Determinants of Government Bond Yield Spreads in EU Countries

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Abstract

This paper explores factors that drive government yield spreads of EU countries' bonds issued between 2000 and 2012. Using panel regression, it identifies three factors: a country specific factor related to country's default risk, a common factor related to general risk aversion premium, and a liquidity factor. It compares bond pricing before and after the collapse of Lehman Brothers in October 2008, bond pricing of the euro area member states with countries outside of the monetary union and in particular contrasts pricing of these two groups of countries before and after the crisis.

Keywords: *interest rates, fiscal policy, risk premium, crisis*

JEL Classification: E43, E62, H63

1. Introduction

Sustainability of public debt has been a crucial topic for many European governments in recent years, since the outbreak of the financial crises in 2008 in particular. Sustainability, among other things, heavily depends on the cost of debt which is determined by bond yields a government is required to pay to be able roll its debt over. Before the crises government bond yields of advanced European countries were very similar, humming comfortably within a range of 50 basis points from German bunds. Financial markets did not pay any attention to very different fiscal performances of individual governments. The crises changed this picture. Spreads over German bunds began to widen for certain countries whose public debt was perceived by financial market to be more riskier than others'. Countries' public debt seemed to be differentiated by fiscal fundamentals of that country.

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In this paper we try to address the following points of interest. First, do government bond yield spreads contain risk premium that would depend on fiscal characteristics i.e. level of public debt and/or fiscal deficit of that country? If yes, is this relationship linear or non-linear? Second, what other factors might influence these spreads? Third, is there a structural change in a market perception of riskiness of various countries before and after (or rather during) the crises? Forth, does a membership in the monetary union play any role in the size of spreads?

There has been a considerable amount of empirical papers addressing one or more points of interest posed in this article. Lemmen (1999) uses government bond yields issued by regional governments in Canada, Germany and Australia. He identifies three determinants of spreads; fiscal stance of an individual government represented by the level of its debt, the world's appetite for credit risk measured by the ratio of an index of emerging market's sovereign debt and an index of G7 countries' sovereign debt, and liquidity, measured by the relative amount of new bonds issued by each state.

Poterba and Rueben (1999) use yields of government bonds issued by 40 US states and find the level of debt and state budget significant factors of yield spreads. Bernoth, von Hagen and Schuknecht (2004) confirm relationship between yield spread differentials over German bunds and public debt and/or budget deficit for 12 EU countries.

Many papers, among them Schuknecht, von Hagen and Wolswijk (2010), De Grauwe and Ji (2012), Greenlaw et al. (2013) show that relationship between yield spreads or interest rate on debt and fiscal fundamentals i.e. public debt or budget deficit, is non-linear. Several studies emphasize the relevance of additional important determinants of yield spreads which are international risk aversion (Attinasi, Checherita and Nickel, 2009) and liquidity (Beber, 2006).

Has crisis changed investors' assessment of sovereign' credit risk, is there a structural change? Schuknecht, von Hagen and Wolswijk (2010) and De Grauwe and Ji (2012) show that a structural break has indeed occurred at the start of the financial crises. These two papers also compare development of yield spreads for countries in monetary union that have no direct control over the interest rates in their country with countries outside monetary union that have.

Our main contribution to this area of research is twofold. First, we include new EU member states, countries that have been omitted in previous studies. We are aware that inclusion of these countries might be questionable as most of them have overcome transition period from command to market economy. During this transition they have undergone various structural changes and it might have been difficult for financial market participants to translate these changes into sovereign risk assessment. Second, previous studies have used countries' government

bonds denominated in the same currency (euro and US dollar) while we use government bonds denominated in national currencies.[1] This is because many new EU countries issue bonds in foreign currency rarely if at all, and thus reliable data are not available.

