The Importance of Being Earnest: Macroeconomic Determinants of Sovereign Bond Yield Spreads in the Eurozone

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Abstract

This paper provides an empirical analysis of the macroeconomic determinants of sovereign bond yield spreads in the eurozone from 2000 until August 2012, when the Outright Monetary Transactions programme was launched. Results show that the relationship between sovereign risk and macroeconomic fundamentals is affected by a strong country sentiment effect. The impact of country sentiment on sovereign risk is larger for those countries experiencing high spreads. Quantile regressions results suggest that policy recommendations should be adapted to each country's market perception, due to the differential effect that variations in fundamentals have on each economy.

1 Introduction

This paper examines the relationship between sovereign risk and macroeconomic fundamental variables in the eurozone-12 for the period 2000–2012Q2. After the second quarter of the year 2012, sovereign yields are biased by ECB's intervention in debt markets (Acharya et al., 2017) through the Outright Monetary Transactions (OMT) programme. Thus, they don't properly reflect market's perception of sovereign risk.

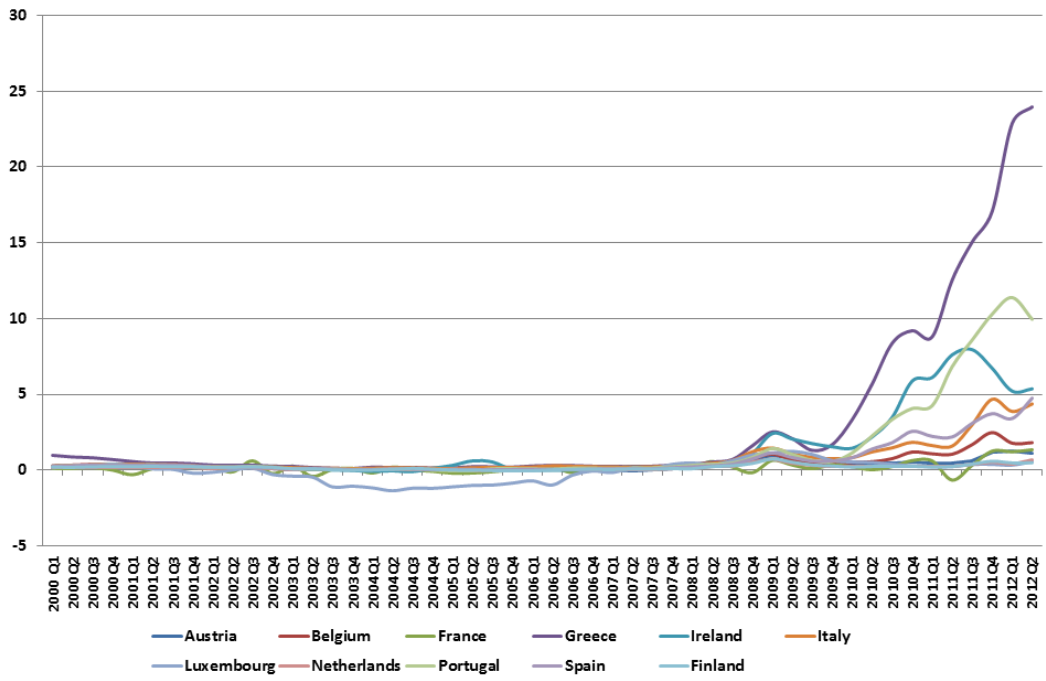
Even from 2018's perspective, we need to look back to those first twelve years of the monetary union to fully understand market perception of sovereign risk without the noise of European Central Bank's (ECB) intervention.

The motivation and selection criteria for the sample and period is based on the existing literature and on the limitations imposed by economic policy. Most of the existing literature, which this paper uses as a key tool for building the main specification, takes into account only Eurozone-12 countries, usually excluding Luxemburg (Attinasi et al. (2009); Bernoth et al. (2006); De Grauwe and Ji (2013); Haugh et al. (2009); Heryan and Ziegelbauer (2016)). In this paper, we decided to include Luxembourg to make results sounder and applicable to the whole set of eurozone founding states plus Greece. As it has been said, the time span chosen begins with the creation of the Euro and finishes with the announcement of the OMT.

It is commonly argued (De Grauwe and Ji, 2013) that, in a monetary union, sovereign bond yield spreads reflect default risks for a given country. Figure 1 shows the evolution of sovereign bond yield spreads in the eurozone from 2000 until the second quarter of 2012. Data shows that Greece, Ireland, Portugal, Italy and Spain have been facing the highest default risks among eurozone countries since the collapse of Lehman Brothers, in September 2008.

The evolution of sovereign spreads rises two important questions. The first one is whether spreads can be explained only by fundamental macroeconomic variables or if other factors, like market perception or country sentiment, could be affecting this relationship. The second one is if the relationship between spreads and macroeconomic fundamentals is constant for every country in the eurozone.

Figure 1: Sovereign Bond Yield Spreads. Eurozone. 2000 Q1 - 2012 Q2



Source: Thomson Datastream.

Both questions are very important from the policy perspective. The first one is connected with the emphasis that European and multilateral institutions are putting on the stabilization of macroeconomic indicators in problematic countries.

The creation of common goals for different countries, like in the Maastricht criteria or in the newly-established Macroeconomic Imbalance Procedure, may not be the most efficient way to anticipate sovereign crises in case that the relationship between macroeconomic fundamentals and spreads was not constant for all countries. Market participants' perception on sovereign risk could be formed by different elements for each country, beyond macroeconomic fundamentals.

The second one is related to the reforms that European policy-makers are implementing to make the eurozone more efficient and resilient. It is important to understand how the market perceives sovereign risk within the monetary union to design the nec-

essary mechanisms to prevent and control debt crises like the one experienced in the 2009-2012 period.

