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Sovereign bond spread drivers in the EU market in the aftermath of the global financial crisis

Iuliana Matei^a and Angela Cheptea^b

(Preliminary version- February 2012)

Abstract: Recently the world economy was confronted to the worst financial crisis since the great depression. This unprecedented crisis started in mid-2007 had a huge impact on the European government bond market. But, what are the main drivers of this “perfect storm” that since 2009 affects EU government bond market as well? To answer this question, we propose an empirical study of the determinants of the sovereign bond spreads of EU countries with respect to Germany during the period 2003-2010. Technically, we address two main questions. First, we ask what proportion of the change in sovereign bond spreads is explained by changes in the fundamentals, external factors, liquidity and market risks. Second, we distinguish between EU member states within and outside the Euro area and question whether long-run determinants of spreads affect EU members uniformly. To these ends, we employ panel data techniques in a regression model where spreads to Germany (with virtually no default risk) are explained by set of traditional variables as well as a number of policy variables. Results reveal that large fiscal deficits and public debt, as well as liquidity and political risks are likely to put substantial upward pressures on sovereign bond yields in many advanced European economies over the medium term.

Key-words: Debt, Euro zone crisis, financial contagion, panel models.

JEL Classification: F33, E42, G15.

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1. Introduction

The last three years the world economy faced the worst financial crisis since the great depression. Started in mid-2007, this unprecedented crisis had huge impacts on the Euro zone government bond market. In the general backdrop of a mix of deteriorating economic prospects, falling commodity prices, growing risk aversion and huge financial stress have raised concerns about risks of sharp increases in fiscal deficits and government debt in many countries. In early 2009 market interest rates on sovereign debt have started to spike upward across several European countries affecting particularly countries with large and vulnerable banking sectors (Iceland for excessive leverage and borrowing in foreign currencies, Austria for exposure to emerging Europe, Ireland and Spain for exposure to housing corrections, Greece, Portugal and Italy for weak fiscal positions. Hence, the rising share of sovereign bond flows in total capital inflows particularly in times of crisis has become an issue of deep concern for many countries around the world.

With respect to the recent crisis, while the sovereign debt increases have been most pronounced only in a few Euro zone countries, they have become a perceived problem for the area as a whole. When the spreads between the yields of sovereign bonds issued by EMU countries and the yields of bonds with similar characteristics issued by German Economy (which virtually is free of default risk) go up, market perceptions of the default risk of non EMU economies increase as well. Hence, yield spreads measure the premiums required by investors to hold such securities and are a component of the costs the latter have to pay when borrowing on external markets. If one combines this with the foreign currency risk for EU countries that are not members of euro zone, one adds to the potential threat.

Taking into account the economic importance of yield spreads, a large body of the literature has focused on its determinants. How does the market assess sovereign default risk has become a crucial issue studied by many researchers and essentially for emerging countries: e.g. Edwards (1984), Cline and Barnes (1997), Kamin and Kleist (1999), Mody (2009), Jahjah and Zhanwei Yue (2010), Bellas, Papaioannou, and Petrova (2010). Although the evidence presented in this literature clearly suggests some empirical regularities for emerging markets and certain periods, the debate on the stable and significant determinants of sovereign default risk is far to be settled.

An increasing number of papers focus on the study of the determinants of sovereign bond yields spread for Euro zone: e.g. Manganelli S. and Wolswijk G. (2009), Barbosa and Costa (2010), Maltritz (2011). This recent literature provides interesting findings concerning drivers of yield spreads. However, the insights are heterogeneous not only for different periods and samples but also for similar periods due to the use of different variables or methodologies. The largest share of these papers employ panel data techniques on small data samples (up to 13 countries). No paper analyzes the determinants of sovereign bond yield spreads for a larger sample, such as the entire EU-27. Investigating yield spreads determinants at the level of the European Union is also relevant for raising the debate on the role of exchange rate policy into the assessment of sovereign default risk.

The purpose of this paper is to empirically identify key drivers of sovereign bond spreads in EU countries from an ex-post perspective. A particular focus is devoted to Euro-area member states when identifying both the long- and short-run determinants of spreads to Germany. This type of analysis, which we believe is at the heart of the current research, might reveal ways for national or regional governments to better assess sovereign default risks and avoid financial stress.

