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THE IMPACT OF THE FINANCIAL CRISIS

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***Abstract**: This note looks at US$ and DM/Euro denominated government bond spreads relative to US and German benchmark bonds before and after the start of the current financial crisis. The study finds, first, that bond yield spreads before and during the crisis can largely be explained on the basis of economic principles. Second, markets penalise fiscal imbalances much more strongly after the Lehman default in September 2008 than before. There is also a significant increase in the spread on non-benchmark bonds due to higher general risk aversion, and German bonds obtained a safe-haven investment status similar to that of the US which they did not have before the crisis. These findings underpin the need for achieving sound fiscal positions in good times and complying with the Stability and Growth Pact.*

***Keywords:** interest rates, fiscal policy, government debt, crisis, risk aversion, safe haven*

***JEL codes:** E43, E62, H63, H74*

Non-technical summary

Significantly rising yield spreads in European government bond markets after the intensification of the financial crisis in September 2008 after the Lehman default has again raised interest in credit risk of government bond yields. In particular, this paper addresses four related questions.

First, are market valuations of government debt during a crisis still in line with economic rationality? In the public debate, it is sometimes argued that the financial crisis reveals that financial markets do not work according to this.

Second, do the larger spreads observed during the crisis result from larger fiscal deficits and debt or do they also reflect a regime shift in the market pricing of government credit risk?

Third, to what extent are the larger spreads during the crisis a result of a general increase in risk aversion?

Fourth, what are the magnitudes of market penalisation of fiscal imbalances in crises compared to more “normal” times?

To answer these questions, we conduct an empirical analysis for European central governments bonds from 1991 until May 2009, thus including the period of market turmoil starting in August 2007, and the period of the financial crisis starting in September 2008.

The empirical results of our study suggest that bond yield spreads can still largely be explained on the basis of economic principles during the crisis. Furthermore, markets penalise fiscal imbalances much more strongly than before only after September 2008. This shift accounts for much of the spread increase for EU country government bonds relative to German or US treasury benchmarks. Coefficients for deficit differentials are 3-4 times higher and for debt differentials 7-8 times higher during the crisis period than earlier. However, there is also a significant increase in bond spreads due to general risk aversion. After the start of the crisis, German government bonds - the benchmark in the euro-denominated bond market - assumed a safe-haven investment status.

Policy implications that can be derived from this include that market valuation of sovereign risk remains a valid mechanism to discipline fiscal policy.

Another lesson is that fiscal policies in “good” times need to be sounder to create leeway for crisis times, pointing to the need for compliance with the Stability and Growth Pact.

1. Introduction

The potential effect of credit risk on government bond yields has received heightened attention especially when yield spreads started rising significantly in Europe as the global financial crisis intensified in September 2008.[1] This note addresses four important questions related to this experience: First, are market valuations of government debt during a crisis still in line with economic rationality? Second, do the larger spreads observed during the crisis result from larger fiscal deficits and debt or do they also reflect a regime shift in the market pricing of government credit risk? Third, to what extent are the larger spreads during the crisis a result of a general increase in risk aversion? Fourth, what are the magnitudes of market penalisation of fiscal imbalances in crises compared to more "normal" times?

The first question is motivated by the view, common in the public debate, that the current financial crisis reveals that financial markets do not work according to economic rationality. This view would lose much of its justification if one could show that, even in times of crises, markets price government bonds in ways which are consistent with economic principles.[2] The second question is motivated by the experience that, prior to the debt crisis of New York City in 1975, municipal bond markets in the US did not pay much attention to public debts and deficits. Since then, however, these markets charge risk premiums on bonds issued by cities and states with large public debts.[3] The third and the fourth questions focus on the role of fiscal performance versus investors' preferences in the pricing of sovereign risk.

To answer these questions, we start from the results of our recent empirical study of government bond yield spreads (Schuknecht et al. 2009). We extend the data base used in that study for the European central

[1] Earlier literature studying European government bond yield spreads generally finds that these spreads are smaller than comparable spreads on bonds issued by state governments in the US, and that the effect of fiscal variables on these spreads is significant but small. A recent exception is Mody (2009) who finds no effect of fiscal variables on bond yield spreads in Europe. For a recent review of the relevant literature see Haugh et al. (2009).

[2] By this we mean that financial markets act on the basis of a limited set of macroeconomic and financial variables that consistently explains (most of) their behaviour over time.

[3] Barrios et al (2009) also point to this possibility for the spreads on euro area governments bonds following the crisis. Attinasi, Checherita and Nickel (2009) look at the impact of fiscal variables and financial sector rescue packages on spreads.

governments until May 2009 and distinguish between two phases of the current crisis, a period of market turmoil starting in August 2007 and lasting until August 2008, and the period of the acute crisis starting with the collapse of Lehman Brothers in September 2008.

The results of our study suggest, first, that bond yield spreads can still largely be explained on the basis of economic principles during the crisis. Second, markets penalise fiscal imbalances much more strongly than before only after the Lehman default in September 2008. This shift in behaviour is responsible for much of the spread increase for EU country government bonds relative to German or US treasury benchmarks. Coefficients for deficit differentials are 3-4 times higher and for debt differentials 7-8 times higher during the post-Lehman crisis period than earlier. In addition to fiscal deficits and debt, however, there is also a significant increase in the spread on non-benchmark bonds due to general risk aversion. After the Lehman default, German government bonds, the benchmark in the euro-denominated bond market, assumed a safe-haven investment status similar to US government bonds which they did not have before.

A first policy implication of these findings is that market valuation of sovereign risk remains a valid mechanism to discipline fiscal policy especially but not only in times of financial crisis. There is, therefore, little justification for the claim that governments faced with high risk premiums during the crisis deserve the solidarity of other governments in the euro area. The second implication is that fiscal policies in “good” times need to be sounder to create leeway for crisis times and avoid the additional large costs of public borrowing that can arise during a global financial crisis. For euro-area member states in particular, this suggests that compliance with the Stability and Growth Pact is a necessary though perhaps not sufficient condition to safeguard against the high costs of public debt.