2. Methodology

In this section we specify an econometric equation relating the bond yield spreads to potential explanatory variables. A framework of two-factor portfolio model can be used for theoretical derivation of this equation. In this framework it is assumed that an investor can choose from two bonds, a domestic one that is subject to a partial default risk with a certain probability and a foreign one that is risk free. Domestic and foreign bonds earn return r_t and r_t^*, respectively and foreign bond is more liquid than domestic one.

Investor's optimization of this problem leads to a conclusion (see e.g. Bernoth, von Hagen and Schuknecht, 2004) that yield spread between these two bonds depends on three risk factors: (1) a country specific risk factor representing a probability of the domestic government default, (2) liquidity risk factor indicating the ease the country's sovereign bond can be traded with and (3) a general (international) investors' risk aversion factor signaling an investors' appetite for buying sovereign bonds. All these explanatory variables are unobservable and need to be approximated.

Yield Spreads

A country's government bond yield spread ($s_{i,t}$) is a difference between 10-year bond yield of that country and German bund. We use EMU (European Monetary Union) convergence criterion harmonized series from Eurostat that are yields of central government bonds denominated in national currencies, on the secondary market, gross of tax, with a residual maturity of around 10 years. In most studies yield spreads are calculated as a difference between yield of a government bond of an EU country and a benchmark's country bond issued in the same currency (euros or US dollars) in order to avoid a problem of exchange rate risk.[2]

Country Specific Risk Factor

Fiscal performance reflects the government's ability to pay its debt. The most common fiscal variables measuring fiscal performance are general government

[1] A problem with exchange rate risk is discussed below.

[2] Exchange rate turned out to be insignificant in all models we have estimated in this study.

debt to GDP (***debt***$_{i,t}$) and deficit to GDP (***bdef***$_{i,t}$) ratios. We use differences of these variables over Germany's counterparts.

Liquidity Risk Factor

Higher liquidity is usually associated with lower yields. It is easier to trade liquid bonds and that results into lower transaction cost. There is a wide range of variables measuring liquidity risk. We use the relative (with respect to EU aggregate) amount of outstanding government debt as a proxy for liquidity measure (***liquid***$_{i,t}$).

General Risk Aversion Factor

In periods of higher general uncertainty let alone financial crisis there is usually flight to safety, investors buy risk-free (benchmark) bonds. As a result yield spreads widen. There are various proxies measuring investors' risk aversion, spread between low grade corporate bonds and government bonds of a benchmark country, for example. Our preferred option is a 3M Euribor spread over Euro Overnight Index Average or Eonia swap market[3] (***ees***$_{i,t}$) which is assumed to be a measure of a health of banks because it reflects what banks believe is the risk of default associated with lending to other banks. Thornton (2009) argues that this index reflects the market's perception of risk endemic to the economy more generally and is correlated with spreads between corporate and government bonds.

The above discussion leads to an estimation of the following econometric reduced form equation

$$s_{i,t} = \alpha + \beta_1 * \left(debt_{i,t}\right)^2 + \beta_2 * debt_{i,t} + \beta_3 * bdef_{i,t} + \gamma * liquid_{i,t} + \delta * ees_t + fe_i + \varepsilon_{i,t} \quad (1)$$

In order to address the question whether EA membership and/or crisis play any role in spread determination the equation is augmented with two dummy variables – D_EA (1 for euro area countries, 0 otherwise) and D_crisis (0 until 3Q2008, 1 afterwards) and their interactions with the fiscal variables.

3. Data Description and Estimation Results

We use Eurostat quarterly data of all EU countries[4] from 2000Q1 to 2012Q4 hence we have 52 observations for each country. It confirms our previous observation; except for a few countries (Hungary, Poland) spreads were very

[3] This is a euro counterpart of the Libor-OIS spread.