Technically, we address two main questions. First, we ask what proportion of the change in market spreads is explained by changes in the underlying fundamentals, external factors, liquidity and market risk. Second, we distinguish between Euro-area members and other EU members and explore the differences between the two groups in order to identify if long-run determinants, and to a lesser extent short-run determinants, of spreads to Germany affect European countries uniformly.

For these purposes, we use a panel of observations for 25 EU countries from 2003 to 2010. More precisely, we estimate an empirical model in which spreads to Germany are explained by a set of explanatory variables including the exchange rate regime, the political risk perception, and traditional determinants of spreads, such as GDP growth, inflation, debt, liquidity and fiscal measures. We apply panel data estimation techniques and test the difference in impacts for EMU and non EMU countries, before and during the crisis episodes.

2. Methodology and data

This section presents the empirical model we employ to test the hypothesis discussed above. Data sources and variables used in estimations are also explained here.

2.1 Methodology

2.1.1. The static panel data model

The present paper examines the main drivers of European sovereign bond spreads to Germany in the aftermath of the recent global crisis. To this end, we consider the following equation:

$$Spread_{it} = \mu + \beta \cdot HYP_{it} + \delta \cdot CV_{it} + v_i + \varepsilon_{it} \quad (1)$$

where $Spread_{it}$ is the difference between the yields of ten-year sovereign bonds issued by country i in year t and the yields of similar bonds issued by Germany. When spreads go up, market perceptions of the risks of default of these less developed EU economies go up too. Hence, the yields spreads measure the premium required by investors to hold such securities and they are a component of the costs that these less developed countries should pay when borrowing on the external markets. If one combines this with the foreign currency risk for EU countries that are not members of the Euro Zone, one adds to the potential threat. HYP is the vector of our hypothesis variables: political stability, exchange rate regimes, and Euro Zone membership. CV is a vector of control variables drawn from the recent empirical literature on long term spreads determinants: GDP growth, inflation, liquidity ratio, budget balance (surplus or deficit), government debt, and interaction variables. The term v_i is the country-specific disturbance and ε_{it} is the disturbance component varying across both time and countries. To get the most out of the variation in the data and in line with the existing literature, we choose to log-linearize the variables. Some of our variables have a negative sign on the considered period which does not allow us for a simple logarithmic transformation. This is why we employ the following expression in order to maintain the sign of each negative variable X and to keep the maximum number of observations in the non-balanced panel (Busse and Hefeker, 2007):

$$Y = \ln \left(X + \sqrt{X^2 + 1} \right) \quad (2)$$

where Y is the new observation obtained after transforming the initial negative observation X .

There are two main approaches to analyze the determinants of sovereign yield spreads in the recent empirical literature, both with their pros and cons (Maltritz, 2011). The first one relates both dependent and independent variables to an “anchor” country (in this paper Germany) by subtracting the selected (in)dependent variables for the studied countries by the (in)dependent variables of the “anchor” country. In doing so, this approach considers that the anchor country is not completely free of default risk. The second approach accepts the “free-risk” assumption regarding the benchmark country and consequently, explains the sovereign yield spreads with respect to the “anchor country” by the observed data for the selected explaining variables. We run the estimations by assuming the second approach where German bond yield is considered as the best approximation for a free-risk interest rate.

The benchmark model becomes:

$$\begin{aligned} \ln Spread_{it} = & \alpha_0 + \alpha_1 \ln GDPgrowth_{it} + \alpha_2 \ln Inflation_{it} + \alpha_3 \ln Debt_{it} \\ & + \alpha_4 \ln Liquidity_{it} + \alpha_5 \ln Deficit_{it} + \alpha_6 \ln Stability_{it} + v_i \\ & + \epsilon_{it} \end{aligned} \quad (3)$$

where α_1 to α_6 are the estimated parameters. Furthermore, to test how EMU membership affects the impact of different variables on the bond yield spreads, we take an additional step and add interaction terms between explanatory *variables* and the Euro Zone dummy EMU_{it} :