2. Methodology and Data

This note applies the approach of Schuknecht, von Hagen and Wolswijk (2009) to bond yield spreads and examines the determinants of issuance spreads on sovereign bonds denominated in DM/euros and US$ relative to the benchmark (German and US federal government treasuries, respectively) via panel analysis with time fixed effects.[4]

In particular, the methodology starts from the assumption that there is a domestic security that is subject to (partial) default risk, while a foreign (benchmark) asset is risk-free. In the case of partial default, the investor receives a fraction τ of his gross payment, $\tau \in [0, 1 + r)$, where r is the interest rate on the domestic bond. Standard portfolio theory implies that the optimal amount invested in the domestic security depends positively on the yield on the domestic security, and negatively on the foreign yield, the domestic government's default probability, a liquidity premium, and the investor's risk premium.

These considerations lead to the following reduced form equation for the yield spread, which will be the basis for our empirical analysis:

$$\frac{r_t - r_t^*}{1 + r_t} = \left(1 - P\left(x_t\right)\right)\left(1 - \frac{\tau_t}{1 + r_t}\right) + \frac{l_t}{1 + r_t} + \Phi_t . \qquad (1)$$

The left-hand side variable is the yield differential between the domestic and the foreign security. The first term on the right-hand side reflects the yield premium over the benchmark due to the partial default risk. Given the expected repayment in the case of default, $(1-\tau_t /(1+r_t))$, it increases with the probability of default, $(1-P(x_t))$. The second term reflects the liquidity premium. The third term stems from the investor's risk aversion and depends on the variance of the return on the domestic security.

These variables need to be approximated. The ratio of central government debt to GDP and the ratio of the central government budget surplus to GDP are used as proxies for a government's probability of default. They are

[4] This and earlier studies, e.g. Bernoth, von Hagen and Schuknecht (2005), found a significant effect from deficits and debt on spreads which, however, decreased markedly with the start of EMU. ECB Monthly Bulletins of July and September 2009 have pointed to the importance of both fiscal and liquidity factors in bond spread developments in the euro area during the crisis period. Haugh et al (2009) argue on the basis of quarterly bond spread data that risk aversion and fiscal fundamentals contributed to spread increases.

measured as differences relative to the benchmark country. To approximate the liquidity premium, we cannot use bid-ask spreads since our yields are yields at issue and bid-ask spreads do not exist on the first day of trading. Instead, we use the size of a debt issue as a proxy for its liquidity. The impact of general investors' risk aversion on yield spreads is captured by the yield spread between low grade US corporate bonds (BBB) and benchmark US government bonds. Thus, in periods of global financial crises or greater uncertainty, investors move to safer and more liquid assets and bond yield spreads increase as a result.[5] General risk aversion may also be affected by the general level of yields offered in other financial markets. The financial market literature suggests that, if long-term rates are generally low compared to short-term rates, investors ask for lower risk premiums as they are eager to find investment opportunities offering attractive spreads over short-term interest rates. On this basis, we also included a short-term interest rate as additional proxy for investors' risk aversion.

Furthermore, we include the time to maturity of the bonds at the time of issue as additional control related to the investors' risk premium, since our sample contains issues of different maturities. Investors receive a compensation for investing in long-term bonds instead of buying short-term bonds and rolling them over. This yields the following model:

$$\frac{r_{it} - r_{jt}}{1 + r_{it}} = \beta_0 + \beta_1' z_{it} + \gamma s_t + \varepsilon_{ijt}. \qquad (2)$$

In equation (2), β_0 and γ are scalar parameters and β_1 is a vector of parameters. r_{it} is the yield at issue of a security issued by government i at time t and r_{jt} the yield at issue of a security issued by the benchmark government j at the same time. z_{it} is a vector containing the fiscal indicators, the short-term interest rate, and the years to maturity. The variable s_t is the corporate spread, while ε_{ijt} is a stochastic error term.

[5] A variable that measures the respective corporate bond spread for the complete euro area is not available, but the empirical literature on sovereign bond spreads of emerging markets shows that spreads are sensitive to US risk factors (see, e.g., Barnes et al. (1997), Kamin et al. (1999), Eichengreen and Mody (2000)). Therefore, data on US corporate-government bond yield spreads can be used as a good proxy for the overall investors' risk attitude.

This approach was tested on EU15 US$, DM and euro denominated government bonds issued between 1991 and mid-May 2009.[6] Each observation consists of the difference between the nominal yield-at-issue of an individual bond issued by a EU15 government and the nominal yield-at-issue of an appropriate benchmark bond. The benchmark bond is a bond with a comparable pay-off structure issued by the German or the US federal government at a date close to the date when the bond under consideration was issued. We use data provided by Dealogic and rely on their selection of the appropriate benchmark. Altogether, our sample consists of 330 observations, of which 158 have German federal government bonds and 172 US federal government bonds as benchmarks, 117 are from the pre-1999 period, 167 from the period between 1 January 1999 and 31 July 2007, 17 from the period between August 2007 and August 2008 ("turmoil"), and 29 from the period between September 2008 and May 2009 ("crisis"). Information on the number of issues per country and per year as included in our sample is shown in Figures 1a and 1b.

As to the independent variables, we interact the fiscal variables with an EMU dummy (1 for euro area countries as of 1999 and 0 otherwise) to see whether the effects of the fiscal variables changed with the start of EMU. Furthermore, we interact them with a "turmoil" dummy to test whether the influence of the fiscal variables changed when the financial turmoil started in August 2007, and with a "crisis" dummy for the period after the Lehman default in September 2008. Moreover, 10 year US BBB corporate bond spreads over 10 year US Treasuries serve as an indicator of general risk aversion in global financial markets. Since general risk aversion may also depend on financial market conditions, we add the short-term money market rate in the reference country as a regressor (see Manganelli and Wolswijk, 2009).[7] The sources of the data used are included in the annex.

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[6] EU-15 refers to the first 15 members of the European Union, that include the first 12 euro area countries (Belgium, Germany, Greece, Ireland, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal and Finland), as well as Denmark, Sweden and the UK. However, Luxembourg and France are excluded from the sample for lack of data.

[7] While using nominal yields, we have not included inflation (expectations) as an independent variable. For one, differences between inflation rates and (especially) inflation expectation are fairly limited. Moreover, we expect the reaction of nominal yields spreads to inflation differentials to change over time with such differentials becoming less relevant, for instance reflecting the demise of (intra-euro area) exchange rates.