From a theoretical perspective, the relationship between fundamentals and sovereign risk offers insights that need to be considered. All else equal, a country with weaker fundamentals is more likely to experience a sovereign default. This risk should be reflected in a higher yield spread on its bonds.

In order to answer to these questions we constructed an unbalanced panel with quarterly data from 2000 Q1 to 2012 Q2 for the twelve eurozone countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Luxembourg, Italy, Netherlands, Portugal and Spain.

We propose a model that explains spreads through the main categories of variables observed in the literature. The relationship between them is analyzed using ordinary least squares (OLS) and quantile regressions. As we will show later, quantile regressions provide a more precise estimation given the huge heterogeneity across counties that can be observed in the eurozone.

The results obtained improve on previous findings on this topic (de Grauwe and Ji, 2012) in two ways. First, they show that even after introducing every category of determinants found in the literature in the main specification, fundamentals can only partially explain the evolution of sovereign risk in the eurozone. Second, they find there is a country-sentiment effect that affects the relationship between macroeconomic indicators and sovereign risk. Furthermore, the paper finds that the country-sentiment effect is larger for countries facing high spreads.

These results suggest that, as in Oscar Wilde's play "The Importance of Being Earnest" (Wilde, 1990), country sentiment, all the elements inherent to each country not captured by macroeconomic fundamentals, play a crucial role in determining spreads, specially for countries already experiencing high default risks.

This paper is organized as follows. Section 2 explains the construction of the main specification. Section 3 estimates the model using OLS and quantile regressions and builds an heterogeneity index to capture the aggregate effect of country-sentiment on sovereign risk. Finally, Section 4 forms the conclusion and explains the main policy implications.

2 Empirical Strategy

2.1 Setting the Main Specification

Research on sovereign risk determinants has been traditionally focused on developing economies. During the last decades, those countries were more exposed to default risk. As a consequence, their sovereign bond yields were higher and more volatile. Macroeconomic and financial fundamentals have been found to have a significant effect on the evolution of bond yields and other sovereign risk variables on this group of countries (Hilscher and Nosbusch, 2010).

In recent years advanced economies have also been object of analysis on this topic. In the case of the United States, fiscal policy variables have been found as significant determinants of default risk, as Goldstein and Woglom (1991) point out. For the same market, Laubach (2003) shows evidence of the relationship between the US government deficit and treasury yields, as well as long-term interest rates.

Research on European countries mainly describes the current economic crisis in countries like Greece, Ireland, Portugal, Spain and Italy. For eurozone countries, there are several papers that point out a significant relationship between fiscal balance indicators and sovereign bond yield spreads, as shown in Faini (2006). Fiscal fundamentals are also determinants of spreads, according to Bernoth et al. (2006). There also ap-

pears to be a consensus on how the overall situation of a country affects default risk, as Alesina et al. (1992) point out.

Default risk in European countries is also affected by other categories of determinants, besides public sector indicators and the individual conditions in each country. Table 1 summarizes all the categories of determinants that have been found to have a signifficant effect on sovereign risk in European countries. Financial system, debt market conditions, external sector, economic activity, labor market, international risk and crisis-related indicators have been included in previous especifications.

Table 1: Literature Review. Main Categories of Sovereign Risk Determinants

	INDEPENDENT VARIABLES								
Citation	**Financial System**	**Public Sector**	**Debt Market**	**External Sector**	**Activity**	**Labor Market**	**Global Risk**	**Country Risk**	**Crisis**
Afonso, 2015		X	X	X	X		X		
Aristei, 2014	X	X	X	X	X		X	X	
Attinasi,2009		X	X				X		
Barbosa,2010	X	X	X	X				X	X
Barrios,2009		X	X	X			X	X	
Basurto,2010		X	X				X		
Beber,2009	X		X					X	
Bernoth,2004	X	X	X		X				
Caggiano, 2012	X		X		X		X		
Codogno,2003		X	X					X	
De Vries, 2016	X	X	X	X	X	X		X	
Ejsing,2011	X		X					X	
Favero,2008			X		X			X	
Ferrucci,2003	X	X	X	X					
Gerlach,2010		X	X					X	
Gomez-Puig,2005			X					X	
Haugh,2009	X	X	X					X	
Heryan, 2016							X	X	
Mati,2008	X	X	X	X	X				
Mody,2009		X	X						
Petrova,2010	X	X	X	X				X	
Rowland, 2002		X	X	X	X			X	
Schuknecht,2010	X	X	X						
Schwartz,2010	X		X					X	
Sgherri,2009	X	X	X		X			X	
This paper	X	X	X	X	X	X	X	X	X

Both in developing and developed economies, research examines the relationship between a variable that captures the country's default risk and a set of financial and macroeconomic variables. This paper contributes to the existing literature through three novel empirical strategies. The first one is the use of a model that includes every single category of sovereign risk determinants found in the literature. The second one is the inclusion of country-sentiment variables that capture all the elements inherent to a country constant across time, other than macroeconomic fundamentals. The third one is the use of quantile regressions to estimate the model.

Default risk is usually measured through three different indicators: sovereign bond yields, sovereign bond yield spreads versus a benchmark bond and credit default swaps (CDS). In the specification that we propose we have selected 10 years sovereign bond yield spread as the variable that captures sovereign risk.

There are two reasons for this choice. The first one is that sovereign bond yield spread versus German bond has become the main variable to analyse the default risk in Europe during the crisis 2008-2012. Literature (Bernoth et al., 2006; Codogno et al., 2003; Schuknecht, 2010) as well as policy-makers (European Commission, 2010a, 2010b, 2011, 2012) focus their research and policy proposals on the evolution of this variable. Furthermore, sovereign bond yield spreads and yields offer similar results in the observed period, as it will be shown later. Spreads will also allow country effects to capture the cost of being country i instead of Germany. Table 6, in the appendix, shows OLS estimation with sovereign yields as the dependent variable, instead of sovereign spreads. Results are quite similar in both cases, as it will be explained later.

