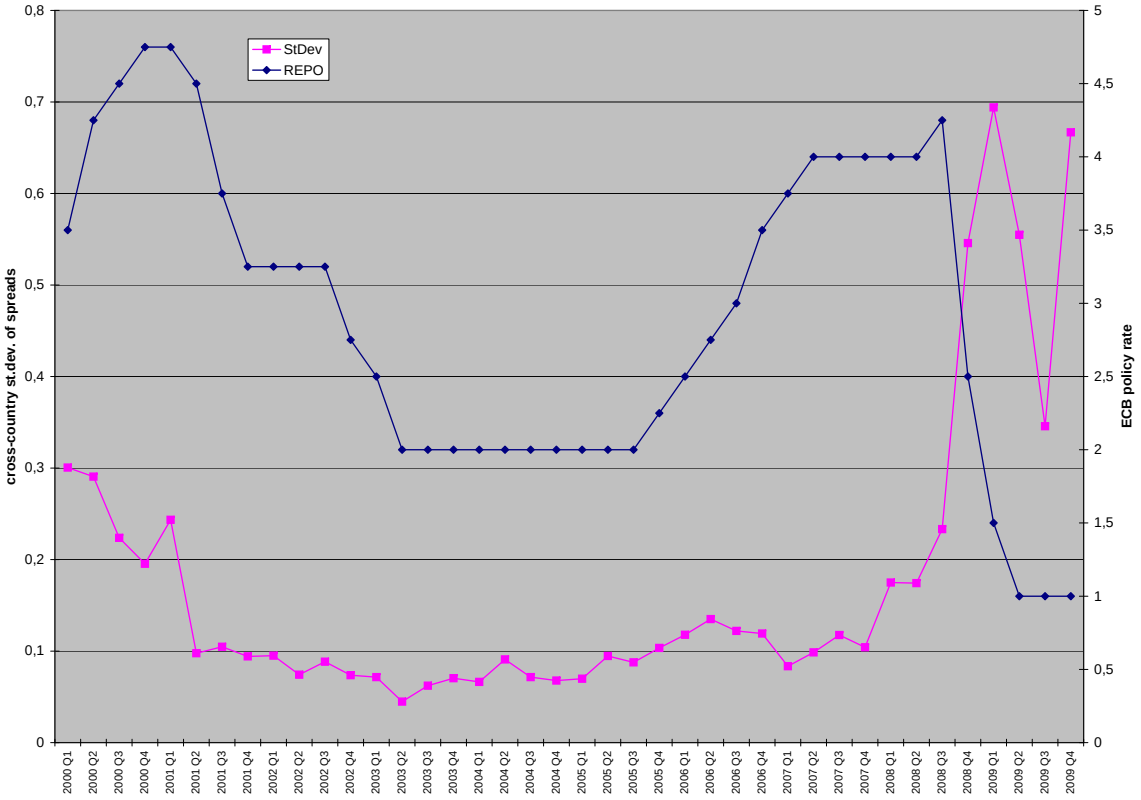

Figure 3: *Debt and Spreads in 2004*

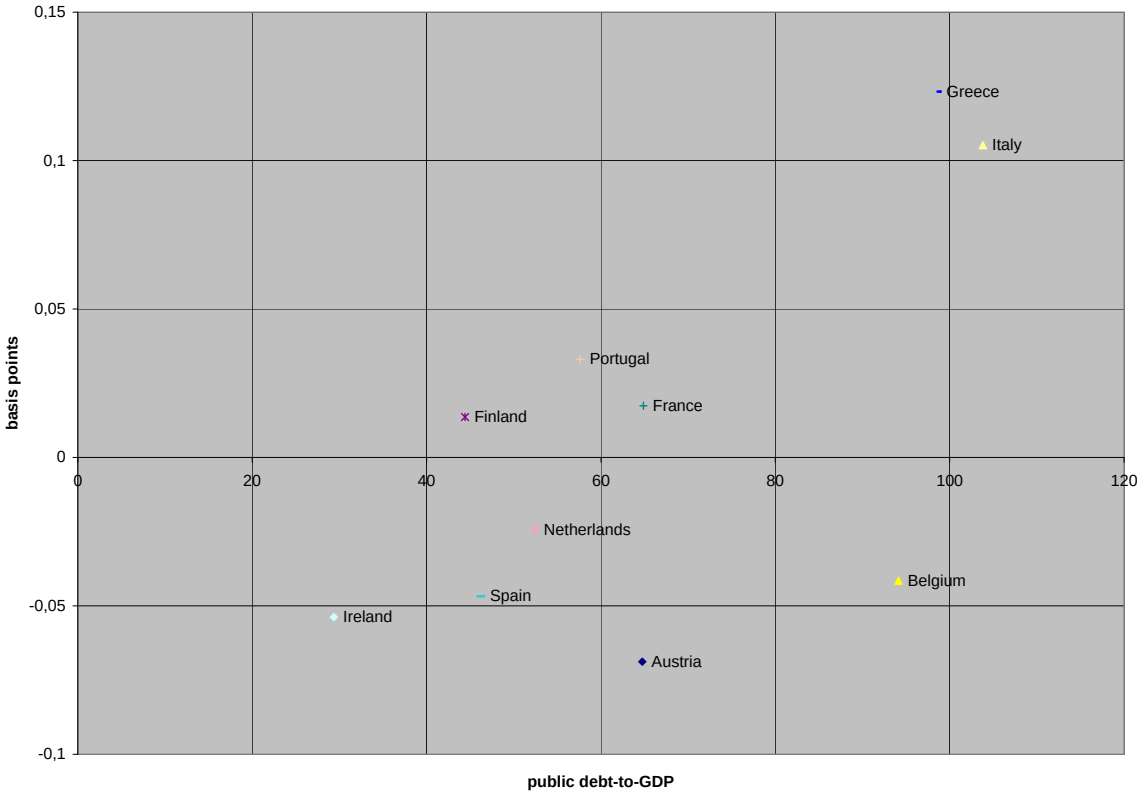

Figure 4: *Debt and Spreads in 2008*

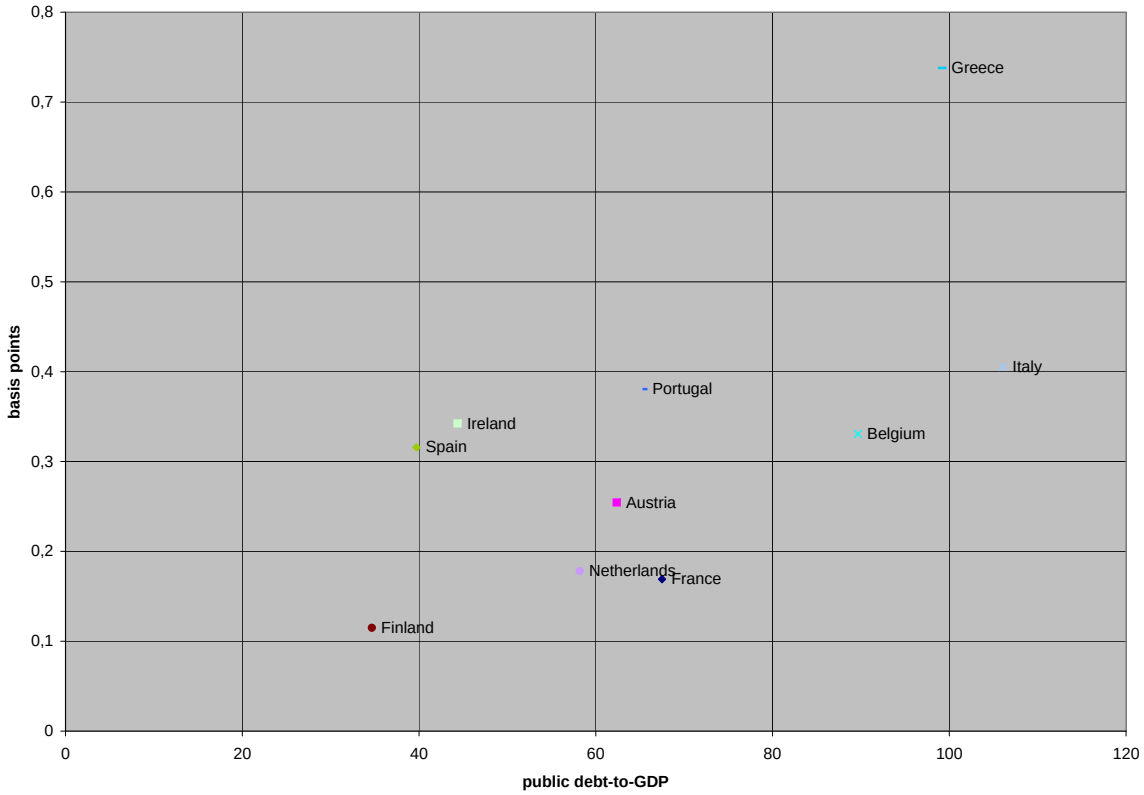

Table 1: *Main Estimation Results*

Regression	A	B	C	D	E
Debt-to-GDP > 1	**0.008434*** **	**0.003513***	**0.002913****	**0.021538*** **	**0.007723*** **
Debt-to-GDP < 1	**0.011601*** **	**0.005048****	0,001724	**0.012012***	
German Debt-to-GDP < 1	**0.042153*** **	**-0.029021*** **	0,010199	**-0.256941*** **	**-0.018329****
Cycl. Adj. Net Lending	**-0.01934*** **	**-0.013537*** **	-0,004198	**-0.028037***	**-0.016541*** **
MFI Debt	-0,000169	0,000303	-0,000452	**0.001907***	
MFI Loans Corporations	**0.000526*** **	-0,000227	5,79E-05	0,000517	
MFI Loans Households	**-0.000472*** **	0,000167	**0.000244****	**-0.001014****	
MFI Loans Foreign Debtors	**0.000798****	**0.000419***	0,000167	0,001017	**0.000921*** **
Expected GDP Growth 3-5YR	-0,02038	**-0.016103***	-0,018096	**-0.142777*** **	**-0.02876*** **