Before showing the estimation results it is worth representing graphically the government bond spreads and fiscal variables. Figure 2 shows the spreads for our sample period. Note that different data points can refer to different governments and issues denominated in US dollars or euros, i.e., the figure does not show a simple time series. Spreads generally fell until mid-1998, shortly before the start of EMU. Following that, they increased until mid-2001, but then came down again and reached their trough in October 2006. After that and during the period of turmoil (August 2007 to mid-September 2008), spreads increased again, but stayed well within the range of values observed before. This changed dramatically with the collapse of Lehman Brothers on 15 September 2008, when spreads reached up to over 300 basis points.

Figures 3a and 3b plot the sample observations for spreads and fiscal surplus and debt ratios relative to GDP, distinguishing pre- and post-Lehman observations. For the surplus ratio, a slightly negative relationship with the spreads can be detected before the crisis. Looking at the crisis observations, the negative relationship has shifted out and may have become steeper. For the debt ratios, the plot does not lead one to detect a (positive) relationship with the spreads as easily, but it does show that in the crisis the link between debts and spreads has shifted out.

Figure 4 plots the BBB US corporate bonds spread during our sample period. It indicates increases in global investor risk aversion in 1991, around the currency crises in South-East Asia and Russia in the late 1990s, and in the early 2000s. Risk aversion then subsided for several years but started to rise again with the onset of the period of financial turmoil in August 2007. Finally, there was a large jump in risk aversion following the collapse of Lehman Brothers in September 2008. During the first half of 2009, BBB spreads came down somewhat, but they remained large in comparison to the rest of the sample period.

3. Empirical Results

Table 1 presents the estimation results. The top panel of the table has the coefficients on the respective explanatory variables together with the marginal probabilities (p-value) of rejecting the hypothesis that the coefficient is zero. The second panel, called "EMU effects," reports the coefficients for the EMU dummy and the respective variables interacted with that dummy. The third panel, called "turmoil period," reports the coefficients on the respective explanatory variables interacted with a dummy which is one for the first phase of the financial crisis from August 2007 to mid-September 2008 and zero for all other periods. The fourth panel, called "crisis period," shows the coefficients of the respective explanatory variables interacted with a dummy which is one after the collapse of Lehman Brothers on 15 September 2008, and zero otherwise. The regressions also use an intercept and year fixed-effects to account for aggregate shocks to all countries considered. These are not reported here to save space. We did not include the dummies for the turmoil or for the crisis period separately since these would be collinear with the year fixed effects. Also not shown are the coefficients on the size of the issuance, our proxy of the liquidity premium in the bond spreads, as this variable turned out significant in none of the estimates.

The first column simply repeats the baseline regression from Schuknecht et al (2009). During the period from 1991 to early 2005, nominal spreads depended positively on the difference of the debt ratios of EU central governments and the debt ratio of the central government of the reference country, and negatively on the difference of central government surplus ratios and the surplus ratio of the central government and the reference country. An increase in the debt ratio by one percent relative to the reference country resulted in an increase of the spread by 0.23 basis point, while an increase in the surplus ratio by one percent resulted in a decline of the spread by almost 4 basis points. Thus, governments' fiscal performance affected the cost of borrowing in the capital markets. An additional year to maturity added 0.9 basis points to the spread. An increase in global investor risk aversion, as reflected by an increase in the BBB spread, increased the spreads on USD denominated issues, but not on DM or Euro denominated issues (not shown). Thus, in times of increased risk perception, investors seek the high credit

quality and liquidity of US treasury bonds, causing the spreads for other bonds – including European bonds issued in USD - to increase. Only US treasury bonds enjoyed a "safe haven" investment status during that period. Finally, an increase in the short-term money market rate decreased the spreads on USD denominated issues but not on DM and Euro denominated issues (not shown).

The second column extends the sample of the baseline regression through mid-May 2009. The basic relationship between spreads and fiscal variables remains intact and the size of coefficients changes little. Interestingly, the effect of the introduction of the euro on the coefficients on debt and fiscal balances as reflected in the interactive EMU terms disappears, leaving only a reduction in the general level of spreads due to the start of EMU. However, the results are not very satisfactory as some explanatory variables such as the time to maturity lose statistical significance.[8]

To test for potential turmoil and crisis-related effects on the determinants of spreads, the third column shows the same regression but including the dummies for the turmoil and crisis periods interacted with the fiscal and risk aversion variables. The estimation broadly confirms the significance and size of the fiscal and other variables for the time before and after EMU up to August 2007. For the period from the start of the turmoil in August 2007 until the bankruptcy of Lehman Brothers, none of the coefficients on the interactive terms for deficits, debt or general risk aversion are significant. This suggests that markets did not significantly change their assessment of profligate governments in this phase. The increase in the spreads observed in the data for this period is driven by the increase in the BBB spread.

After the collapse of Lehman Brothers, however, the picture changed markedly. In column 4, we report the results of estimating the model after dropping the interactive terms for the period from August 2007 to mid-September 2008, thus focusing on the crisis period. Here, we see that the interactive terms are highly significant. While an additional percent of deficit relative to the German benchmark resulted in an increase of the spread of

[8] The R-squared increases, but this reflects the effect of the year-dummies for 2008 and 2009.

3.49 basis points before the crisis, it resulted in an increase of 12.64 basis points after the collapse of Lehman Brothers. Similarly, while an increase in the debt ratio by one percent relative to the benchmark country resulted in an increase in the spread by 0.16 basis points before September 2008, this effect increased to 1.25 basis points afterwards. The crisis thus seems to have caused a significant change in the markets' assessment of the governments' fiscal performance and the cost of profligate fiscal behaviour has increased considerably. This is confirmed by Wald tests on the coefficients, indicating that differences between coefficients before and after the start of the crisis are statistically significant (see Table 2).