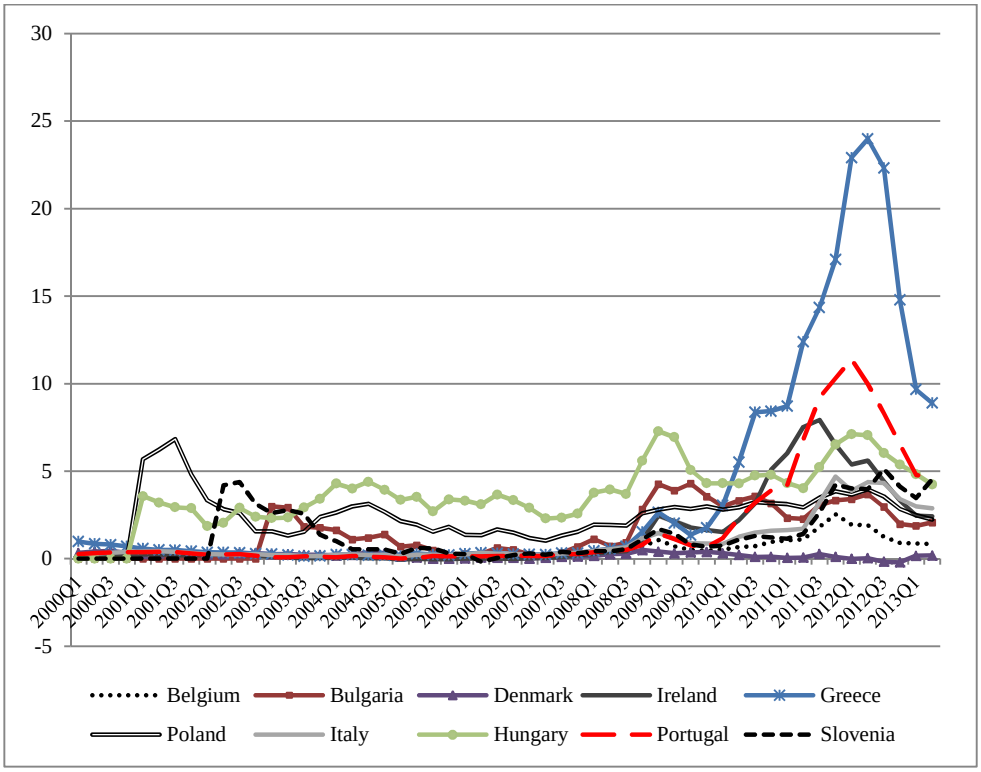
[4] Except Estonia for which long term government bond yields are not available yet.

low, before the crises, reflecting a deceptive assumption of market participants that default risk of these bonds is similar. For Euro area countries, this perception was fostered by their use of common currency that was thought to mitigate their riskiness caused by high level of public debt (Greece, Italy).

Figure 1 presents a development of bond yield spreads of some EU countries over German bunds.

F i g u r e 1

Spreads 10-year Government Bond Rates



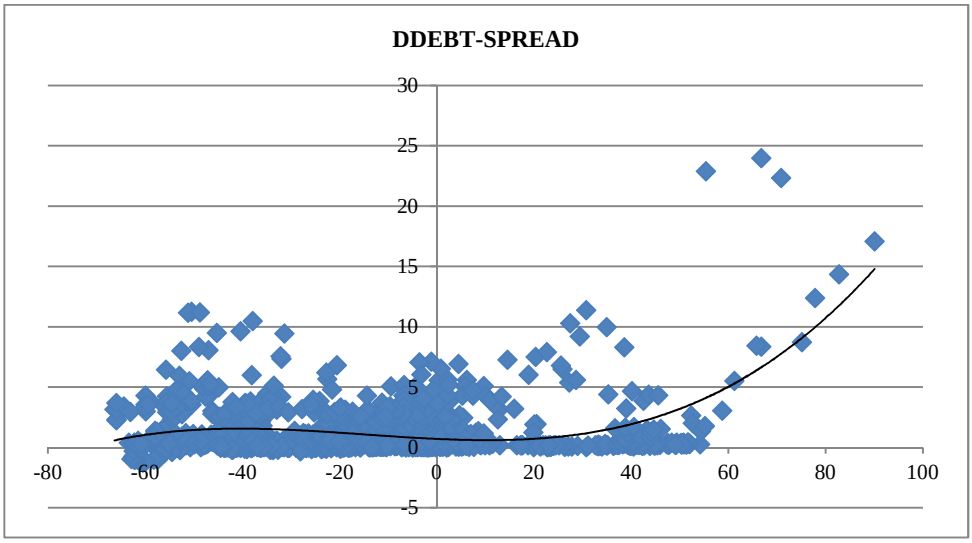
Source: Eurostat; own calculations.

