Fiscal effort, banking intermediation and sovereign bond risk premiums in the Euro area

Preliminary version

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Abstract: beyond institutional changes, the sovereign debt crisis in the Euro area implies to reduce public debts and deficits together with the implementation of measures to sustain growth. Numerous studies point out risk aversion as a key factor of the increase in sovereign spreads. However risk aversion is also an outcome, which can be explained by the crisis: so we point out the role of banking intermediation and fiscal efforts to explain the differences in long term interest rates within Euro area countries from 2008 to 2011.

Keywords: interest rate premium; fiscal effort; sovereign debt; banking intermediation

JEL classification: F34 ; G12 ; E43, E62

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Introduction

The markets for public debt establishes the cost of debt for countries and so the price of government bonds. Following standard theory, current prices reflect all available information; they depend on monetary factors (including official interest rates and inflation levels) and on fundamentals linked to the ability to repay. Besides risk premium, borrowing rates also include a liquidity premium linked to trade volumes on secondary markets. However assets prices are often disconnected from fundamentals and behavioural finance theorists emphasize psychology and expectations of market operators. In line with this, despite the monetary tightening from 2004 by the Fed, expectations on real estate prices remain widely upward (namely a "bandwagon effect"), and the crisis triggering in 2007 is explained by their inversion. Well, speculation on derivatives (as Credit Default Swaps [CDS]) is likely to affect the price (and price volatility) of the underlying security. So an interest rate premium cannot be just explained by economic fundamentals.

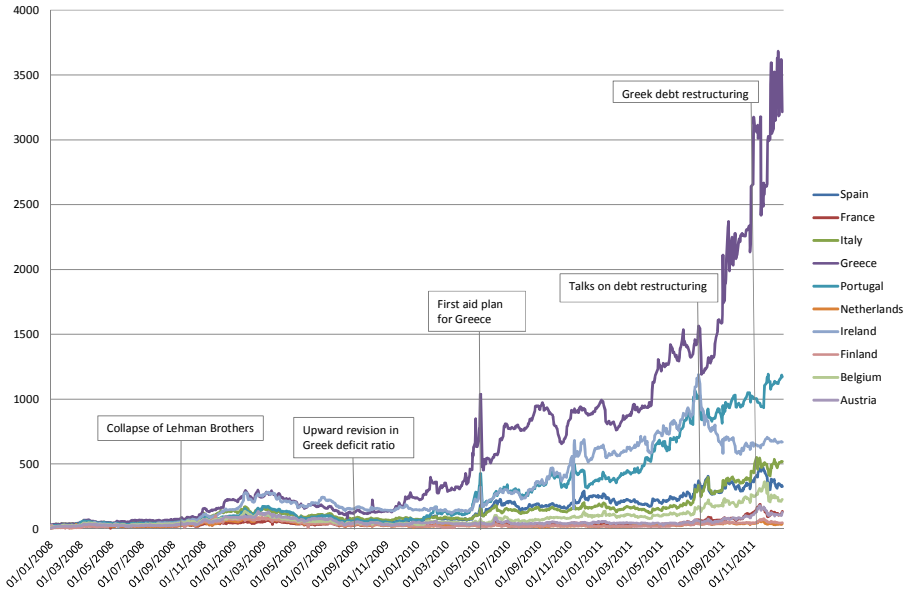
Two features at least define the European debt crisis as an interesting topic for empirical research, giving that common monetary policy allows ignoring exchange rates matters (even though banking troubles are also linked to national frameworks of member states). First, the crisis may result in the death of redistributive models, or by contrast it may only mean that markets need credible and reassuring information about consistency between public finance management and chosen growth models. The question is all the more important that member states must at the same time reduce (and streamline) debt and deficit ratios and implement measures aimed at enhancing economic growth. Second, the Greek debt restructuring raises the question of the efficiency of current preventive measures such as the Stability and Growth Pact, whose procyclical effects is added to anti investment biases (Minea and Villieu, 2011). Crisis management mechanisms and European institutions (European Financial Stability Facility, and then European Stability Mechanism) are also questioned. Even financial contracts may be improved by collective action clauses (Serbini, 2012).

After the financial crisis triggered in 2007 and mostly 2008, economic theory predicts a flight to quality, usually in favour of public securities. However at the same time, Euro area member states are no more considered as a homogeneous risk class (Schuknecht et al., 2010), what may be consistent with market sanction (bail-in) and accountability of member states. So by contrast, long-term interest rate premiums (relative to German benchmark bonds) increase, sometimes dramatically. We try to explain it from 2008 to 2011 for ten EU countries, by taking into account banking features and fiscal efforts. Stylized facts and related literature are firstly presented. Beyond usual results, we find that banking activity crucially defines the functioning of markets for public debt. Moreover, the debt crisis may have brought about a report from public to corporate bonds.

Stylized facts

Globally, bond risk premiums increase for each country (Figure 1, Table 1). At the end of 2011, the Greek premium is the highest and reaches 3214 basis points (after a peak at 3682 basis points), that is to say one hundred times the premium observed at the beginning of 2008 (30 basis points). By contrast, Netherlands issue with a low interest rate, just 38 basis points more than Germany. Actually premiums first rise for all Euro area members after Lehman Brother's default (after the rescue of Bear Stearns in March 2008, according to Mody [2009]), and then come back to a low level.