Furthermore, an increase in the BBB spread had a significant effect only on spreads of US dollar denominated issues before the crisis. After September 15, 2008, this effect doubled for US dollar denominated spreads, and a rise in the BBB spread now also increases the spread on euro denominated bonds relative to German treasuries. This suggests that in the crisis German treasuries gained a safe-haven status in international financial markets which they had not had before. However, US Treasuries still dominate as safe haven, as confirmed by a Wald test on the similarity of coefficients for the corporate bond spreads on USD and EUR issues after the crisis (see Table 2). Nevertheless, according to the same test, the increases in coefficients on account of the crisis are identical in both currency areas. For US dollar denominated bonds, the short-term interest rate is again significant with a coefficient comparable that in the baseline regression (1). For euro denominated issues, that rate remains insignificant and, to save space, we do not report the results of including it here. Finally, also not shown, it is interesting to note that the year dummy for 2009 is not statistically significant, i.e., given the changes in the coefficients, the explanatory variables explain the large increase in the yield spreads. Finally, we have not included country-fixed effects in our estimates, first to preserve full comparability with the approach taken in our previous paper, and second as these effects were generally found to have little value-added. At a 10% significance level, only UK issues deviated significantly from zero, with coefficient 0.70 (i.e. UK spreads are 70 basis points lower than the variables in our preferred equation 4 would suggest.

In column (5) of Table 1, we follow a suggestion of Haugh et al (2009) and include squared terms of the fiscal variables to test for nonlinearities in the markets' pricing of sovereign risk. The results show that the squared terms are statistically significant, but they mainly reduce the coefficients on the linear terms and they do not add to the explanatory power of the model as indicated by the adjusted R-squares. We also followed Haugh et al. (2009) and interacted the fiscal variables with the BBB spread rather than the crisis dummies. This is motivated by the idea that markets put more emphasis on fiscal performance in times when general risk aversion is large. The results – not reported here to economize on space – show that these interactive terms are indeed statistically significant and have the expected signs. Compared to the results in column (4), however, the explanatory power of the model decreases considerably. We conclude from this that (4) is the more preferable specification and that the change in the markets' valuation of government debt and balances is due to the crisis sparked by the collapse of Lehman Brothers.

Finally, column (6) of Table 1 reports the results of estimating the same model as in column (4), but using general rather than government debt and balances (see Bernoth et al. 2006 for an empirical analysis using general government data.) This is motivated by the fact that the EU Treaty framework for fiscal policy relates to general government data. The results are broadly similar to those of the regressions using central-government debt.

To illustrate the results, figures 5a and 5b show the components of the estimated risk premiums from the model in column (4) for all issues from the collapse of Lehman Brothers until May 2009 in our sample. Where there are multiple issues from the same country, bars to the right refer to later issuing dates. A "$" behind the country name indicates that the issue is denominated in dollars. One noticeable aspect is the dominance of Danish and Greece bond issues in the period covered (10 respectively 5). However, this should not have a major impact on the results as country-fixed effects generally were not found to be significantly deviating from zero.

For each issue, figure 5a decomposes the model into the estimated spread using only the pre-crisis coefficients and the contribution due to the

crisis. For most issues, the crisis-related part of the estimated spread is larger than the pre-crisis part. On average, the crisis part is two thirds of the total. The figure also shows that the contribution of the crisis-related part of the model is larger for euro-denominated issues than for dollar-denominated issues. The reason is that changes in the BBB spread did not affect spreads on euro-denominated issues before the crisis, but they did afterwards. For US dollar-denominated issues, the impact of such changes became stronger in the crisis, but it was present already before. In the case of one Danish issue denominated in dollars, the estimated spread is even smaller after the crisis than before the crisis. For euro-denominated issues, the average contribution of the crisis-related part is 85 percent of the total estimated spread, implying that spreads increased on average by a factor of 6.7.

Figure 5b decomposes the crisis-related part of the estimated spreads into the part due to the countries' fiscal performance relative to the benchmark countries and the part due to the increase in global investor risk aversion represented by the BBB spread. The negative spikes in the figure show that Denmark, Finland, and the Netherlands, three countries with relatively good fiscal performance at the outset of the crisis, actually benefitted from the markets' stronger reaction to fiscal variables. In the absence of an increase in the BBB spread, these countries would have enjoyed a decline in their bond spreads as a result of the crisis. For Greece, Ireland, and Portugal, in contrast, relatively weak fiscal performance explains almost or more than half of the increase in the spreads during the crisis.

4. Conclusions

This note looks at government bond yield spreads in the USD and euro-denominated bond market before and after the start of the financial crisis that began with the collapse of Lehman Brothers in September 2008. It asks whether market valuations of government deficits and debts during the crisis are still in line with economic rationality, what role is played by general risk aversion versus fiscal criteria before and since the start of the crisis, and how the magnitude of market penalisation of fiscal risks has changed.

The results of our study (which extends the database of an earlier analysis until May 2009) suggest, first, that bond yield spreads can still largely be explained on the basis of economic principles during the crisis. Second, markets penalise fiscal imbalances much more strongly since the Lehman default in September 2008. This shift in behaviour is responsible for much of the spread increase for EU country government bonds as compared to German or US treasury benchmarks. Elasticities for deficit differentials are around 3-4 times higher and those for debt differentials 7-8 times higher during the post-Lehman crisis period than earlier. In addition to fiscal deficits and debt, however, there is also a significant increase in the spread on non-benchmark bonds due to general risk aversion. After the Lehman default, German government bonds assumed a safe-haven investment status similar to US government bonds which they did not have before.

US municipal bond markets began to discriminate strongly between state governments with weak and strong fiscal performance after the fiscal crisis of New York City in 1975 and have continued to do so since then. If the change in the pricing behaviour in European bond markets is similarly persistent after the crisis, the pressures for fiscal discipline coming from financial markets will be much stronger in the future than they had been before the crisis.