The second one emerges from the fact that, in March 2012, the International Swaps and Derivatives Association (ISDA) decided that the CDS on Greece were not going to be activated, since Greece did not actually default on its debt (ISDA, 2012). This implies that CDS are problematic as a measure of default risk in the case of the eurozone. Moreover, publicly available data for sovereign CDS in the eurozone have important discontinuities before the year 2008. For these reasons we have favored spreads over CDS as the dependent variable.

From the perspective of the explanatory variables, it is somewhat surprising that most of the existing literature does not take into account the whole default risk picture at the same time. Previous analyses are usually focused on a specific element that could be affecting sovereign risk but they rarely try to answer the default question globally.

As it has been previously said, Table 1 shows the main categories of macroeconomic determinants detected in the literature. In the specification that we propose in section 2.2, we select the variable that best captures the effect of the whole category on sovereign risk. On the side of the independent variables, we have established nine categories of determinants: financial system, public sector, debt market, external sector, economic activity, labor market, international risk, country risk and crisis effect. It could be argued that GDP size and GDP growth take both into account economic activity, but GDP size is used in the literature, and in our paper, as a proxy for the cost of a hypothetical bail-out. Tables 4 and 5, in the Appendix section, show the summary statistics and the data measures and sources.

2.2 Specification

Equation 1 captures the selection of variables presented and described in Section 2.1. It shows the relationship between sovereign bond yield spreads and the set of selected macroeconomic determinants. Data sources and summary statistics can be found in Tables 4 and 5, in the Appendix.

$$S_{it} = \gamma_1 Credit_{it} + \gamma_2 Deficit_{it} + \gamma_3 Debt_{it} + \gamma_4 CA_{it} + \gamma_5 GDPg_{it} + \gamma_6 GDPs_{it} + \gamma_7 U_{it} + \gamma_8 VIX_t + \alpha_i + \beta_t + u_{it}$$

(Equation 1)

S_{it} = Sovereign bond yield spread (10 years) of country i in period t.

$Credit_{it}$ = Size of the financial sector, measured as the total credit to GDP ratio.

$Deficit_{it}$ = Budget balance to GDP ratio.

$Debt_{it}$ = Sovereign debt to GDP ratio.

CA_{it} = Current account surplus / deficit to GDP ratio.

$GDPg_{it}$ = GDP growth year on year.

$GDPs_{it}$ = GDP size measured in current euros.

U_{it} = Unemployment rate.

VIX_t = VIX index for all countries in period t.

α_i = Country i's fixed effect.

β_t = Time dummy

3 Results

Table 2 shows the results of estimating Equation 1 using OLS. The model is estimated both controlling and not controlling by country dummies, as it can be seen in columns 1 and 2. Columns 3 and 4 show the results adding the lagged spread (t-1) to the main specification, to account for spreads persistence (Gerlach et al., 2010).

Results show a significant relationship between public debt, VIX index, GDP growth and unemployment rate in both models. GDP size, budget balance and Credit to GDP are only found significant in the first estimation. After the inclusion of country dummies their significance partially fades away.

The most interesting fact that arises after the estimation of Equation 1 is that there is an increase in R2 for the second estimation (Column 2). This suggest that there are non-variant and non-fundamental elements for each country affecting the evolution of spreads. We will call this effect country-sentiment or non-fundamental country effect.

Results including the lagged spread as an explanatory variable are quite similar. Its inclusion does not alter the main point of the paper. It is true that the overall significance of the model increases after the inclusion of the lagged spread and that the significance of VIX index, GDP size and Credit to GDP ratio also varies. However, country effects still play a crucial role in determining the evolution of sovereign risk.

We would like to emphasize that we are not looking for a causal link between macroeconomic fundamentals and sovereign yield spreads. The main point of the paper, regarding the OLS regression, is showing that macroeconomic fundamentals, from all the categories found to be significant in the existing literature, cannot explain the evolution of sovereign yields by themselves. Country effects must be taken into account, even when we include all possible categories of determinants found in the literature. Again, this result holds after the inclusion of the lagged spread.

Robustness checks included in the appendix show that these results hold after the inclusion of more dependent variables (real effective exchange rate) and after measuring sovereign risk using yields instead of yields spreads. Tables 6 and 7 account for this facts. Table 8 show also that multicollinearity is not an issue. As can be seen in the

Table 2: OLS with and without country effects

VARIABLES	Yields Spread No Country Effects	Yields Spread Country Effects	Yields Spread No Country Effects	Yields Spread Country Effects
Current Account Balance	0.0034	-0.0233	-0.0014	-0.0053
	(0.010)	(0.017)	(0.006)	(0.015)
Public Debt	1.0845***	7.7494***	0.6034***	5.7592***
	(0.296)	(1.004)	(0.229)	(1.289)
VIX Index	0.0133***	0.0100***	0.0054	0.0060*
	(0.004)	(0.004)	(0.004)	(0.004)
GDP growth	-0.0880***	-0.0510*	-0.0995***	-0.0620**
	(0.030)	(0.031)	(0.035)	(0.031)
GDP size	-0.1905***	0.0615	-0.1437***	0.3957**
	(0.043)	(0.123)	(0.050)	(0.175)
Budget Balance	-0.0316***	0.0212	-0.0252***	0.0109
	(0.010)	(0.020)	(0.009)	(0.017)
Unemployment Rate	0.1252***	0.0890***	0.0665**	0.0516**
	(0.028)	(0.020)	(0.029)	(0.023)
Credit to GDP	0.0031**	0.0076	0.0020	0.0075
	(0.001)	(0.008)	(0.001)	(0.007)
Lagged Spread			0.4492**	0.2823
			(0.211)	(0.185)
Austria		0.4322		1.8179**
		(0.628)		(0.846)
Belgium		-1.7849**		0.1112
		(0.710)		(1.033)
Finland		2.5046***		3.4117***
		(0.650)		(0.779)
France		0.0699		0.2722
		(0.253)		(0.397)
Greece		-1.6715**		0.4979
		(0.750)		(1.141)
Ireland		3.4640***		4.0876***
		(0.726)		(0.834)
Italy		-2.7450***		-1.6065*
		(0.508)		(0.834)
Luxembourg		5.4193***		5.6161***
		(0.857)		(0.943)
Netherlands		1.3685		2.0270**
		(0.886)		(0.862)
Portugal		1.1779		2.5906***
		(0.726)		(0.927)
Spain		1.5195***		2.1748***
		(0.499)		(0.534)
Constant	-1.1498***	-6.4248***	-0.4615*	-6.3475***
	(0.295)	(0.945)	(0.236)	(1.061)
Observations	556	556	509	509
R-squared	0.384	0.646	0.615	0.721