Figure 1. Ten-year government bond spreads in Euro area, relative to German benchmarks bonds



Data: Financial Times, Thomson Reuters

Greece is the first country really concerned by the debt crisis in December 2009, as soon as its budget deficit is updated. Then sovereign bond risk premiums increase in the Euro area, especially for Greece whose spread's growth is exponential. Portugal and Irish premiums sharply increase to November 2010. Then the Irish premium increases more strongly to July 2011, and next this trend is reversed for these two countries. Spanish and Italian premiums move in the same direction. Note that premiums also react strongly when Greece asks European Union (EU) and International Monetary Fund (IMF) for a financial rescue, and after first debates about ways to restructure Greek sovereign debt in July 2011.

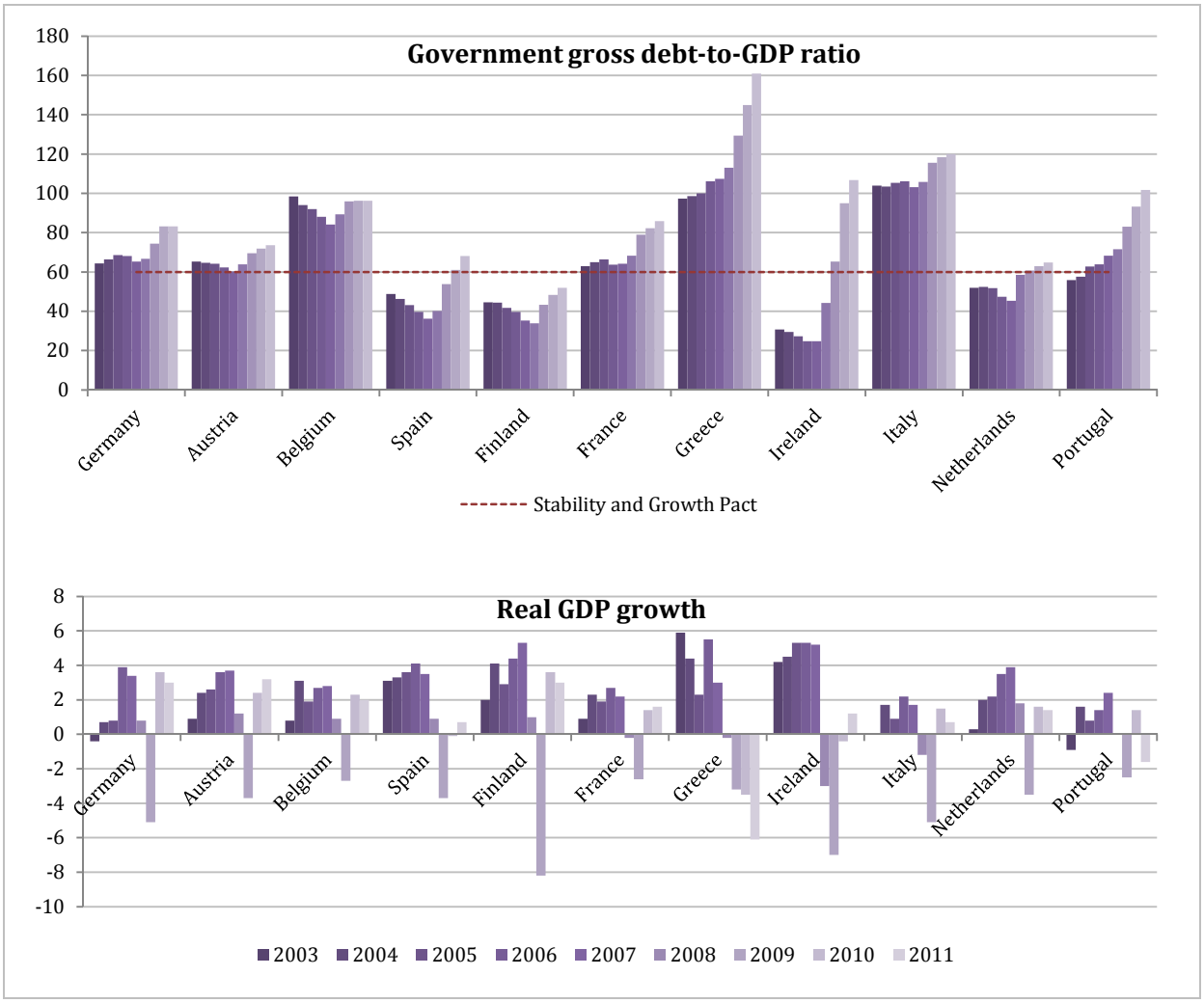
Table 1. Descriptive statistics, ten-year government bond spreads (2008-2011)

	Average	Std deviation	Minimum	Maximum
Spain	137	105	8	471
France	40	25	8	189
Italy	141	122	28	552
Greece	638	757	30	3682
Portugal	294	316	22	1194
Netherlands	31	8	7	86
Ireland	311	4	8	1190
Finland	33	18	5	101
Belgium	83	59	13	364
Austria	53	27	7	180