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Table 1: Regression results

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Public debt p-value	0.23*** 0.00	0.29*** 0.01	0.17** 0.04	0.16*** 0.04	-0.15 0.38	0.03 0.75
Fiscal balance p-value	-3.97*** 0.00	-4.06*** 0.00	-3.55*** 0.00	-3.49*** 0.00	-2.28*** 0.01	-3.38** 0.00
Time to maturity p-value	0.91*** 0.00	0.22 0.47	0.68*** 0.00	0.61*** 0.01	0.62*** 0.01	0.53** 0.04
BBB spread, USD issuance p-value	0.21*** 0.00	0.11 * ** 0.00	0.20*** 0.000	0.21*** 0.00	0.21*** 0.00	0.19*** 0.00
Short-term rate, USD issuance	-2.76*** 0.00	0.66 0.57	-2.56** 0.01	-2.64** 0.01	-2.62** 0.01	-2.11* 0.06
Public Debt Squared p-value					0.004** 0.03	
Fiscal balance squared p-value					0.23** 0.02	
EMU effects						
EMU dummy p-value	-6.41 0.17	-2.60 0.67	-11.90** 0.02	-12.02** 0.01	-9.36* 0.06	-14.16** 0.01
Public debt p-value	-0.22** 0.04	-0.19 0.17	-0.09 0.40	-0.07 0.55	-0.03 0.78	0.10 0.39
Fiscal balance p-value	1.52 0.12	-1.49 0.22	0.63 0.53	1.03 0.28	0.93 0.32	1.48 0.18
Turmoil period (August 2007-14 September 2008)						
Public debt p-value			-0.01 0.98			
Fiscal balance p-value			2.60 0.25			
BBB spread p-value			-0.06 0.15			
Crisis period (after 15 September 2008)						
Public debt p-value			1.12*** 0.00	1.09*** 0.00	1.17*** 0.00	1.85*** 0.00
Fiscal balance p-value			-8.71*** 0.00	-9.15*** 0.00	-9.20*** 0.00	-3.99** 0.01
BBB spread, euro issuance p-value			0.16*** 0.00	0.19*** 0.00	0.18*** 0.00	0.25*** 0.00
BBB spread, USD issuance p-value			0.18*** 0.00	0.21*** 0.00	0.15*** 0.00	0.25*** 0.00
NOBS	263	330	330	330	330	330
R2 adj.	0.57	0.63	0.79	0.79	0.80	0.74

Notes: *, **, *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 2. Hypothesis tests

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Hypothesis	Probability	Conclusion
No change in coefficients on fiscal deficit since the start of the crisis	0.00	Rejected
No change in coefficients on government debt since the start of the crisis	0.00	Rejected
Similar coefficients for the corporate bond spreads on USD and EUR issues after the crisis	0.00	Rejected
Similar increase in coefficients for the corporate bond spreads on USD and EUR issues after the crisis	0.79	Accepted

Note: All tests refer to equation 4 in table 1. Entries show the level of significance at which the relevant hypothesis is rejected.