$$\begin{aligned} \ln Spread_{it} = & \alpha_0 + \alpha_1 \ln GDPgrowth_{it} + \alpha_2 \ln Inflation_{it} + \alpha_3 \ln Debt_{it} \\ & + \alpha_4 \ln Liquidity_{it} + \alpha_5 \ln Balance_{it} + \alpha_6 \ln Stability_{it} \\ & + \beta_1 EMU_{it} \times \ln Debt_{it} + \beta_2 EMU_{it} \times \ln Liquidity_{it} \\ & + \beta_3 EMU_{it} \times \ln Balance_{it} + v_i + \epsilon_{it} \end{aligned} \quad (4)$$

Similarly, to test the impact of these variables during the 2008-2010 financial crisis, we add interaction terms with a crisis dummy which takes the value one for the last three years of our panel and zero elsewhere:

$$\begin{aligned}
\ln Spread_{it} = & \alpha_0 + \alpha_1 \ln GDPgrowth_{it} + \alpha_2 \ln Inflation_{it} + \alpha_3 \ln Debt_{it} \\
& + \alpha_4 \ln Liquidity_{it} + \alpha_5 \ln Balance_{it} + \alpha_6 \ln Stability_{it} \\
& + \gamma_1 Crisis_{it} \times \ln Debt_{it} + \gamma_2 Crisis_{it} \times \ln Liquidity_{it} \\
& + \gamma_3 Crisis_{it} \times \ln Balance_{it} + v_i + \epsilon_{it}
\end{aligned} \tag{5}$$

This is a convenient alternative to estimating equation (3) on the 2008-2010 sub-panel, as it does not induce a large drop in the number of observations, nor losses in terms of degrees of freedom.

To study the main determinants of bond yield spreads in countries with different exchange rate regimes, we take into account both time-series and cross-country variation of the available data set. Including the time-series variation involves using the annual data for our panel of 25 EU members. Annual data are taken into account to fit fundamental and long term determinants of spreads and the market perception of default risk; higher time frequencies (i.e, quarterly, monthly or daily) are usually supposed to capture short-term factors.

2.1.2 The dynamic panel data model

To check for the robustness of the previous method, we modify the standard spread specification (equation 3) and we obtain the following specification:

$$\begin{aligned}
\Delta \ln Spread_{it} = & \sum \mu_j \Delta \ln Spread_{i,t-j} + \alpha_1 \Delta \ln GDPgrowth_{it} \\
& + \alpha_2 \Delta \ln Inflation_{it} + \alpha_3 \Delta \ln Debt_{it} + \alpha_4 \Delta \ln Liquidity_{it} \\
& + \alpha_5 \Delta \ln Deficit_{it} + \alpha_6 \Delta \ln Stability_{it} + \eta_t + v_i + \epsilon_{it}
\end{aligned} \tag{6}$$

where α_1 to α_6 and μ_j are the estimated parameters and η_t a crisis-dummy to capture the crisis period in the columns from 2 to 4. The dependent variable $\Delta \ln Spread_{it}$ is the rate of change in the spread for country i in time period t explained by the lagged rate of change in spreads and by a set of control variables capturing changes in GDP growth, inflation, debt, liquidity, public deficit and political environment for country i and time period t ; v_i a country-specific effect and ϵ_{it} an independent and identically distributed error term. As in the previous subsection, we test in what way EMU membership and the financial crisis, have an influence on the given control variables. We add progressively interaction terms between differenced explanatory variables and the Euro Zone dummy

EMU_{it} and respectively, between the identical explanatory *variables* and the crisis dummy *Crisis-dummy*.

We estimate the equation (6) through the Generalized Method of Moments (GMM) of Arellano-Bond (1991). The use of this method is motivated by the inclusion of the lagged dependent variable as an explanatory variable and the potential endogeneity of some variables (as it is likely the case of the fiscal variables).