In Figure 2 plots debt difference over German's against spreads. By observation it is difficult to detect a relationship but a polynomial fit line indicates a positive one between these two variables. For higher debt differences there seems to be a non-linearity.

Figure 3 plots difference of budget deficit over German one against spreads. Ignoring an outlayer on the lefthand side (Hungary's government revenue of 91% of GDP in the 2011Q1 caused by one-off measure) there seems to be a positive linear relationship between budget deficits and spreads.

Figure 2

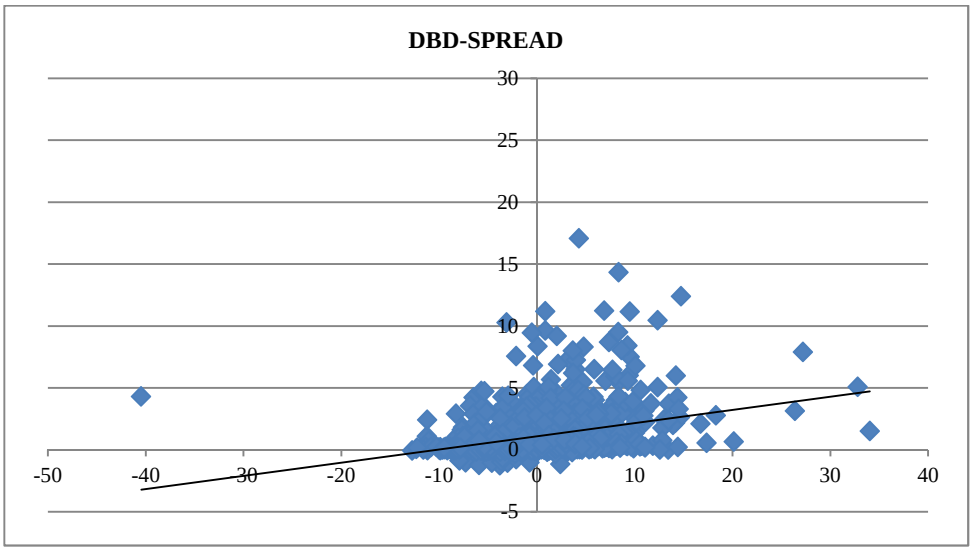
Spreads and Debt-to-GDP Ratio Gaps (2000 – 2012)



Source: Eurostat; own calculations.

Figure 3

Spreads and Budget Deficit-to-GDP Ratio Gaps (2000 – 2012)