Figure 1a: Number of issues by country

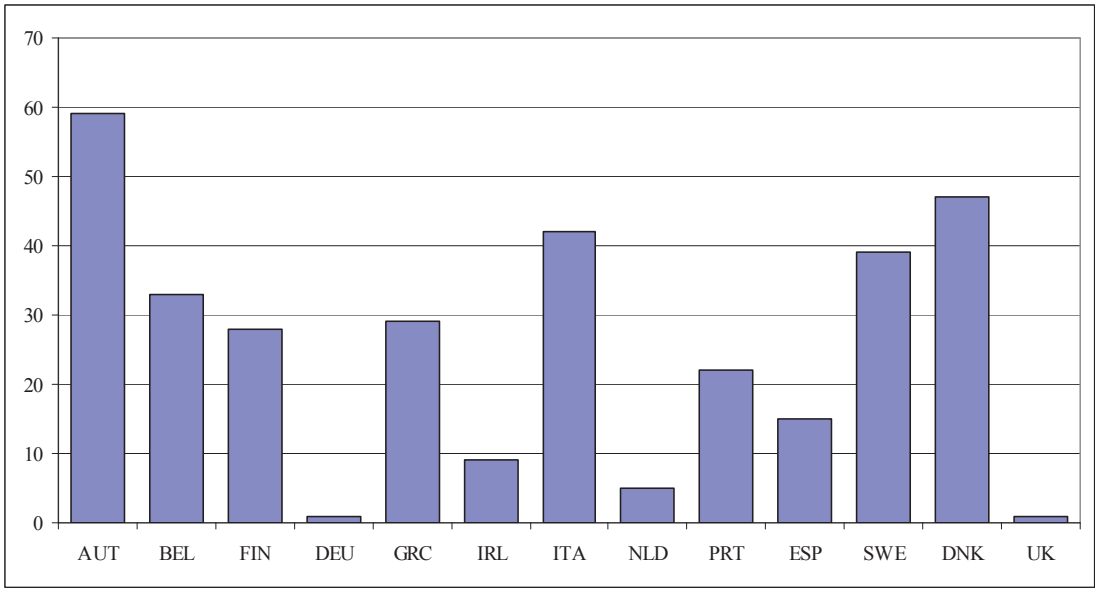


Figure 1b: Number of issues by year

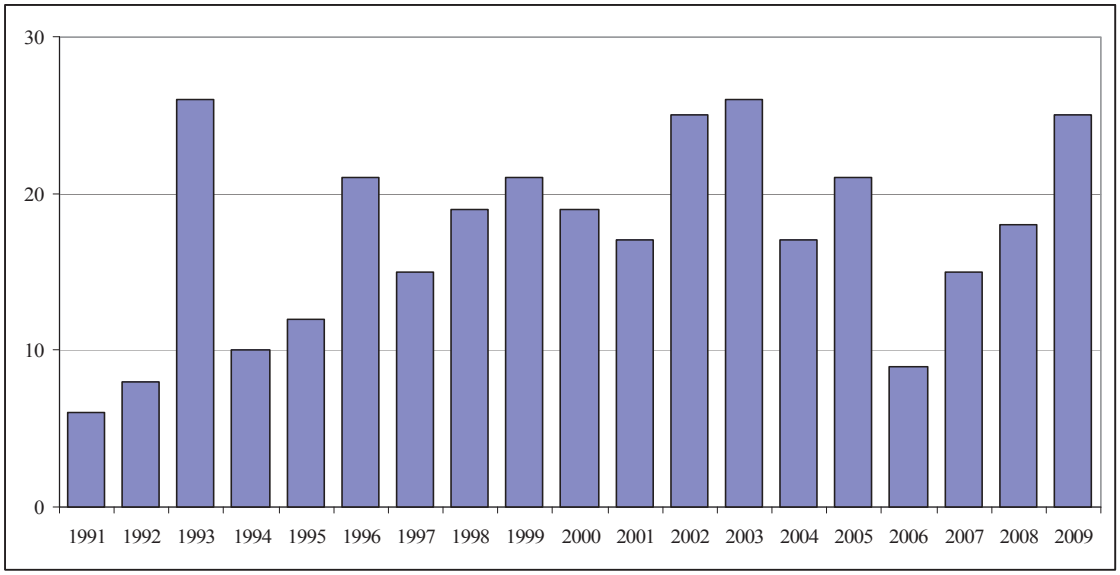
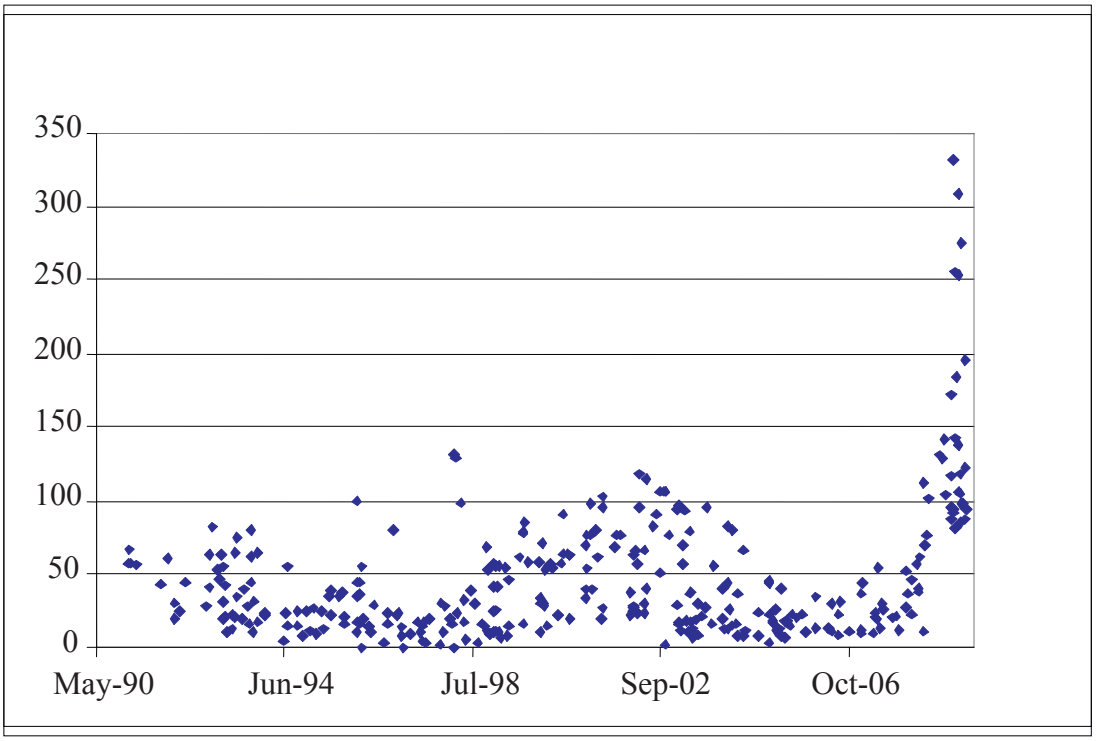
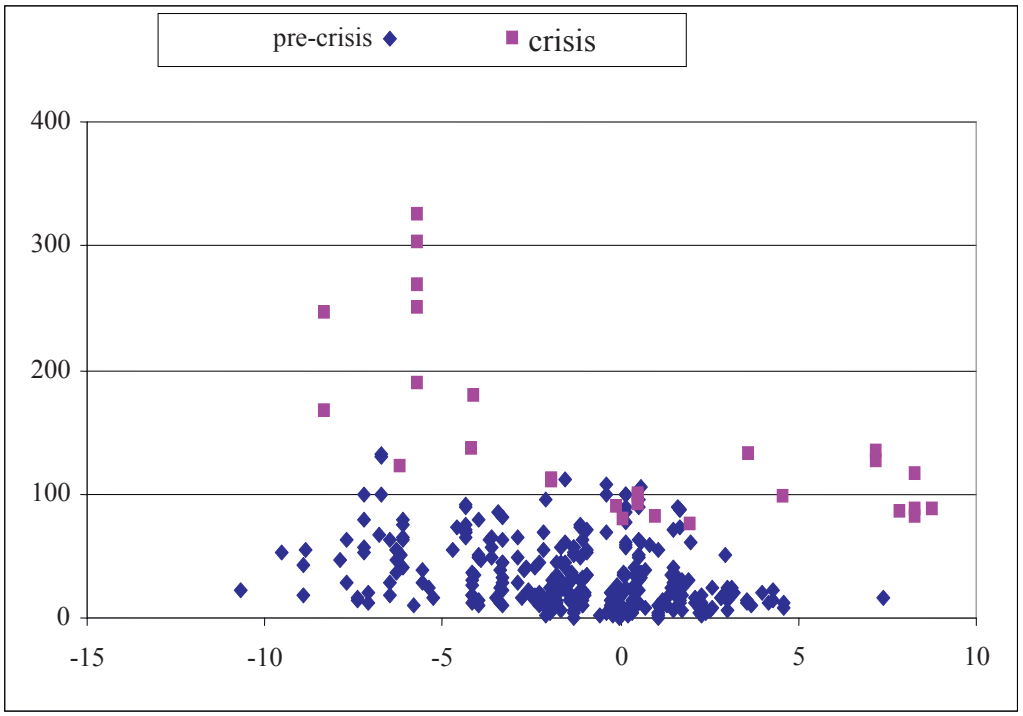