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

correlations matrix, all the coefficients are below 0.5, and most of them below 0.3. Therefore, correlations are too low to induce a bias related to multicollinearity.

We also estimate Equation 1 using quantile regressions. OLS results in estimates that approximate the conditional mean of the response variable given certain values of the predictor variables. The problem with OLS estimations, as Angrist and Pischke (2008) point out, is that , sometimes, "distributions can change in ways not revealed by an examination of averages; for example, they can spread out or become more compressed".

The use of OLS and quantile regression techniques should show why OLS is not the most appropriate technique to study the relationship between macroeconomic determinants and sovereign risk in the eurozone. The existing heterogeneity among member states asks for a more precise estimation; the one provided by quantile regressions.

In order to obtain a more detailed picture of the relationship between sovereign bond yield spreads and macroeconomic fundamentals, it is necessary to know what is happening to the entire distribution, looking for winners and losers, as well as averages. Quantile regressions estimate either the conditional median or other quantiles of the response variable. This will allow us to understand what is happening to the entire distribution, to the relative winners and losers, as well as to averages.

The original quantile regression was introduced by Koenker and Bassett (1978), and was initially used by labor economists to study changes in the wage distribution. Its novel use for the research on sovereign risk will help us to understand how the same change in macroeconomic fundamentals can have a different impact on sovereign spreads, depending on your position on the sovereign spread distribution.

It could happen, for example, that a one point increase in the debt to GDP ratio may have a stronger relationship with spreads in the case of Greece than in the case of the Netherlands. Quantile regressions will allow us to detect these different relations for variables and countries.

Table 3: 10-year bond yield spreads against Germany. OLS and Quantile Regressions.

VARIABLES	OLS	0.25 Quantile	0.5 Quantile	0.75 Quantile
Current Account Balance	-0.0233	-0.0212***	-0.0216***	-0.0438***
	(0.017)	(0.004)	(0.004)	(0.007)
Public Debt	7.7494***	1.3919***	2.1243***	5.0148***
	(1.004)	(0.111)	(0.139)	(0.285)
VIX Index	0.0100***	0.0114***	0.0154***	0.0170***
	(0.004)	(0.001)	(0.001)	(0.002)
GDP Growth	-0.0510*	-0.0141***	-0.0145**	0.0238**
	(0.031)	(0.005)	(0.006)	(0.011)
GDP Size	0.0615	0.1156***	0.2578***	0.1940**
	(0.123)	(0.042)	(0.048)	(0.088)
Budget Balance	0.0212	0.0008	-0.0015	-0.0136**
	(0.020)	(0.002)	(0.003)	(0.007)
Unemployment Rate	0.0890***	0.0335***	0.0646***	0.0810***
	(0.020)	(0.006)	(0.007)	(0.013)
Credit / GDP	0.0076	0.0061*	0.0060	0.0271***
	(0.008)	(0.004)	(0.004)	(0.006)
Austria	0.4322	0.6842***	1.4103***	1.1118**
	(0.628)	(0.211)	(0.250)	(0.475)
Belgium	-1.7849**	0.3525*	0.8389***	-0.2151
	(0.710)	(0.207)	(0.254)	(0.484)
Finland	2.5046***	1.1770***	2.0778***	2.7012***
	(0.650)	(0.220)	(0.255)	(0.486)
France	0.0699	0.1376*	0.4587***	0.6950***
	(0.253)	(0.074)	(0.090)	(0.168)
Greece	-1.6715**	0.2088	0.6177**	-1.0473**
	(0.750)	(0.226)	(0.277)	(0.521)
Ireland	3.4640***	1.4014***	2.5184***	3.1812***
	(0.726)	(0.219)	(0.260)	(0.501)
Italy	-2.7450***	-0.0978	-0.0796	-1.6947***
	(0.508)	(0.116)	(0.145)	(0.275)
Luxembourg	5.4193***	1.2880***	3.2036***	4.8271***
	(0.857)	(0.239)	(0.275)	(0.531)
Netherlands	1.3685	0.6123*	1.4449***	0.2401
	(0.886)	(0.339)	(0.372)	(0.633)
Portugal	1.1779	0.6802***	1.5549***	1.6486***
	(0.726)	(0.227)	(0.270)	(0.514)
Spain	1.5195***	0.6374***	1.1995***	1.4037***
	(0.499)	(0.147)	(0.178)	(0.360)
Constant	-6.4248***	-2.1734***	-3.7134***	-5.5316***
	(0.945)	(0.251)	(0.291)	(0.564)
Observations	556	556	556	556
R-squared	0.646			
	Robust standard errors in parentheses			
	*** p<0.01, ** p<0.05, * p<0.10			