Data: Financial Times, Thomson Reuters, authors' calculation

Public debt data highlight main features of the studied period. First, numerous countries have reduced debt-to-GDP ratios since 1999: Ireland (-5,9 points from 2003 to 2007), Spain (-22.3 points from 1999 to 2008), Belgium and Netherlands (respectively -29.5 points and -15.8 points from 1999 to 2007). Second, some general government debt-to-GDP ratios systematically exceed the 60% reference value since 1999: Austria (66.2% on average), Greece (112,5% on average), Italy (109% on average) and Belgium (97.4% on average). Finally, the most indebted countries are the same whether considering 2008 or 2011: Greece (113% in 2008 and 162,8% in 2011) and Italy (105.8% in 2008 and 120.5% in 2011). This remains true for the less indebted countries, namely Finland (33.9% in 2008 and 49.1% in 2011) and Spain (40.1% in 2008 and 69.6% in 2011). So Euro area members are at the very least very heterogeneous face to the crisis. Since 2008, debt level increases for each considered country, except Finland (Figure 2).

Figure 2. Debt-to-GDP ratios and GDP growth for selected countries from 2003 to 2011 (%)



Data: Eurostat, European Commission 2011

In 2010-2011 (and 2012), three members of the euro area accessed IMF, EU and ECB resources: Greece, Portugal and Ireland. After a debt relief policy, the Irish debt ratio continuously increases

from 2007, that to say after the subprime crisis. Debt level first remains consistent as regards Growth and Stability Pact criteria. From 2008, large recapitalization schemes entail a dramatic increase in debt ratio (the largest among studied countries): +64 points, to reach 108.1% in 2011. Similarly, the Greek debt ratio continuously increases since 2004. Its level is systematically superior to 60% (cf. *infra*). The increase from 2008 to 2011 reaches 49.8 points, the greatest except Ireland. Since 2001 the increase in Portuguese debt ratio is also constant, so that it exceeds convergence criterion from 2005, and represents the third largest growth from 2008 to 2011 (+30 points).

Despite similarities, the paths taken by these countries are different. For instance, we note that Portuguese and Irish debt ratios are approximately equal in 1999 (respectively 49.6 and 48%) and in 2010 (respectively 93.3 and 92.5%). However, Portugal takes on debt from 2001 while Ireland lowers its debt level to 2007, and then the crisis cancels out the efforts undertaken. This last case so reveals links between public and private debt: the public debt deleveraging process implies an increase in private debt, for which the government is the guarantor of last resort. This situation is similar to what can be observed in Spain in 2012.

Related Literature

Standard optimization models enable assessing the effect of an increase in budget deficit on the debt-to-GDP ratio, and then on growth and welfare. However, steady-state long-term relationships may be inadequate to explain long-term interest rates on financial markets driven by short time horizon. Indeed the purpose is to bring out the financial determinants of interest rate premiums, especially the role of larger players, namely banks.

In case of a decline in the value of public securities, the value of banks' balance sheets declines too, due to International Financial Reporting Standards. As a result, a credit crunch lowers growth, hence a negative feedback effect on future tax revenues and a self-sustaining spiral of higher long-term interest rates. In the extreme case, financial losses reduce levels of capital positions such as a recapitalisation scheme is necessary, reinforcing public over-indebtedness: this is all the more likely, that prudential rules will be tightening and especially solvency ratios will be higher, as EU promised to adopt next recommendations of the Basel Committee on Banking Supervision. Again, one can expect a decrease in excess demand for (downgraded) public securities, which is accompanied by an increase in the yield on government bonds when tender procedure. Again, this is all the more likely when the central bank has reached the "zero lower bound": a possible rise in official interest rates would also reduce the value of securities on secondary markets, including in banks' balance sheets[2]. Other relationships may be put forward, as, for instance, households are supposed to save more if the Ricardian equivalence holds[3].

Regardless the reason, a rise in debt burden implies a rise in debt-to-GDP ratio, but also a decrease in primary balance as there is a ceiling for public deficit (i.e. 3%): hence a lower deal of control in public

[2] However in case of non-standard monetary policies, central banks wish to ensure that monetary easing will be lasting. For example, in order to control expectations in this way, the ECB runs itself to the risk of capital loss (market risk) by holding long term securities (Bastidon et al., 2012).

[3] Some relationships are on the opposite refuted. For example, Ducoudré (2005) rejects the idea that the deterioration of public finance would have lead to increased real interest rates (and then rejects the idea that households and companies would have delayed their consumption and investment decisions).

spending. That is why the later structural fiscal adjustments are, the more painful they get (Koutsogeorgopoulou, 2007). Fiscal consolidation is thus necessary, but at the same time austerity measures may have a severe impact in terms of unemployment, if fiscal multiplier is underestimated (Blanchard and Leigh, 2013). That is also why it is important to better understand determinants of long-term bond risk premiums, knowing that they bear no more relation to the fundamentals if confidence is lost.

Debt sustainability is achieved when government finance is not supposed to be drastically adjusted in the near future. So two issues at least derive from the intertemporal budget constraint: short-term refinancing needs (liquidity) and long-term repayment ability (solvency). Many indicators aim at stabilize debt-to-GDP ratio, usually through primary balance and tax rate (Blanchard, 1990). In this sense, for each country we compute the stabilising primary balance as do Kerdrain and Lapègue (2011), that is the level of budget balance for which debt-to-GDP ratio is constant (Annex 1). That is also why Borgy et al. (2011) use expected changes in debt/GDP ratios for each country in order to assess fiscal sustainability and then sovereign bond yields.