The method implies the transformation of all regressors commonly by first-differencing the equation (3). In the equation (6), we choose as valid instruments for the lagged difference of the endogenous variables, the values of independent variables lagged two periods or more.; a key assumption for the validity of GMM being that the instruments are exogenous. To test the joint validity of instruments, we apply the Sargan test of over-identifying restrictions. The GMM validity depends also on the assumption that the model is not subject to second-order serial correlation in the residuals of the differenced equation. We thus limit the lag density by choosing one instrument for each explanatory variable and lag distance (the time period being neglected). The results of our estimations are provided in the next section.

2.2 Data and variables

The data panel contains observations from 25 EU countries and covers the 2003-2010 period. In the considered sample we included all countries for which the European Central Bank (ECB) publishes sovereign bond yields, i.e. all EU members except Estonia. Also, our panel does not include Germany since it is taken as reference.

Table 1 presents a brief summary of employed variables and data sources. Spreads on government bonds are computed as the difference between the yields on 10-year bonds issued by each country in our panel and Germany. We employ monthly data provided by the ECB and take annual averages. GDP growth and inflation are obtained from the World Bank's World Development Indicators (WDI) database. The liquidity ratio is computed as money and quasimoney (M2) divided by reserves exclusive of gold, both from the WDI database. Data on government debt and budget balance (deficit or surplus) come from the Eurostat. Finally, to assess countries' political stability we use

the Political Stability and Absence of Violence/Terrorism ranking indicator from the World Bank's Worldwide Governance Indicators (WGI) database, computed by Kaufman, Kraay and Mastruzzi (2010). It measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. It corresponds to the percentile rank among all countries and ranges from 0 (lowest) to 100 (highest) rank or political stability. (See <http://info.worldbank.org/governance/wgi/index.asp> for additional information.) This is an inverse measure of political insecurity and political risk. Unlike the spread, explanatory variables are expressed in levels rather than as differences with respect to Germany, which virtually is considered here as free of default risk.

Table 2 summarizes the labels and logarithmic transformations of variables used for estimating the model presented in section 2.1. As explained above, variables that take both positive and negative values need a more specific transformation. Table 3 exposes the main descriptive statistics of variables integrated in estimations.

Table 1: Data sources of explained and explanatory variables

Variable	Explanation, computation	Data source
Spread	Difference between yields on 10-year bonds of a given country and Germany, annual average obtained from monthly data	European Central Bank (ECB) statistics, monthly data
GDP growth	Annual GDP growth (%)	World Development Indicators (WDI), World Bank
Inflation	Annual inflation rate in terms of consumer prices (%)	World Development Indicators (WDI), World Bank
Government debt	Total government debt as % of GDP	Eurostat
Liquidity ratio	Money (M2) to reserves (without gold) ratio (%)	World Development Indicators (WDI), World Bank
Budget balance	Public administration financing capacity (+) or needs (-) as % of GDP	Eurostat
Political Stability	The Political Stability and Absence of Violence percentile rank of countries: the higher the index, the lower the political risk and the higher the stability	Worldwide Governance Indicators (WGI), World Bank

Table 2: Labels and transformations of explained and explanatory variables

Variable	Variable label	Transformation
Spread	$Spread_{it}$	$\ln\left(Spread_{it} + \sqrt{Spread_{it}^2 + 1}\right)$
GDP growth	$GDPgrowth_{it}$	$\ln\left(GDPgrowth_{it} + \sqrt{GDPgrowth_{it}^2 + 1}\right)$
Inflation	$Inflation_{it}$	$\ln\left(Inflation_{it} + \sqrt{Inflation_{it}^2 + 1}\right)$
Government debt	$Debt_{it}$	$\ln Debt_{it}$
Liquidity ratio	$Liquidity_{it}$	$\ln Liquidity_{it}$
Budget balance	$Balance_{it}$	$\ln\left(Balance_{it} + \sqrt{Balance_{it}^2 + 1}\right)$
Political Stability	$Stability_{it}$	$\ln Stability_{it}$