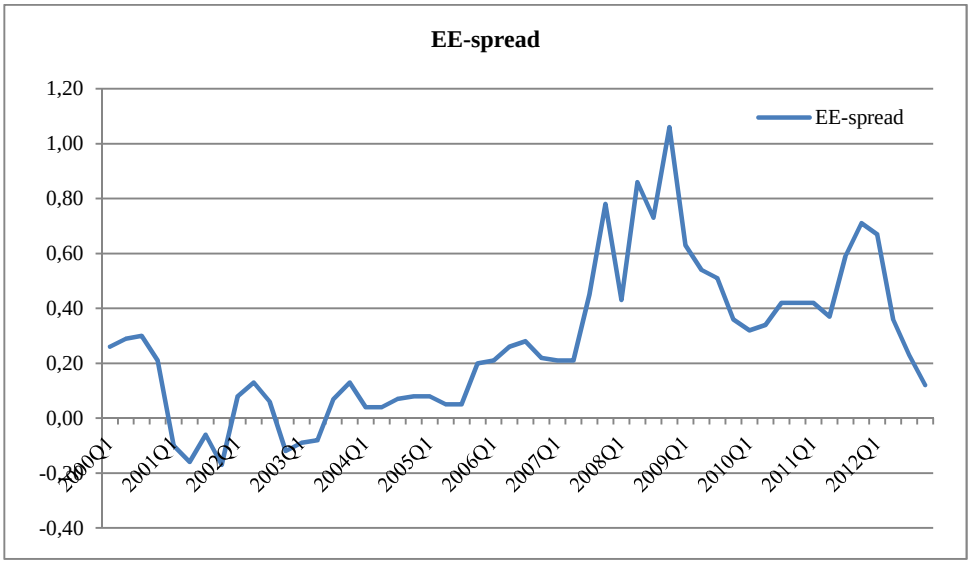


Source: Eurostat; own calculations.

Figure 4 shows development of spread between 3M Euribor and Eonia which exhibits a dramatic increase just before the outbreak of the crises in 2008 and remain elevated above their pre crises period levels, reflecting concerns with an ongoing recession.

F i g u r e 4

Yield Spread between Euribor and Eonia



Source: Eurostat; own calculations.

Equation (1) is estimated by a pooled least square method with fixed effects for each country.[5] Estimation results are reported in Table 1.

The results show that there is a positive relationship between yield spreads and fiscal variables; almost all fiscal coefficients are positive and highly significant. There is also positive relationship between yield spreads and EE-spread variable measuring uncertainty on markets; one percentage point increase of EE-spread increases yield spreads approximately one by one. And finally there is a negative relationship between yield spreads and liquidity as liquidity coefficients are all negative and in almost all regressions highly significant.

According to regressions with EA dummy, EA membership has significant effect on yield spreads. If country's debt ratio over Germany's is smaller than certain threshold (below 50 according to regression1) then yield spreads are lower for countries belonging to EA. Above that threshold non-linear debt term starts to dominate for EA countries and makes their yield spreads larger. Similar results have been found in Bernoth, von Hagen and Schuknecht (2004) and De Grauwe and Ji (2012) and it can be consistent with the view that markets anticipate fiscal support for EMU countries unless the debt gap is not too high. For high debt levels being outside the union and having own currency may be advantageous as a country can buy its own debt by printing money in order to avoid

[5] Figure 5 in Appendix illustrates the observed spreads with spreads predicted by the model.

a default. Results also show that country's budget deficit exceeding Germany's increases yield spreads more for countries outside the union than inside for which it turns out to be insignificant.

T a b l e 1
Regression Results

Explanatory variable	Regression 1	Regression 2	Regression 3
EA effects			
Debt squared	0.05*	0.06**	
Debt squared*D_EA	0.09***	0.07**	
Debt	6.77***	7.80***	
Debt*D_EA	4.77***	4.38***	
Budget deficit	7.34***		6.83***
Budget deficit*D_EA	–2.20		4.11*
Liquidity	–73.05***	–70.19***	–5.56
EE-spread	1.27***	1.58***	0.80***
Constant	294.72***	286.04***	106.46***
D_EA	110.99***	119.10***	34.77
R-squared	0.59	0.57	0.35
Observations	1212	1212	1215
Crisis effect			
Debt squared	0.03***	0.02***	
Debt squared*D_crisis	0.12***	0.13***	
Debt	6.98***	7.48***	
Debt* D_crisis	1.95***	2.13***	
Budget deficit	–0.54		–1.44
Budget deficit* D_crisis	8.34***		20.38***
Liquidity	–31.85***	–25.02***	–15.82*
EE-spread	0.60***	0.78***	0.86***
Constant	247.75***	240.16***	140.88***
R-squared	0.67	0.66	0.40
Observations	1212	1212	1215
EA & crisis			
Debt/BD	8.00***		2.50
Debt/BD*D_EA	3.21***		–8.16***
Debt/BD* D_crisis	3.14***		12.18***
Debt/BD*D_EA* D_crisis	11.24***		10.45***
Liquidity	–49.83***		–13.28
EE-spread	1.30***		0.90***
Constant	245.86***		127.64***
D_EA	238.02***		3.44
R-squared	0.57		0.41
Observations	1212		1215