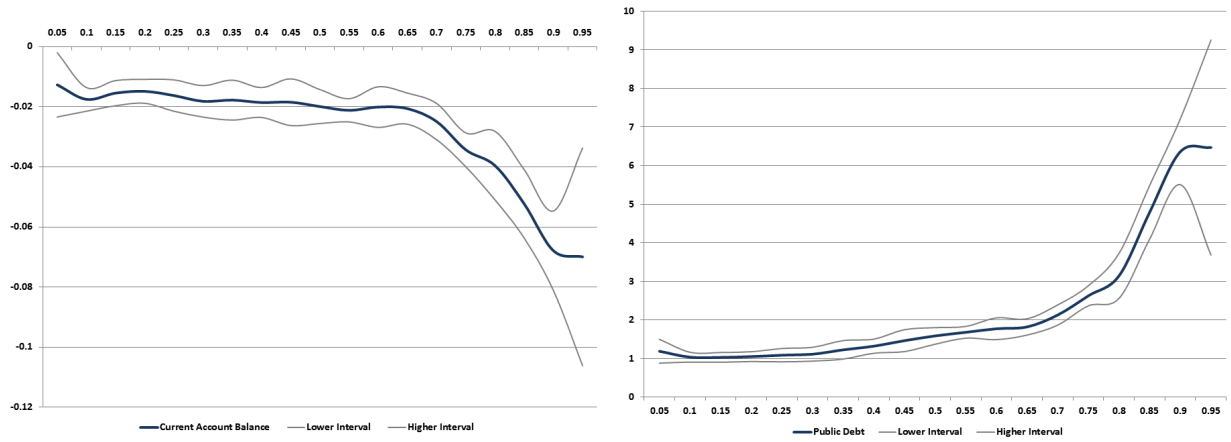
The main results obtained from OLS and quantile regressions estimations are shown in Table 3. The first column contains the results from OLS estimations while the second, the third and the fourth columns offer the results for the quantiles 0.25, 0.5 and 0.75. If significant differences arise from parameters in each quantile it would be necessary to repeat quantile regression estimation for every quantile, not only for 0.25, 0.5 and 0.75, in order to obtain the whole picture of the estimation.

OLS estimation results are consistent with those found in the previous literature (de Grauwe and Ji (2012); Barbosa and Costa (2010)), and with the economic theory. There is a significant and positive relationship between public debt, VIX index and the unemployment rate with sovereign bond yield spreads. The relationship between GDP growth and spreads is significant also, but with a negative sign.

Country sentiment play an important role in explaining spreads evolution, not only for the conditional mean, but for the entire distribution. OLS results show that reputation variables have a significant effect on spreads in all cases, except for France, the Netherlands and Portugal. The effect of being country i instead of Germany has a positive relationship with spreads in nearly all cases. The effect is higher for the last quantiles. There are only three exceptions to this rule: Greece, Italy and Belgium. This result seems to be biased by the fact that, along the whole sample, their debt to GDP ratio was above 100 per cent. Further research is needed to confirm or reject this hypothesis.

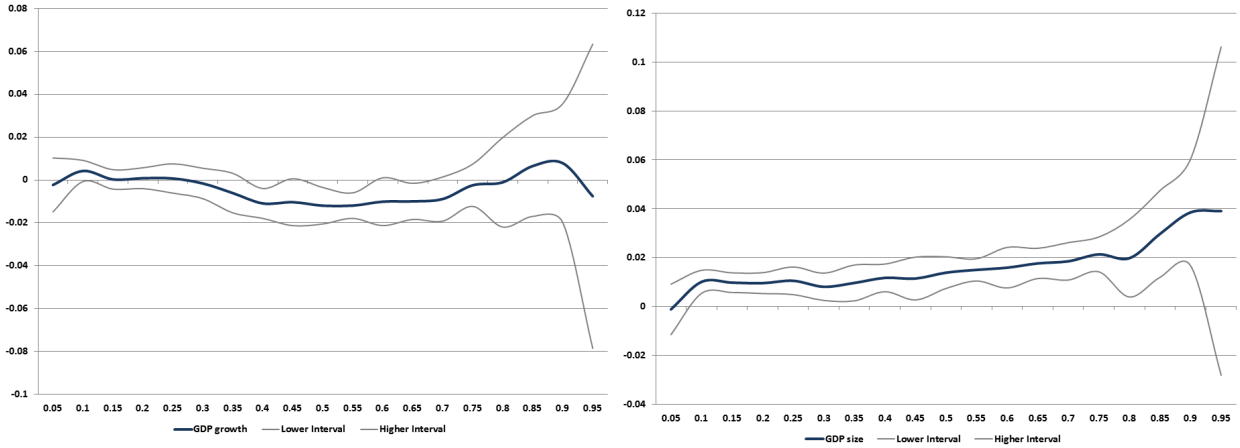
Quantile regressions offer different coefficients for each variable along quantiles. The variability of coefficients does not affect each variable in the same way. For example, current account balance coefficients do not vary too much along the three observed quantiles. However, public debt coefficients increase from 1.38 in the first quantile to 5.09 in the third. This fact suggest that public debt has a tighter relation with spreads in the case of countries experiencing higher spreads.

The question that arises from the observation of Table 3 is whether the relationship between macroeconomic variables and country sentiment is stable for the sample or if there are important differences across all quantiles. In order to answer this question we estimate the main specification using quantile regressions, not only for the three mentioned quantiles, but for all of them. Figures 2 to 5 show the results obtained.