Table 3: Descriptive statistics of explained and explanatory variables

Observed values	2003-2010					2008-2010				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
Spread	198	1.03	1.61	-1.19	10.78	75	1.77	2.14	-0.10	10.78
GDP growth	200	2.32	4.16	-17.95	12.23	75	-0.74	4.57	-17.95	9.43
Inflation	200	3.01	2.58	-4.48	15.40	75	2.85	2.92	-4.48	15.40
Government debt	200	50.80	27.65	6.10	144.90	75	56.01	29.57	13.40	144.90
Liquidity ratio	198	103.16	243.69	1.32	2235.76	73	105.77	192.72	1.42	1025.38
Budget balance	200	-2.98	4.22	-31.30	5.30	75	-5.26	4.93	-31.30	4.20
Political Stability	200	73.92	15.98	34.12	100.00	75	73.06	16.47	34.12	100.00

Logarithmic transformations	2003-2010					2008-2010				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
Spread	198	0.66	0.72	-1.01	3.07	75	1.04	0.76	-0.10	3.07
GDP growth	200	1.17	1.60	-3.58	3.20	75	-0.11	1.84	-3.58	2.94
Inflation	200	1.58	0.80	-2.20	3.43	75	1.44	1.01	-2.20	3.43
Government debt	200	3.75	0.64	1.81	4.98	75	3.87	0.59	2.60	4.98
Liquidity ratio	198	2.96	1.95	0.28	7.71	73	3.27	1.91	0.35	6.93
Budget balance	200	-1.24	1.50	-4.14	2.37	75	-1.94	1.29	-4.14	2.14
Political Stability	200	4.28	0.23	3.53	4.61	75	4.26	0.25	3.53	4.61

Notes: Logarithmic transformations correspond to the last column on Table 2.

The GDP growth is an important determinant of the bond spread. It is usually used to capture the state of the economy and is supposed to have a negative influence on spread. Theoretical researches on the sustainability of the country's debt (e.g., Domar, 1950) highlight the relationship between the growth rate of GDP and the growth rate of debt pointing out that growing economies are more able to fulfill their financial obligations than the stagnating economies. Inflation influences economic activity but may also impact spreads. Higher price differentials lead to losses in competitiveness, mainly for countries that lack an independent monetary policy, such as pegged currencies, increasing the default risks. Furthermore, countries troubled in the past by episodes characterized by high inflation rates achieve easier low inflation rates by integrating a monetary union. The liquidity ratio measures the access to credit relative to national reserves. According to the literature (e.g., Cartapanis, 2002), this ratio is also a good indicator for the capacity of the economies and central banks to face speculative attacks. Furthermore, a higher ratio can decrease investors' confidence in the economy and this could be a sign of a banking crisis followed by "flight to quality". The government debt is expected to have a positive influence on the spreads because higher levels of debt increase the default risk and as a consequence yield spreads. The fiscal performance of the economy is captured by the government's budget balance. Large fiscal deficits over a long period amplify the default risk and negatively affect spreads. The EMU dummy variable is used to capture not only the quality of the member of the monetary union, but also the exchange rate regime. Interaction terms between both debt, fiscal and liquidity variables on the one hand and the EMU dummy in the other hand are used to measure their amplified effect.

3. Econometric results

3.1 Fixed-effect model results

In this section we look at the determinants of spreads on sovereign bond yields of EU countries with respect to Germany over the entire 2003-2010 period and during the 2008-2010 crisis. The Hausman test statistics is always significant at the 1% level, pleading in favor of a fixed effects model. Results displayed in this section correspond to fixed-effects estimators.

Table 4 summarizes the effects of different determinants over the entire period. Column 1 shows parameter estimates of equation (3). The other three columns report the point estimates of equation (4) parameters with each EMU interaction term added separately in the equation. Indeed, the three interaction terms are highly correlated with each other and cannot be introduced simultaneously in the same estimation.