Real Effective Exchange Rate	0,00246	**-0,002724**	-0,004113	**-0.054298****	
Repo Rate	**0.058534*** **	**0.046301*** **	**0.033634*** **	**-0.17165*** **	**0.059822*** **
Variance Euribor-Repo	**9.047119*** **	**-1.643585***	**-3.622647*** **	**7.228381*** **	
Variance Euro Stoxx	**0.000124*** **	2,81E-05	-6,47E-06	**0.000306*** **	
Variance Spread	**7.003149*** **	-1,009988	**-4.129583*** **	**4.882702*** **	
D*Debt-to-GDP > 1					**0.00355*** **
D*German Debt-to-GDP < 1					**-0.166006*** **
D*Cycl. Adj. Net Lending					**-0.011587*** **
D*MFI Loans Households					**-0.00013*** **
D*Real Effective Exchange Rate					**0.014472*** **
D*Repo Rate					**-0.216432*** **
D*Variance Euribor-Repo					**7.390355*** **
D*Variance Euro Stoxx					**0.000248*** **
D*Variance Spread					**5.272176*** **
Sample	Full	Pre-crisis	Stable	Crisis	Full
Adjusted R-Squared	0,722216	0,730221	0,734881	0,843276	0,833146

Table 2: *Predictive Power of the Baseline Model, Full Sample*