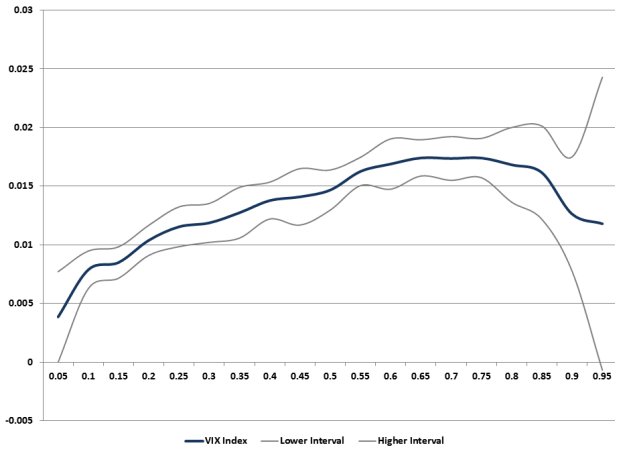
(a) Current Account Balance (b) Public Debt to GDP ratio

Figure 2: Quantile Regression I

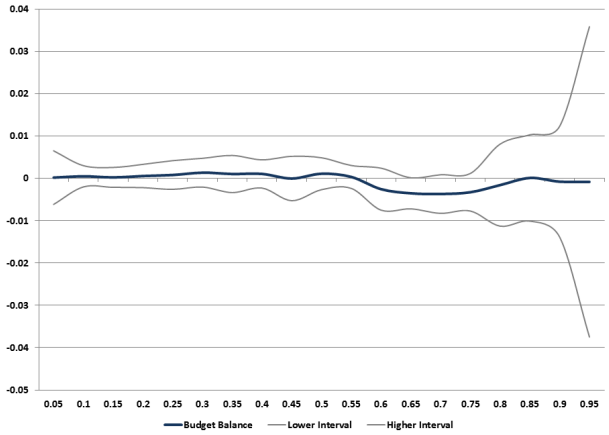


(a) VIX Index (b) GDP Growth

Figure 3: Quantile Regression II

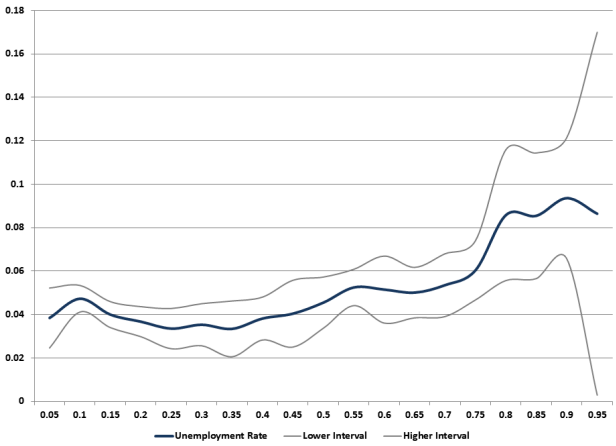


(a) GDP Size

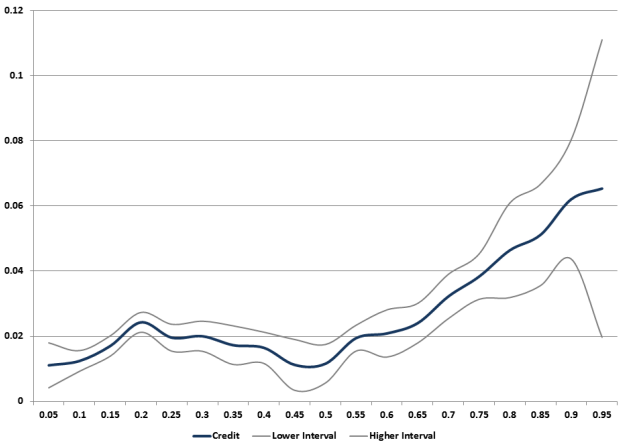


(b) Budget Balance

Figure 4: Quantile Regression III



(a) Unemployment Rate



(b) Credit to GDP ratio

Figure 5: Quantile Regression IV

Figure 2 shows that current account balance has a negative relationship with sovereign bond yield spreads for every quantile. Coefficients are increasingly negative as we move from 0.1 quantile to 0.9 quantile. Debt to GDP ratio, on the other hand, has a positive and strong relationship with spreads. The effect of an increase in the debt to GDP ratio is stronger for countries with high spreads.

International risk, measured through VIX Index results in a positive and increasing coefficients, as can be seen in Figure 3. GDP growth experience no significant change in the relationship with spreads for the whole sample. A similar behaviour is found for

GDP size (Figure 4). GDP size coefficients slightly increase as we move from initial to final quantiles, although they fall lightly for 0.9 and 0.95 quantiles. Budget balance results are mostly constant for the entire distribution.

Unemployment rate coefficients increase as we move from initial to final quantiles, as it can be seen in Figure 5. This suggest that the effect of a one-point increase in the unemployment rate on sovereign bond yield spreads would be higher for countries currently experiencing high spreads. The size of the financial sector shows a similar performance than unemployment, although its coefficients are smaller.

Concerning country effects, quantile Regression results suggest that the fact of being country i instead of Germany has a stronger relationship with sovereign bond yield spreads as we move from quantile 0.1 to quantile 0.9. In order to confirm this result we will develop a heterogeneity index that will show the aggregate behaviour of these variables.

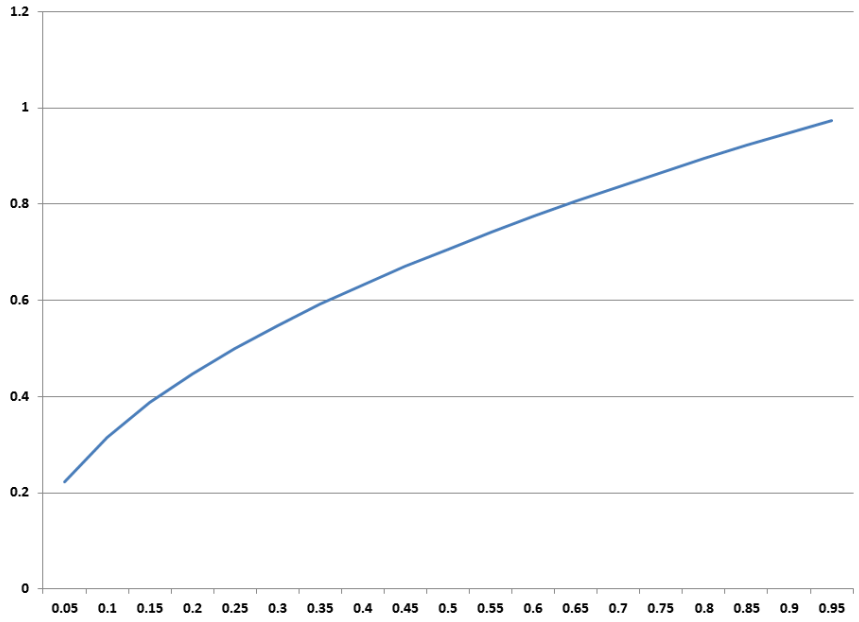
Equation 2 shows the aggregate effect of country variables on sovereign bond yield spreads, for every quantile. We define this heterogeneity index similarly to mean average deviation. The index shows the aggregate effect of country variables on sovereign bond yield spreads, for every quantile. This measure should be more effective than just using absolute values, since it penalizes more outliers thanks to the use of squared parameters.