On the basis of projections of public debt ratios including age-related spending, Cecchetti et al. (2010) find that "the path pursued by fiscal authorities in a number of industrial countries is unsustainable" and advocate drastic measures both to support monetary stability and long-term growth. Indeed demographic ageing put additional pressure on public finances in many countries (Rother, 2012). However, Cerisier and De Lucia (2011) point out progress made both on government debt reductions and on institutional developments in the Euro area. Their study allows comparing theoretical and actual sovereign risk premiums. Globally budget and growth variables are significant but also very connected, as shown by interaction terms. Despite a right predictive power until 2010, thereafter premiums are clearly underestimated because of a sharp fall in global confidence. In fact a rise in risk aversion is supposed to produce higher risk premiums (and further adverse selection). However, a refinement is yet necessary because the lack of confidence can be interpreted as a cause of the crisis and at the same time as a result: amongst others, authors advocate to take into account banking data in order to improve their results.

The work carried out by Attinasi et al. (2009) is thus helpful, by including dummies related to support measures to the banking sector. The model's ability to forecast is enhanced, but the study ends in 2009 and cannot encompass more recent developments in the European debt crisis. Again, and as for Barrios et al. (2009) or Manganelli et al. (2009), the high degree of risk aversion appears as a key factor of the bond yield spreads widening. Moreover, growth of GDP is not supposed to affect the government debt load and is thus controlled: this assumption seems to be too restrictive given the interactions between growth and debt, thereby we use the share of GFCF in government spending, in addition to fiscal effort. Indeed the relative shares of investment expenditure and operating costs may be taken into account by investors during any tender (through actuarial calculations), because it tends to matter for future economic growth.

According to Barbosa and Costa (2010), again global risk premium is the main driver of spreads after the collapse of Lehman Brothers, but it is clear that liquidity premium and sovereign credit risk premium play then a major role and even become the determining factors of the evolution of spreads. Over a longer period of time, Gerlach et al. (2010) also show that an aggregate risk factor is a main driver of spreads. In case of increase, the level of equity ratios and the size of the banking

sector also play a major role in widening yields spreads, as financial markets expect for bank bailouts. According to Assman and Boysen-Hogrefe (2012) and Bernoth and Erdogan (2012), such a long study period reveals the need of time-varying coefficient models. So despite risk premium and liquidity premium, the third component of spreads, namely the expected loss component, rises during the recent financial crisis, such as sovereign spreads rise too (Dötz and Fischer, 2010). With the same (GARCH) methodology, Arru et al. (2012) measures the effect of macroeconomic surprises on the level and volatility of yield spreads. Finally the need for careful econometric specification is highlighted by Georgoutsos and Migiakis (2010). For example, Maltritz (2012) chooses to apply Bayesian Model Averaging to annual panel data (from 1999 to 2009). Alexopoulou et al. (2009) use a dynamic panel error correction model for new EU countries over the period 2001-2008 and highlight the role of fundamentals for the assessment of creditworthiness (by including exchange rates or even trade openness). Domestic fundamentals but also swings in market perception of sovereign risks are more relevant when countries are characterised by large external imbalances and historically high levels of spreads.

Sgherri and Zoli (2009) show that sovereign risk premium differentials tend to co-move over time as they are mainly driven by global risk; however, markets are more and more concerned about specific criteria for countries in the euro area, including liquidity risk. Over the period 2007-2012, dynamic co-movements of sovereign bond yield spreads in the Eurozone are also explained by credit rating agencies' downgrades (Antonakakis, 2012). The aim of this paper is to provide a similar analysis over the period from 2008 to 2011, by focusing on banks' involvement and fiscal efforts. Indeed both banking troubles and productive spending cuts are supposed to affect sovereign bond yields and bond risk premiums. By contrast, a fall in unproductive government spending supports expected economic growth and then may reduce sovereign spreads relative to Germany (as for Minea and Villieu, 2011).

Methodology

The spread between national and German loan rate is our endogenous (monthly) variable. The sample consists of the first countries to adopt the euro on 1st January 1999 (except Luxembourg): Germany, Austria, Belgium, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands and Portugal. Each individual explicative variable is expressed by difference compared with Germany, the referent country, from 1st January 2008 to 31 December 2011. Indeed, although there is no sign of a debt crisis until 2009, the year 2008 is significant as it presents a major financial crisis that weakened banks and may play an important role in determining government spreads. A difficulty held that banking sectors and the sovereign debt markets are highly correlated, as shown by a CDS analysis in both sectors.

A first element of the determination of spreads is the bond liquidity risk. So, we calculate a liquidity premium for each country characterized by a higher borrowing cost than Germany. We do not retain the bid-ask spread (Barrios et al., 2009) neither the amount of issuances, but we prefer to calculate the share of outstanding (fixed rate denominated) long-term securities issued by each central government at the end of the period, within total outstanding at the end of the period for the whole sample (as do Bernoth et al., 2004). These data are provided by the ECB Securities Issues Statistics,

with a monthly frequency. The expected sign is negative as a large part reflects a low liquidity risk. Note here that the treatise of Maastricht covers on gross public debt; a net debt is net of aid: EFSF debt is recorded within public debt of the pool member States, and at the same time supported countries record a debt to each member of the pool.