The state of the economy captured by the GDP growth has a negative and significant (at the 1% level) impact on sovereign bond yield spreads with respect to Germany. This finding is in line with theoretical literature predictions stating that growing economies are more able to respect payment obligations than stagnating countries. The inflation rate affects spreads positively but the effect is not statistically significant. This result can be explained by large differences between countries in terms of inflation. For example, in the case of countries without an independent monetary policy (with pegged currencies or in a monetary union), which is the case of the most part of countries of our sample, price differentials lead to losses in competitiveness which increases the default risk. The total government debt to GDP ratio increases significantly (at the 1% level) the spreads. The high absolute value of this effect confirms that debt level is an essential component of the risk premium incorporated in sovereign bond yields. The budget balance to GDP ratio has a negative and significant coefficient (at the 5% level) on spreads. A high surplus (or financing capacity) or a low deficit (or financing needs) depict a higher capacity of the country to honor payments on issued bonds and keeps the cost of sovereign debt (yields on new bonds) down, close to the of the free-risk reference. We also find that political stability reduces the cost differential on new bonds, although the effect is significant only at the 10% level. The effects of all these variables are in line with theoretical predictions and are robust across different specifications.

On the opposite, we do not find evidence of a negative effect of liquidity, as suggested by the theory. In all specifications but the last the liquidity ratio effect is not significantly different from zero. In column 4, however, this ratio enters the equation with a positive coefficient, revealing that an increase in liquidity of EMU countries has not been always positively appreciated by the market. One possible explanation is the fact that most EMU countries severely affected by the 2008-2010 crisis saw their liquidity ratio increase significantly in the years preceding the crisis.

By including interaction terms between the EMU membership dummy and debt, liquidity and fiscal variables in columns 2 to 4 we are able to test whether the effects of these variables differ for EMU and non EMU countries, or as a country integrates the Euro Zone. We find a significant effect only for the budget balance. According to our findings, the government surplus or deficit is reflected only in the level of spreads of non EMU countries or prior to joining the EMU.

Table 4: Determinants of sovereign bond yield spreads: 2003-2010

	(1)	(2)	(3)	(4)
GDP growth	-0.10*** (0.02)	-0.10*** (0.02)	-0.10*** (0.02)	-0.10*** (0.02)
Inflation	0.02 (0.04)	0.02 (0.04)	0.01 (0.04)	0.00 (0.04)
Government debt	0.77*** (0.13)	0.77*** (0.13)	0.78*** (0.13)	0.77*** (0.13)
Liquidity ratio	0.06 (0.04)	0.07 (0.06)	0.18 (0.15)	0.11** (0.05)
Budget balance	-0.06** (0.03)	-0.06** (0.03)	-0.07** (0.03)	-0.13*** (0.04)
Political Stability	-0.54* (0.29)	-0.54* (0.29)	-0.55* (0.29)	-0.61** (0.28)
EMU member * Government debt		-0.01 (0.05)		
EMU member * Liquidity ratio			-0.10 (0.11)	
EMU member * Budget balance				0.12** (0.05)
Constant term	-0.10 (1.40)	-0.12 (1.41)	-0.22 (1.41)	0.08 (1.38)
N	196	196	196	196
R ² within	0.551	0.551	0.553	0.568
R ² between	0.018	0.018	0.026	0.017
Corr ($u_i, X_{it}\beta$)	-0.662	-0.661	-0.682	-0.662
$\rho = \sigma_u^2 / (\sigma_u^2 + \sigma_e^2)$	0.871	0.870	0.877	0.875

Notes: The explained variable is expressed as change with respect to yields on German bonds. Fixed-effects estimators. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

In Table 5 we test whether the effect of macroeconomic fundamentals change during the crisis. In the first column we restrict the sample to the crisis period, i.e. the last three years of our panel, and report estimates of our benchmark model given by equation (3). Accordingly, we end up with fewer observations and degrees of freedom for our estimation. Only three of the control variables included in the equation impact significantly the spread and all of them have the expected sign. Differently from results for the entire period, we find a larger positive effect for government debt and a negative effect for liquidity. This confirms the common belief that during a crisis markets follow closely the dependence of economies on debt. A one percent increase in the debt-to-GDP ratio results in an equal increase in spreads. During the crisis the liquidity ratio of most countries decreased, picturing a more constraint access to credit relative to national reserves. This increased the pressure on the credit market and pushed up the cost of newly issued bonds, countries with the largest drop in liquidity suffering the largest spread escalation.