Figure 2: Bond yield spreads for EU central governments
In basis-points



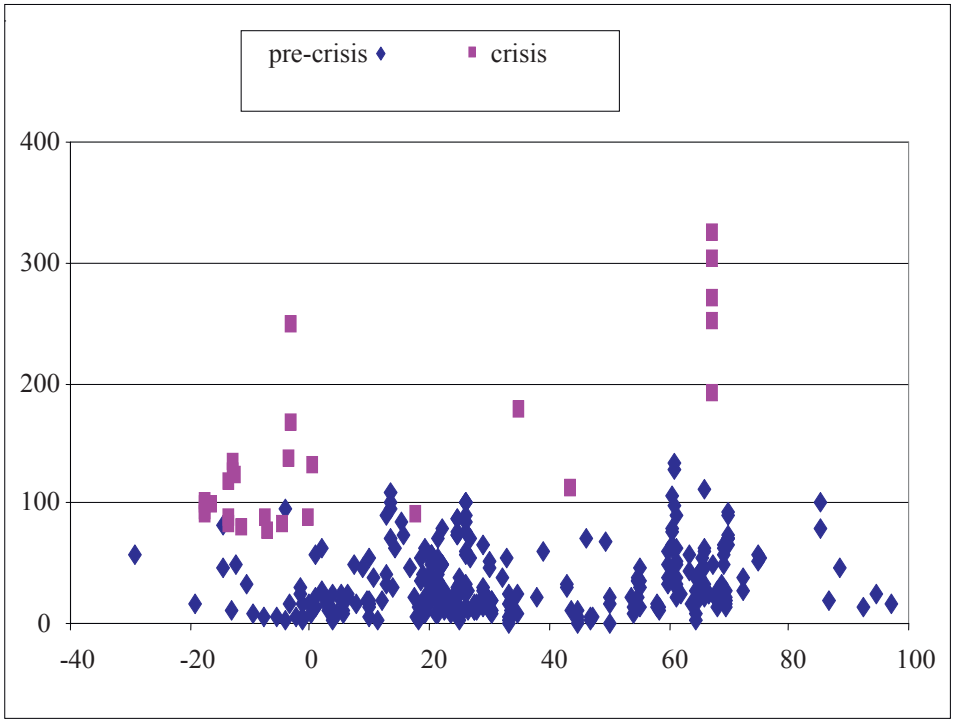
Source: Dealogic.

Figure 3a: Bond yield spreads and fiscal balance ratios
In basis-points, respectively percent-point of GDP



Note: Positive numbers on the x-axis indicates more favourable fiscal balances compared to the benchmark country.

Figure 3b: Interest rate spreads and debt ratios
In basis-points, respectively percent-point of GDP



Note: Positive numbers on the x-axis indicates more favourable fiscal balances (panel a) and less favourable debt (panel b) compared to the benchmark country.

Figure 4: US BBB Corporate Bond Spread
In per cent

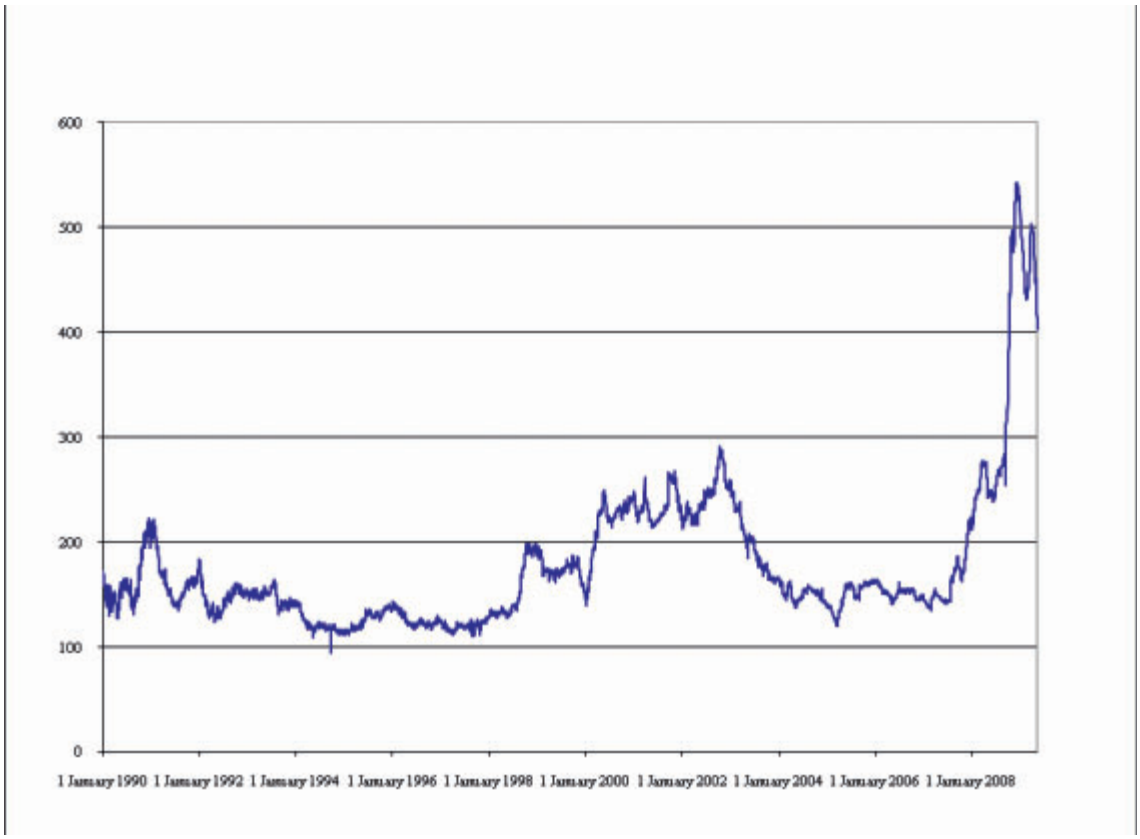


Figure 5a: Estimated Spreads during the Crisis
(% of estimated bond yield spread)