Secondly, depending on the risk profile of each country, it may be required a credit risk premium which involves to calculate the risk posed by each sovereign issuer[4]. In this paper, we use CDS spreads provided by Bloomberg, with a daily frequency. To refine the measurement of counterparty risk, we present a second set: the balance stabilizing debt is calculated as the product of gross public debt at n-1 and growth rate of nominal GDP. By subtracting the interest burden from the stabilizing balance (i.e. the difference between budgetary and primary balances), we obtain the stabilizing primary balance. So, the gap to the stabilizing balance is obtained by difference between theoretical and observed balances, i.e. the difference between the stabilizing balance and the current primary balances. Like the others, this set is expressed in difference compared to Germany. A third variable complements the evaluation of counterparty risk since we recover, on a quarterly basis, the rate of growth for the public sector share of gross fixed capital formation (GFCF) spending, related to the previous quarter but also to the same quarter of the previous year.

Lastly, risk and risk aversion is a third important component in works focused on sovereign spreads. The macroeconomic risk is measured by private bond market. Two series come from the Fed: yield differential between BAA and AAA American corporate bonds, and yield spread between high rated short-term securities issued by the non-financial sector and securities with worse signature (similarly to Haugh et al., 2009), namely “global risk” indicators. We also use the stock index for each European country (Stoxx) and the S&P 500 index to assess the impact of the environment and economic performance. Aversion to the risk is measured by the European (Vstoxx) or American implied equity market volatility (Vix). Two series are important in the literature: implied volatility on European bond market (Eurex) and on American bond market (CBT). These latest series are most likely to produce results that include both the evolution of risk and the aversion to the risk.

The use of other control variables refines the results and their interpretation. Thanks to the World Economic Outlook (IMF), we calculate for each half-year the evolution of the growth for the current year compared to that of the previous year. The growth during the current year is unknown by market participants, nevertheless these data reflect the evolution of the macroeconomic situation, and they may influence the choices of well-informed operators in terms of possession (and pricing) of assets. The growth of GDP is also used for each country. Lastly, it comes to see if the only status of country in support can play a role (e.g. stigma effect), hence the construction of dummy variables relative to countries in support and bank distress.

Indeed, Attinasi et al. (2009) use a dummy variable taking the value 1 the day of the announcement of bank rescue packages, by taking into account the size of guarantees and recapitalizations. But it is difficult to suppose that the announcement of a bank rescue enhances the spread; the hypothesis of

[4] Attinasi et al. (2009) successively use debt ratio and budget balance, through the data of the European Commission Forecast. Cerisier and De Lucia (2011) also use the debt ratio, but they prefer the payment of interest debt. The approach of Barrios et al. (2009) is more comprehensive and complex: they use a principal component analysis to incorporate the performance of countries, the risk of a debt rating’s downgrade and the default risk.

a decrease in borrowing rate (in association with the recovery ok bank activity) is also plausible. Further, the dummy variable used by Barrios (2009) to capture the bailouts is not significant. We prefer standard time series, with daily frequency: the spread between three month EURIBOR and EONIA rate, indicating the steepening of the curve of interbank rates; and the spread between EURIBOR and EUREPO (both at three month). In this last case, the maturity is the same, but the degree of risk is different because the EUREPO is collateralized (credit or counterparty risk).

Having regard to the characteristics of long-term bonds, we make some regressions through the series of interest rates of main refinancing operations by the ECB, and through the growth of general price level for the Eurozone. The break-even inflation rate may also inform about the anticipation of a monetary policy tightening. However, a lower anticipation of inflation may also increase spreads, by indicating a recessive scenario or a liquidity trap. The estimated equation takes the form:

$$spread_{i,t} = \alpha_i + \beta_1(X_1)_{i,t} + \beta_2(X_2)_{i,t} + \beta_3(X_3)_{i,t} + \beta_4(X_4)_{i,t} + \beta_5(X_5)_{i,t}$$

The list of variables (Annex 2) and their evolution over the period (Annex 3; annex 4) are presented. X_1 represents the sovereign risk (including liquidity risk and credit risk, e.g. CDS but also fiscal effort or dummies for downgrades), X_2 the economic environment (including GDP growth or stock indexes, or even official interest rates, inflation rate, break-even inflation rate), X_3 the risk aversion (here based on market volatility), X_4 banking indicators (through interbank spreads or dummies for recapitalization schemes) and X_5 is a possible breakdown.

Results

The model is estimated by fixed-effects regressions with a monthly frequency, from 1st January 2008 to 31 December 2011. Hereafter, all specifications of the equation are estimated in robust standard error in response to the presence of heteroskedasticity.