Alternatively, we can test the effect of control variables during the crisis by adding the interaction between each variable and a crisis dummy on the left hand side of equation, producing equation (5). An important advantage of this approach is that estimations are performed on the entire panel. As previously, interaction terms are highly correlated with each other and, therefore, introduced one-by-one in the equation, Point estimates of parameters are displayed in columns 2 to 4 of Table 5. Again, we find that in times of crisis an economy's dependence on debt is more severely reflected in the spreads on the new sovereign bonds it issues. Our results suggest that markets penalize governments with large budget deficits only during the crises, while the impact of liquidity is not statistically significantly different from zero. Estimates from the last three columns also confirm the role of a country's political stability in reducing the cost of its sovereign debt. This aspect is important since the political risk generally increases during a crisis. For example, the Economist Intelligence Unit argues that the level of threat posed to governments by social protests has increased in most European countries since 2007.

For robustness checks we have also computed the liquidity ratio as M2(money and quasimoney) over reserves including gold. Similarly, we used different measures of budget balance: the central administration [primary] budget balance and the public administration surplus or deficit, both computed as percentage of GDP. We obtained very similar results to those in Tables 4 and 5 for all specifications. In addition, we also

estimate the model without making the risk-free assumption. For that both dependent and independent variables are related to the “anchor” country (Germany), i.e. all are expressed as deviations from values for Germany. Results confirm main previous findings, although some estimate points loose in significance, due to a lower variance in explanatory variables in this case.

Table 5: Determinants of sovereign bond yield spreads during the 2008-2010 crisis

	2008-2010	2003-2010		
	(1)	(2)	(3)	(4)
GDP growth	-0.07** (0.03)	-0.07*** (0.02)	-0.09*** (0.02)	-0.08*** (0.02)
Inflation	0.05 (0.06)	-0.01 (0.04)	0.01 (0.04)	0.02 (0.04)
Government debt	1.00*** (0.27)	0.65*** (0.13)	0.71*** (0.13)	0.67*** (0.13)
Liquidity ratio	-0.39** (0.17)	-0.01 (0.05)	0.03 (0.05)	0.02 (0.05)
Budget balance	0.02 (0.05)	-0.04 (0.03)	-0.06* (0.03)	-0.02 (0.03)
Political Stability	-0.39 (0.72)	-0.63** (0.28)	-0.54* (0.28)	-0.57** (0.28)
Crisis * Government debt		0.06*** (0.02)		
Crisis * Liquidity ratio			0.03 (0.02)	
Crisis * Budget balance				-0.09*** (0.03)
Constant term	0.05 (3.20)	0.87 (1.39)	0.19 (1.41)	0.52 (1.39)
N	73	196	196	196
R ² within	0.523	0.581	0.557	0.570
R ² between	0.198	0.000	0.009	0.000
Corr ($u_i, X_{it}\beta$)	-0.520	-0.511	-0.604	-0.538
$\rho = \sigma_u^2 / (\sigma_u^2 + \sigma_e^2)$	0.854	0.834	0.855	0.839

Notes: The explained variable is expressed as change with respect to yields on German bonds. Fixed-effects estimators. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

3.2 Robustness checks

The second step of our empirical work consists in applying a dynamic log-linear model to check for the robustness of the previous results. We begin our empirical analysis by examining the results for the entire period (table 6).

Table 6: Determinants of sovereign bond yield spreads: 2003-2010

	(1)	(2)	(3)	(4)
Spreads(-1)	0.43*** (0.16)	0.40** (0.17)	0.58*** (0.02)	0.22 (0.16)
GDP growth	-0.09*** (0.03)	-0.08*** (0.02)	-0.07*** (0.03)	-0.10*** (0.02)
Inflation	0.04 (0.05)	0.001 (0.05)	0.004 (0.05)	-0.01 (0.05)
Government debt	0.65*** (0.20)	0.66*** (0.20)	0.52*** (0.20)	0.67*** (0.19)
Liquidity ratio	0.15*** (0.06)	0.24*** (0.08)	0.34 (0.19)	0.16** (0.05)
Budget balance	-0.02 (0.04)	-0.02 (0.04)	-0.01 (0.04)	-0.10** (0.05)
Political Stability	-0.77* (0.33)	-0.66** (0.33)	-0.77** (0.34)	-0.82*** (0.32)
EMU member * Government debt		-0.102 (0.07)		
EMU member * Liquidity ratio			-0.13 (0.14)	
EMU member * Budget balance				0.15*** (0.05)
Constant term	0.66 (1.50)	0.11 (1.50)	0.78 (1.41)	0.84 (1.44)
N obs.	104	104	104	104
Chi2, P-value	0.000	0.000	0.000	0.000
No. groups	22	22	22	22
No. instruments	27	29	28	30