$H = (\sum_{i=1}^{N} C_i^2)^{1/2}$

(equation 2)

Results for every quantile are shown in Figure 6. Heterogeneity increases for all quantiles. This fact suggests that being country i instead of Germany has a stronger relationship with spreads for countries that are currently facing high spreads. Fundamentals, thus, can't explain by themselves the interest that countries have to pay for their public debt, specially in the most problematic cases; country sentiment play an increasingly relevant role in determining sovereign risk, specially in countries experiencing high spreads.

Figure 6: Heterogeneity Index.



Source: Own research.

4 Conclusions and Policy Implications

This paper offers two main conclusions. The first one is that the relationship between macroeconomic fundamentals and sovereign bond yield spreads is not constant for every quantile. Quantile regressions show that parameters and significance vary from first to last quantiles.

The second one is that macroeconomic fundamentals explain sovereign bond yields behaviour only partially. There are big country effects that affect sovereign risk. These results have been obtained after analysing the main literature regarding sovereign bond yield spreads and building a specification containing variables from each category of determinants.

The main categories of determinants found in the literature are financial system, public sector, debt market, external sector, economic activity, labour market, international risk, country risk and economic crisis. For each of those categories, our specification contains a variable that captures its relationship with sovereign bond yield spreads.

The variables that we have used are the total credit to GDP ratio, the budget balance to GDP ratio, the sovereign debt to GDP ratio, the current account position (as percentage of GDP), the GDP growth, the GDP size, the unemployment rate and the VIX index. We have also used country and time dummies to control by country and crisis effects. The results obtained build on previous findings on this topic (de Grauwe and Ji, 2012).

Results developed in Section 3 suggest that there is something else, apart from macroeconomic fundamentals, that is affecting sovereign bond yield spreads: country effects. This means that markets and investors are perceiving risks and strengths in each country that are not captured by fundamental macroeconomic variables. Further research is needed to clarify how this effect is formed and how can it be controlled by policy-makers.

Some authors, like de Grauwe and Ji (2012), argue that the decision of defaulting "is a discontinuous one, and leads to potential losses. Thus, as the debt to GDP ratio increase, investors realise that they come closer to the default decision making them more sensitive to a given increase in the debt to GDP ratio". The same conclusion can be found in Favero et al. (1997).

If we take into account this possibility and include a non-linear specification with squared debt to GDP ratio, all the results obtained hold also and remain consistent. Results also hold when considering other default-risk measures like 10-year-bond yields, or including additional explanatory variables, such as the lagged spread or the real effective exchange rate.

4.1 Policy Implications

It is important to highlight that the results contained in section 3 rely on relationships between variables without assuming causality. Thus, policy implications can only be tentatively stressed since more research is needed to confirm causality relations.

In the introduction we highlighted the relevance of the research question to the light of two different policy implications. The first one is the emphasis that European policy makers are putting on macroeconomic indicators stabilization. The second one is related to the reforms that are being implemented to make the Eurozone more efficient and resilient, as well as with market perception of sovereign risk within the monetary union.

Regarding the first one, the establishment of common goals, like the Maastricht criteria or the newly-established Macroeconomic Imbalance Procedure, may not be the most efficient way to anticipate and prevent sovereign crises. Market participants' perception on sovereign risk seems to be formed by different idiosyncratic elements for each country, beyond macroeconomic fundamentals.

Furthermore, quantile regression results show that variations in macroeconomic fundamentals don't affect each country in the same way, and that not all the fundamentals seem to have a significant effect on sovereign spreads. This fact suggests that an adapted adjustment path (different variables, different goals) should be proposed to each country experiencing a shock, even when it is a symmetrical one. All these results highlight that it is almost impossible to find a common and unique economic policy for the whole monetary area in order to reduce sovereign risk.

In addition to correct macroeconomic imbalances, policy makers should focus on country effects' decomposition in order to find the inherent drivers of sovereign risk perception in each country. This would help to understand what the market expects from the ongoing eurozone's reform process, both from the institutional and the economic convergence points of view. Factor analysis techniques could be useful for this task. Market participants seem to have different expectations for each country.

5 Appendix

Table 4: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Current Account to GDP	594	-0.15	6.24	-16.39	17.81
Public Debt to GDP	596	0.67	0.32	0.06	1.75
10 year yield	600	4.53	1.98	1.42	25.40
10 year spread	600	0.71	2.18	-1.33	23.98
GDP size	600	1.71	1.82	0.05	6.59
GDP growth	597	1.77	2.65	-8.23	10.06
VIX Index	600	23.00	9.05	11.41	62.54
Budget Balance to GDP	597	-1.95	5.99	-95.36	9.04
Unemploymen Rate	600	8.08	3.51	1.80	24.63
Total Credit to GDP	559	14.82	20.47	2.77	96.03
Lagged Spread	550	0.77	2.26	-1.33	23.98