Developments of the baseline model

As shown by Table 2 (Annex 5), initially we do not retain the qualitative aspect of public finances or banking sector. The purpose is to find a good measure of global risk and economic performance. In this baseline model, not surprisingly, the variable of counterparty risk (lagged CDS) is consistently significant with expected sign. On the opposite, we expected for a negative sign of the liquidity risk (LIQ), as expected by Attinasi et al. or Haugh et al. (2009): indeed, the series is stable over the studied period, expect for Germany and Spain (Annex 4), so the growing share of outstanding amounts for Spain does not reflect a deeper and more liquid market, but an increase in issues of long term debt and so a higher vulnerability. The different measures of the economic environment are also instructive. Overall, the data specific to the Euro area are more significant than data based on US markets (ie. Stoxx relatively to S&P 500). Corporate bond spreads (Spread BAA-AAA and SpreadNFA2_P2) are indicative of private market tensions or global risk: the second shows a positive relationship with sovereign spreads; however this result may not be robust. So we retain the stock index in addition to liquidity and credit risks, and look for an indicator of risk aversion.

In Table 3 (Annex 5), the first four regressions show a high significance of implied volatility on European bond markets (Eurex). The following four regressions use corporate bond spreads (instead of stoxx) to control the economic environment and tend to confirm this result, although the implied volatility on European and American stock index (VIX and Vstoxx) is significant too, with the expected sign. Next, we retain the 3rd model of the Table 3 (with Eurex which remains significant even without the lagged CDS data, as in the model 9).

We construct four dummy variables to identify a structural break: EFSF, EFSF_hyst, piigs_break and common_break (Table 4, Annex 5). Since all the binary variables (except common_break, which concerns the whole sample) are significant, we choose EFSF_hyst, corresponding to the regression that best explains the evolution of the endogenous variable (model 2, and model 5 without lagged CDS). This variable takes into account the first aid plan for Greece, from May 2010, and the first payments from EFSF to Ireland and Portugal, respectively in February 2011 and June 2011. This significance is surprising insofar as the difficulties of countries are well known in these times of the studied period. Transfers from EFSF, for example, have resulted in loans during which its Triple A helped recover many offerings (except if the use of assistance devices implies a reduction of flexibility of the Member States to deal with the changes in the debt crisis. Indeed, the funds available to the EFSF have been enhanced to increase its borrowing capacity while maintaining the Triple A rating, taking into account the collateralization mechanisms that accompany it). Again, we note that the liquidity risk, measured by the share of outstanding amounts of long term public securities, systematically presents an unexpected sign when significant.

Fiscal effort and banking

This new set of tests allows introducing the qualitative dimension of public finances and the interbank troubles, together with a dummy variable characterizing national plans to recapitalize banks (Table 5). Firstly, the variable GFCF is not significant, in other words markets may be sensitive to the evolution of the debt but not to its composition. On the opposite we note that public effort, i.e. the evolution of the distance regarding to stabilizing primary balance, is systematically significant with expected sign. Rating downgrades are also accompanied by an increase in sovereign spreads. As shown by model 2, these results remain valid without CDS data as an explanatory variable.

Conversely to Attinasi et al. (2009), the impact of recapitalization schemes is not significant, what could be explained by the way we have coded this variable (i.e. the absence of instruments for weighting rescue packages). Well, as the break-even inflation rate in the Euro zone, interbank tensions are not significant when they are measured by the yield curve, i.e. the spread between 3 month rate and overnight rate (Euribor - Eonia), neither when we use the Euribor-Eurepo spread, which represents bank credit risk. The use of a lag for these variables, reflecting if the increase in sovereign spreads would not refer to previous tensions, does not seem relevant. Insofar as the banks are big players on sovereign bond markets, it is important to check the direction of the variables indicating interbank tensions: a first approach is to change the frequency of data.

Table 5. Fiscal effort and banking

	1	2	3	4
CDS_1	0,39*** (0,01)		0,39*** (0,01)	
LIQ	2,42 (4,50)	-15,16 (10,80)	0,21 (4,67)	-0,07 (12,08)
Stoxx	-1,34*** (0,13)	-3,86*** (0,41)	-1,41*** (0,12)	-4,14*** (0,59)
Eurex	7,86*** (2,11)	16,01 (11,52)	10,91*** (3,54)	18,79* (10,85)
EFSF_hyst	257,98*** (31,22)	489,01*** (56,87)	256,48*** (29,65)	483,80*** (63,78)
GFCF	66,27 (47,84)	-65,74 (64,30)		
Rating	90,22*** (16,12)	121,94*** (34,38)	91,26*** (19,01)	95,85* (55,70)
Pub_effort	75,72*** (16,21)	15,68** (61,72)	75,82*** (14,34)	15,61** (61,60)
Bor3_eonia			-11,25 (43,78)	-194,37 (158,01)
Bor3_repo3			-8,34 (40,74)	160,53 (165,09)
Recap			-3,67 (5,39)	-2,10 (19,31)
Breakeven			1531,42 (2127,21)	12592,6 (11057,3)
Constant	34,28 (70,75)	-244,64 (252,56)	-21,90 (78,82)	-233,85 (201,41)
R2	0,971	0,798	0,971	0,802

Fixed-effects regression (models 1 and 3: 47 periods, 470 obs.; models 2 and 4: 48 periods, 480 obs.): 10 u. of cross-section, monthly; dependent variable: spread
*Note: (standard error). *** Significant at 1%, ** Significant at 5%, * Significant at 10%.*

By using weekly data, we exclude fiscal efforts undertaken by member States, but also Eurex (Table 6). So for the first three models, regardless the measure of global risk/risk aversion (respectively VIX, Vstoxx, spreadNF_A2_P2), the yield curve of interbank market is not significant. By contrast, interbank strains are systematically significant with the expected sign when measured through Bor3_repo3, i.e. counterparty risk. The fourth model confirms this significance when no using lagged CDS, and the fifth shows that interbank troubles precede the rise in sovereign spreads. An interesting result appears when using SpreadNF_A2P2 as a measure of global risk: these results (with its negative sign) bear out the possibility of a reallocation towards the US corporate bond market.