Note: The first regression contains both fiscal variables – linear and quadratic terms of debt and linear term of budget deficit; its quadratic term turned out to be insignificant. In order to minimize potential co-linearity and as a robustness check, the second regression includes only debt and the third regression only budget deficit variables, respectively.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: Own calculations.

Crisis related effects are tested by including crisis dummy in regressions. Result shows that non-linearity of debt increased dramatically after the bankruptcy of Lehman Brothers in October 2008, i.e. in the crisis period. While before the crisis the linear coefficient had dominated in yield spreads determination, after

the crisis debt squared coefficient became dominant for higher debt level differentials. And while budget deficit had not been significant before the crisis, it became important after. So after the crisis investors became more vigilant to countries' fiscal performances. Higher yield spreads after the crisis can be partly explained also by EE-spread variable measuring general risk aversion in the financial market. Before the crisis this variable had been very low, gradually increasing until summer 2007, then shot up and culminated in October 2008 and remained elevated afterwards.

Are countries inside and outside the monetary union treated differently by financial markets before and after the onset of the financial crisis? To judge this combine effect of EA membership and crisis, we refer to regressions with both EA and crisis dummies. Here we exclude non-linear debt term to make regression results tractable.

These results indicate the following phenomenon observed also in other studies (e.g. Bernoth, von Hagen and Schuknecht, 2004, and De Grauwe and Ji, 2012). Before the crisis debt differential as seen in regression 1 and also budget deficit differential (regression 3) have much stronger effects on yield spreads for countries outside the monetary union. Countries in the monetary union are perceived to be shielded better against potential default before crisis. This perception had changed dramatically by the onset of the crisis. Countries inside the monetary union are charged more for their debt than countries outside the union with comparable level of debt.

Conclusion

This work identifies determinants of government bond yield spreads of all EU countries. Spreads are defined as differentials between countries' and Germany's yields of the central government bonds with 10-year maturity denominated in domestic currency. The empirical results indicate that spreads contain idiosyncratic risk premium reflecting country's default risk which is positively related to fiscal fundamentals of each country, namely public debt and budget deficit relative to GDP vis-à-vis Germany's. The impact of debt on spreads showed to be non-linear but non-linearity has not been significant in the case of budget deficit. Spreads are also positively related to liquidity risk reflecting availability and tradability of country's bonds and to a common factor measuring general risk aversion prevailing in the market.

Impact of fiscal variables on spreads for countries outside the monetary union is larger than for members of the union but this holds true only to a certain threshold. When the gap between country's debt and/or budget deficit over Germany's

exceeds this threshold, markets punish EA members more, possibly anticipating default due to the fact, that this country cannot finance itself through printing money.

Investors were more benevolent in their assessment of countries' fiscal performance before the collapse of Lehman Brothers in October 2008. They became much more vigilant since the onset of the crisis and charged heavier penalties for countries with lax fiscal performance. This was true in particular for EA members with high debt or deficit levels whose debt cost became unsustainable. Countries with their own currencies with comparable fiscal performance have not experienced similar spikes in their debt financing.