Table 5: Data Measures and Sources

Variable	Measure	Source
Current Account Balance	% of GDP	Eurostat
Public Debt	% of GDP	Eurostat
10-year yield	Bond Interest, secondary market	European Central Bank
10-year spread	Difference with German bond	European Central Bank
GDP size	Constant, billion euros	Eurostat
GDP growth	% change, year on year	Eurostat
VIX Index	%, expected movement in S&P 500	Thomson Reuters
Budget Balance	% of GDP	Eurostat
Unemployment Rate	%	Eurostat
Total Credit	% of GDP	Eurostat
Lagged Spread	Difference with German bond, T-1	European Central Bank

Table 6: Robustness: Real Effective Exchange Rate (REER)

	WITH REER		WITHOUT REER	
	Spread		Spread	
VARIABLES	No Country Effects	Country Effects	No Country Effects	Country Effects
Current Account Balance	0.0034	-0.0174	0.0034	-0.0233
	(0.010)	(0.018)	(0.010)	(0.017)
Public Debt	1.0481***	8.0473***	1.0845***	7.7494***
	(0.287)	(1.074)	(0.296)	(1.004)
VIX Index	0.0122***	0.0120***	0.0133***	0.0100***
	(0.005)	(0.004)	(0.004)	(0.004)
GDP growth	-0.0992***	-0.0317	-0.0880***	-0.0510*
	(0.034)	(0.029)	(0.030)	(0.031)
GDP size	-0.1870***	-0.1142	-0.1905***	0.0615
	(0.042)	(0.149)	(0.043)	(0.123)
Budget Balance	-0.0320***	0.0222	-0.0316***	0.0212
	(0.010)	(0.021)	(0.010)	(0.020)
Unemployment Rate	0.1245***	0.0783***	0.1252***	0.0890***
	(0.028)	(0.020)	(0.028)	(0.020)
Credit to GDP	0.0032**	0.0080	0.0031**	0.0076
	(0.001)	(0.008)	(0.001)	(0.008)
Austria		-0.4511		0.4322
		(0.749)		(0.628)
Belgium		-2.6670***		-1.7849**
		(0.894)		(0.710)
Finland		1.6109**		2.5046***
		(0.720)		(0.650)
France		-0.0947		0.0699
		(0.275)		(0.253)
Greece		-2.4963***		-1.6715**
		(0.835)		(0.750)
Ireland		2.6456***		3.4640***
		(0.736)		(0.726)
Italy		-3.1540***		-2.7450***
		(0.600)		(0.508)
Luxembourg		4.6114***		5.4193***
		(0.813)		(0.857)
Netherlands		0.5638		1.3685
		(0.895)		(0.886)
Portugal		0.3792		1.1779
		(0.755)		(0.726)
Spain		1.1683**		1.5195***
		(0.477)		(0.499)
REER	-0.0106	0.0231**		
	(0.008)	(0.011)		
Constant	-0.0336	-7.9860***	-1.1498***	-6.4248***
	(0.873)	(1.427)	(0.295)	(0.945)
Observations	556	556	556	556
R-squared	0.385	0.648	0.384	0.646

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 7: Robustness: Yields

VARIABLES	yields	yields	spread	spread
Current Account Balance	-0.0052	-0.0036	-0.0233	0.0034
	(0.020)	(0.011)	(0.017)	(0.010)
Public Debt	6.6235***	1.2495***	7.7494***	1.0845***
	(1.018)	(0.291)	(1.004)	(0.296)
VIX Index	0.0196***	0.0229***	0.0100***	0.0133***
	(0.005)	(0.005)	(0.004)	(0.004)
GDP growth	0.0397	0.0336	-0.0510*	-0.0880***
	(0.033)	(0.030)	(0.031)	(0.030)
GDP size	-1.4092***	-0.1883***	0.0615	-0.1905***
	(0.163)	(0.044)	(0.123)	(0.043)
Budget Balance	0.0368	-0.0007	0.0212	-0.0316***
	(0.029)	(0.021)	(0.020)	(0.010)
Unemployment Rate	0.0600**	0.1158***	0.0890***	0.1252***
	(0.024)	(0.027)	(0.020)	(0.028)
Credit to GDP	0.0167	0.0029	0.0076	0.0031**
	(0.013)	(0.002)	(0.008)	(0.001)
Austria	-7.0177***		0.4322	
	(0.827)		(0.628)	
Belgium	-8.7270***		-1.7849**	
	(0.884)		(0.710)	
Finland	-5.7818***		2.5046***	
	(0.841)		(0.650)	
France	-1.8417***		0.0699	
	(0.320)		(0.253)	
Greece	-8.5835***		-1.6715**	
	(0.986)		(0.750)	
Ireland	-4.7193***		3.4640***	
	(0.911)		(0.726)	
Italy	-5.3065***		-2.7450***	
	(0.590)		(0.508)	
Luxembourg	-3.9458***		5.4193***	
	(1.043)		(0.857)	
Netherlands	-6.1586***		1.3685	
	(1.354)		(0.886)	
Portugal	-6.3718***		1.1779	
	(0.949)		(0.726)	
Spain	-3.5668***		1.5195***	
	(0.645)		(0.499)	
Constant	6.4867***	2.3955***	-6.4248***	-1.1498***
	(1.101)	(0.289)	(0.945)	(0.295)
Observations	556	556	556	556
R-squared	0.480	0.248	0.646	0.384

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 8: Robustness: Correleations Matrix

	Current Account	Debt	GDP size	GDP growth	VIX Index	Budget Balance	Unemployment Rate	Total Credit
Current Account	1.00							
Debt	-0.4088	1.00						
GDP size	0.0541	0.2304	1.00					
GDP growth	0.0988	-0.3442	-0.254	1.00				
VIX Index	-0.0345	0.0381	0.0049	-0.277	1.00			
Budget Balance	0.3339	-0.4024	0.0649	0.3657	-0.0959	1.00		
Unemployment Rate	-0.3654	0.4244	0.1702	-0.3514	-0.005	-0.3839	1.00	
Total Credit	0.2302	-0.0258	-0.0394	-0.0694	0.0212	-0.0047	-0.3905	1.00

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