So there is nothing to suggest that external factors would have strengthened the European debt crisis, besides the adverse international economic conditions. Additional computations show that sovereign CDS premiums interact with banking data, namely with Bor3_repo3.

Table 6. Weekly frequency

	1	2	3	4	5
CDS_1	0,31*** (0,02)	0,31*** (0,02)	0,30*** (0,02)		0,30*** (0,02)
LIQ	16,10** (6,67)	18,30*** (6,31)	13,41* (6,87)	-1,65 (15,24)	14,41** (6,72)
Stoxx	-2,10*** (0,29)	-2,015*** (0,29)	-2,18*** (0,28)	-5,44*** (0,78)	-2,15*** (0,28)
EFSF_hyst	282,60*** (62,46)	287,12*** (62,72)	280,88*** (58,69)	398,50*** (78,64)	283,10*** (59,08)
VIX	-1,49** (0,63)				
Vstoxx		-0,84** (0,35)			
spreadNF_A2_P2			-25,28*** (7,46)	-87,58** (43,56)	-22,20*** (6,44)
Bor3_eonia	-11,91 (16,79)	-4,89 (16,75)	7,93 (17,78)	-32,29 (39,64)	
Bor3_repo3	77,37*** (22,08)	57,52*** (18,44)	80,98*** (19,72)	265,52** (133,69)	
Bor3_eonia_1					16,01 (17,30)
Bor3_repo3_1					68,44*** (16,77)
Recap	-15,02 (13,80)	-17,13 (13,65)	-18,91 (13,99)	-33,56 (31,99)	-20,12 (13,66)
Constant	409,59*** (115,24)	438,71*** (110,79)	330,43*** (116,00)	127,06 (269,12)	348,27*** (112,97)
R2	0,946	0,945	0,947	0,780	0,946

Fixed-effects regression (models 1, 2, 3, 5: 207 periods, 2070 obs.; model 4: 208 periods, 2080 obs.): 10 u. of cross-section, weekly; dependent variable: spread
*Note: (standard error). *** Significant at 1%, ** Significant at 5%, * Significant at 10%.*

Preliminary conclusions

Some general points may be made in conclusion. Globally, in the context of the European debt crisis from 2008 to 2011, one should not measure risk aversion through VIX, and the so-called “global risk” is not significant when measured by spreads on US corporate bond markets. European data about growth, volatility and stock indexes are clearly more relevant, which means troubles in the Euro zone cannot be explained through external mechanisms. It is interesting to note a robust inverse relationship between on the one hand sovereign bonds spreads in the Euro area, and on the other hand U.S. corporate bond spreads excluding the financial sector. Such a relationship suggests a reallocation, from usual public bonds towards U.S. corporate bonds. Moreover, even though it is clearly not the main driver of sovereign spreads, the efforts undertaken by member States to lower the distance to the stabilizing primary balance seem to be accompanied by a decrease in sovereign spreads. Does the debt crisis systematically imply a drastic decline in the share of public spending within GDP? The sole GFCF data do not allow answering this question. One can just note that markets are more concerned about the debt dynamics than about the sole level of debt, as shown by the significance of the deviation from the stabilizing balance.

As regards banks, we do not find any impact of recapitalization schemes on sovereign spreads. However, we found that the counterparty risk among banks is highly correlated with sovereign

spreads. So the quality of bank intermediation is crucial to the good functioning of bond markets, including the pricing of assets and therefore the borrowing rates of Member States. Here, there is a need to split public spending and banking activity or by countercyclical public spending or by prudential rules that present the same countercyclical characteristic. It does not explain the debt crisis, but helps to understand its magnitude. Nevertheless a next step is to better take into account bank troubles, by isolating the share of interbank spreads which are not directly due to write-downs of fixed income government securities (BIS, 2011): indeed banking troubles may also be explained by non-performing loans or by the uncertainty about the monetary policy stance (e.g. the ECB raises its key interest rate two times in 2011). Finally, the liquidity risk on public debt markets may be more important that initially assumed. Here a next step is to replace it by bid-ask spreads and to take into account the effect of debt maturity. Within this comprehensive framework, dynamic panel will be implemented.