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A p p e n d i x

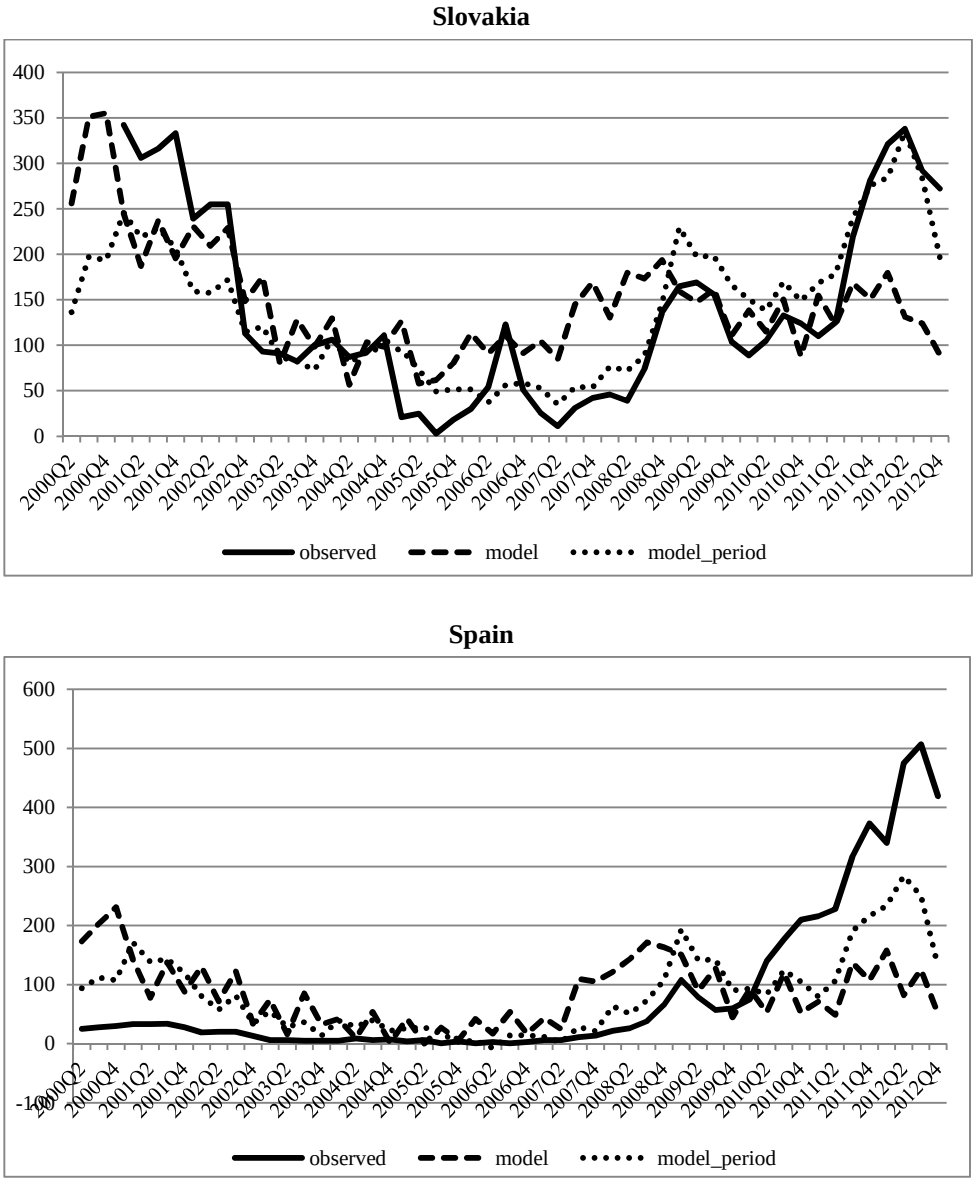
In Figure 5 two countries' – Slovakia's and Spain's – observed spreads (solid line) are compared with spreads predicted by the model[6] (dashed line) and by the model augmented by period fixed effects (dotted line). The model describes spread dynamics quite well most of the time but not since the onset of euro zone debt crisis in 2010. It seems that markets reacted irrationally and overpriced risk

[6] Model here is represented by regression 1.

well above the level that would conform to the corresponding change in fundamentals. The model with time effects comes much closer in predicting spread developments in the crisis period.

F i g u r e 5

Observed and Estimated Spreads



Source: Eurostat; own calculations.