Notes: The explained variable is expressed as change with respect to yields on German bonds. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

We find significant evidence of a positive effect of liquidity, public debt, lagged spreads and political instability on the rate of change in the spreads as highlighted by the theory. The rate of change in the spread is negatively and significantly influenced by the growth of GDP meaning that growing economies are more able to honor the financial obligations than the stagnating economies. The interaction term between *EMU* and the lagged fiscal variable impact also significantly and positively the spread variation.

Table 7 summarizes the estimation results for the crisis period. In column (3) the interaction term with liquidity ratio affects negatively and significantly the spread variation, meaning that an increase in EMU liquidity has been clearly appreciated by the market and avoid fears regarding credit rationing.

Table 7: Determinants of sovereign bond yield spreads during the 2008-2010 crisis

	2008-2010		2003-2010	
	(1)	(2)	(3)	(4)
Spreads(-1)	0.85*** (0.41)	0.31*** (0.10)	0.30*** (0.10)	0.34*** (0.10)
GDP growth	-0.08* (0.05)	-0.06*** (0.02)	-0.06*** (0.02)	-0.07*** (0.02)
Inflation	-0.03 (0.07)	0.06 (0.05)	0.06 (0.04)	0.08* (0.05)
Government debt	0.19 (0.33)	0.32** (0.17)	0.37** (0.16)	0.28* (0.17)
Liquidity ratio	0.19** (0.09)	0.04 (0.06)	0.05 (0.06)	0.03 (0.06)
Budget balance	0.02 (0.06)	-0.03 (0.03)	-0.03 (0.03)	-0.004 (0.04)
Political Stability	-0.28* (0.61)	-0.80*** (0.34)	-0.92*** (0.33)	-0.85*** (0.32)
Crisis – dummy		0.34 (0.33)	0.37*** (0.10)	0.17** (0.09)
Crisis * Government debt		-0.03 (0.08)		
Crisis * Liquidity ratio			-0.04* (0.02)	
Crisis * Budget balance				-0.06 (0.04)
Constant term	0.25 (2.53)	1.48 (1.52)	2.70 (1.55)	2.78 (1.57)
N obs.	41	146	146	146
Chi2, P-value	0.000	0.000	0.000	0.000
No. groups	22	25	25	25
No. instruments	29	37	37	38

Notes: The explained variable is expressed as change with respect to yields on German bonds. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

4. Conclusions

This paper aims to identify the key drivers of sovereign bond spreads in EU countries from an ex-post perspective. Two main questions are addressed. First, we ask what proportion of the change in market spreads is explained by changes in the underlying fundamentals, external factors, liquidity and market risk. Second, we distinguish between Euro zone members and other EU countries and test how effects vary across the two groups.

To answer these questions we use a data panel of 25 EU countries from 2003 to 2010. We estimate an empirical model in which spreads to Germany on ten-year government bonds are explained by a set of variables including the exchange rate regimes, the political risk perception, and traditional determinants of spreads, such as GDP growth, inflation, debt, liquidity and fiscal measures. The data suggests the use of a fixed effect estimator. We find significant effects in line with theoretical predictions for all variables except inflation. The only difference in impacts between EMU and non EMU countries is obtained for the budget balance. According to our results, the government surplus or deficit is reflected only in the level of spreads of non EMU countries.

We also test the difference in the impacts of different explanatory variables before and during the 2008-2010 crisis. We conclude that during the crisis markets penalize more a high dependence on debt and larger drop in liquidity. As for large budget deficits, they are reflected in spread escalation only in times of crises.

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