Country	Spread		Error
	Actual	Predicted	
Austria	0,0844775	0,0844785	-0,001184%
Belgium	0,0946375	0,0946363	0,001321%
Finland	0,0377425	0,0377428	-0,000662%
France	0,0265875	0,0265878	-0,000940%
Greece	0,5073750	0,5073745	0,000099%
Ireland	0,2043025	0,2043020	0,000245%
Italy	0,2712075	0,2712070	0,000184%
Netherlands	0,0279925	0,0279923	0,000893%
Portugal	0,2002350	0,2002350	0,000000%
Spain	0,1183725	0,1183728	-0,000211%
Average	0,1572930	0,1572929	0,000079%

Table 3: *Predictive Power of the Baseline Model, Crisis Sample*

Country	Spread		Error
	Actual	Predicted	
Austria	0,2937500	0,2937490	0,000340%
Belgium	0,3234700	0,3234700	0,000000%
Finland	0,1544600	0,1544600	0,000000%
France	0,1527800	0,1527800	0,000000%
Greece	1,1564500	1,1564490	0,000086%
Ireland	0,8060400	0,8060400	0,000000%
Italy	0,5986400	0,5986390	0,000167%
Netherlands	0,1974400	0,1974390	0,000506%
Portugal	0,5225100	0,5225100	0,000000%
Spain	0,4043100	0,4043110	-0,000247%
Average	0,4609850	0,4609847	0,000065%