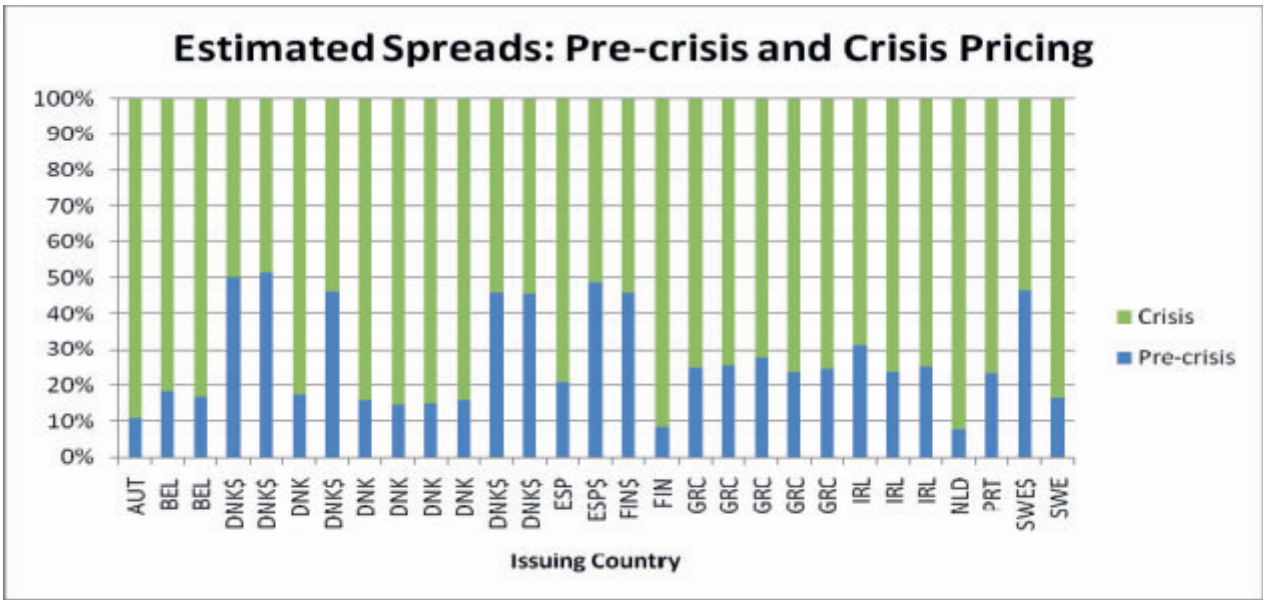
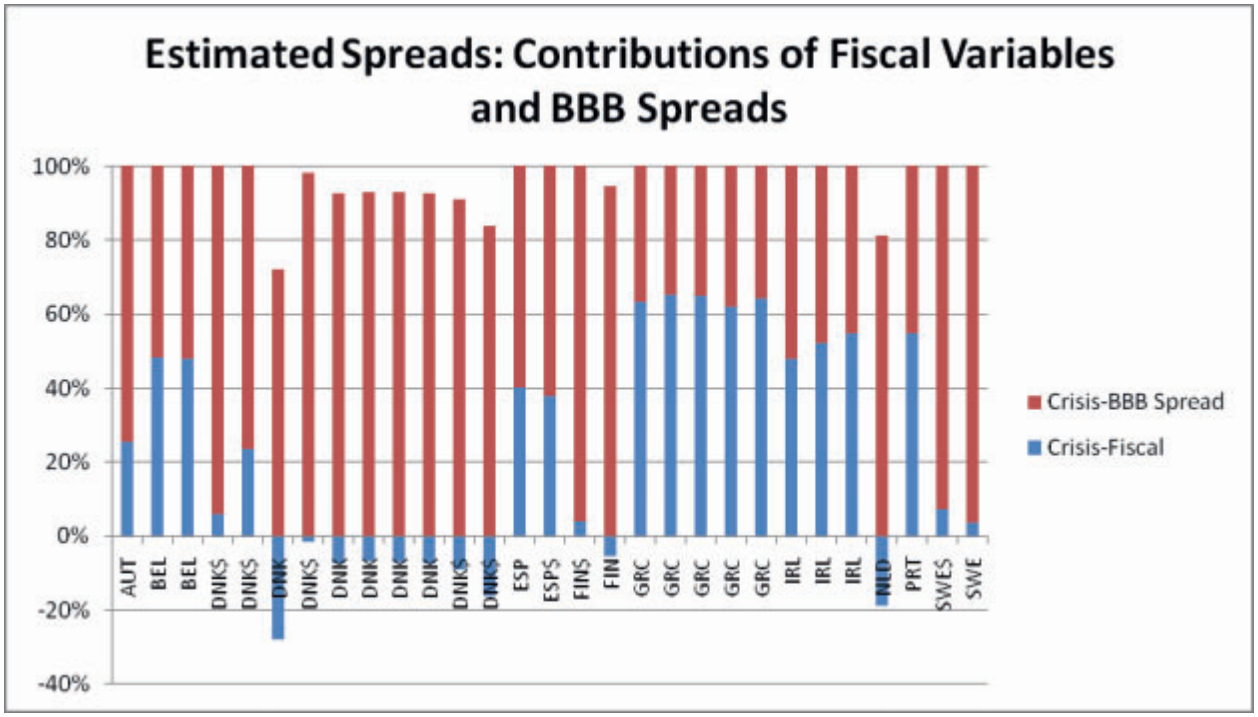


Figure 5b: Estimated Spreads during the Crisis
(% of estimated bond yield spread)



Annex: list of variables and their sources:

Bond size = issue size of the bond issued, in mln euro. Source: Dealogic.

Corporate spread (BBB spread) = difference between 7 - 10 year BBB-rated US corporate bonds (BBB) and 7 - 10 year US benchmark government. Source: Merrill Lynch.

Crisis = dummy taking value 1 for issuances since 15 September 2008, and 0 else.

EMU = dummy taking value 1 for euro area countries since 1999, and 0 else.

Government debt: Spring 2009 official Commission notifications. 2008 and 2009 data supplemented by fiscal projections included in the countries' Stability or Convergence Programmes.

Government deficit: Spring 2009 official Commission notifications. 2008 and 2009 data supplemented by fiscal projections included in the countries' Stability or Convergence Programmes.

Short-term interest rate:

US: 3 month US$ Libor rate. Source: Reuters

DM/euro: 3 month FIBOR, replaced on 1 January 1999 by the 3 month EURIBOR rate. Source: Datastream

Spread = difference in the yield to maturity at the time of issue between the national/regional bond and an equivalent government bond issued in the same currency by the government of the issue-currency. Source: Dealogic.

Time to Maturity = time until planned maturity of the bond. Source: Dealogic.

Turmoil = dummy taking value 1 for issuances between August 2007 and mid-September 2008, and 0 else.