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Annex 1. Stabilization of public debt ratio

Public debt is the sum of previous budgetary deficits. Budget balance consists of 2 parts: primary balance and payment of debt interests. Primary balance is the difference between government revenues and spending, without debt interests. Therefore, budget balance is equal to primary balance minus interests. Formally, budget balance is written:

$$BB_t = PB_t - \left(rD_{t-1}\right) \quad (1)$$

With: BB_t: budget balance at the time t
PB_t: primary balance at the time t
r: interest rate
D_{t-1}: previous debt

The current debt is equal to previous debt minus budget balance. Formally, it is written:

$$D_t = D_{t-1} - BB_t \quad (2)$$

With: D_t: debt at the time t

Using the equation (1), we can rewrite the equation as follows:

$$D_t = D_{t-1}\left(1+r\right) - PB \quad (3)$$

Therefore, the current debt depends on the previous debt, on the interest rate and on the primary balance. To stabilize the outstanding debt, the primary balance should at least be equal to the repayment of the debt, otherwise a vicious circles appears (a so-called “snowball effect”). The most common sustainability indicator is the debt burden relative to GDP. The evolution of the debt is linked to growth and to interest rate: the crucial element is the difference between the interest rate and the growth rate. The stabilization of government debt-to-GDP ratio implies to achieve a primary balance equal to:

$$pb_t = d_{t-1}\left(r-g\right) \quad (4)$$

With: pb_t: primary balance to GDP at the time t
d_{t-1}: previous debt to GDP
g: growth rate

Using equation (4), three cases are possible:
r = g, a primary budget equal to 0 allows to stabilize the debt-to-GDP ratio.
r > g, a primary budget equal to 0 does not stabilize the debt ratio: the government must achieve a surplus, which will be even greater than the difference between interest rate and growth rate is high.
r < g, a primary balance equal to 0 allows to decrease the debt-to-GDP ratio.

Annex 2. List of dependent and explicative variables

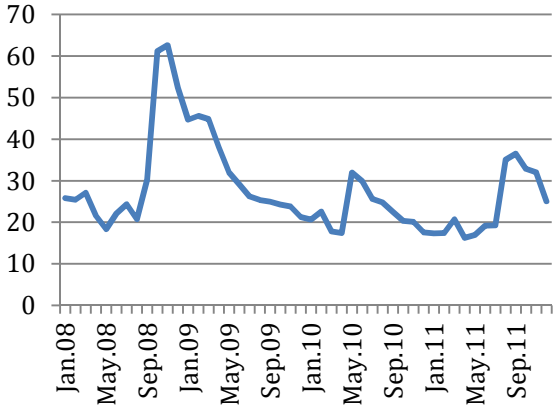
Variables	Source	Frequency	Comments
Endogenous variable: government spread relative to German benchmark bonds			
SPREAD	Financial Times, Thomson Reuters	Daily	*In terms of basis points. Also see:* http://sdw.ecb.europa.eu/reports.do?node=10000049
Credit risk variables (by difference with Germany)			
Pub_effort	Eurostat, authors' calculation	Annual	*Fiscal effort is the deviation from budgeted primary fiscal balance, i.e. the difference between theoretical stabilising primary balance and current primary balance. Positive sign is expected.*
CDS	Bloomberg	Daily	*Sovereign CDS premium in terms of basis points. Positive sign is expected.*
GFCF **GFCF_2**	Eurostat, European Commission	Quarterly	*Developments in public GFCF spending compared to the previous quarter (GFCF) and to the same quarter of the previous year (FBCF_2). Negative expected sign. For GFCF_2, as regards Austria and Finland at the second and fourth quarter 2009, we replace "<0.1" by "0.05".*
Liquidity risk variables (by difference with Germany)			
LIQ	European Central Bank (ECB)	Monthly	*Liquidity risk associated to whole long-term EU sovereign bonds. Negative expected sign.*
Macroeconomic variables			
Feature shared by all studied countries (not expressed by difference with Germany)			
breakeven	Agence France Trésor (AFT)	Daily	*Break-even inflation: difference between the April 2019 4.25% French bond and the July 2020 2.25% French bond indexed on future inflation in the Eurozone. Positive expected sign.*
Ngp_zone	AFT	Monthly	*Rise in the general price level. Positive expected sign as a rise in goods prices carries a capital loss, hence a higher sovereign spread.*
I_MRO	ECB	Monthly	*Floating or fixed interest rate for main refinancing operations in the Eurozone. Data frequency is linked to Monetary Policy Committee meetings. The expected sign is positive as an easing may support both growth and the price of securities.*
Feature specific to each country (by difference with Germany)			
PIB **PIB_2**	OECD, Eurostat	Quarterly	*GDP growth compared to previous quarter (PIB) or compared to the same quarter of the previous year (PIB_2). Seasonally adjusted data. Negative expected sign. As OECD does not provide Greek data for second, third and fourth quarter 2011, we also use Eurostat data.*
PIBexp_real	IMF (World Economic Outlook)	Half-yearly	*Growth differential from T-1 to T. Underlying assumption: markets look IMF prospects for economic growth in the current year and compare them with the growth of the previous year. It represents markets psychology, i.e. the difference between expectations and what was achieved: the expected sign is unknown as only statistical significance matters (in fact, when the variable is positive, the sovereign spread is supposed to increase, and conversely: so this variable could be replaced by a dummy variable).*

Risk aversion and global risk factors			
Risk aversion			
vstoxx	Stoxx	Daily	*Vstoxx (VIX) indicates volatility in the European (American) equity market. Closing share price. As a rise (decrease) in the indicators implies market nervousness (optimism), the expected sign is positive.*
VIX	Chicago Board Options Exchange (CBOE)		
Risk on corporate bond market/"global risk"			
spreadBAA_AAA	Federal Reserve Bank	Monthly	*Spread between the yield on U.S. corporate BAA bonds and AAA bonds. Positive expected sign.*
spreadNF_A2_P2		Daily	*Spread between at least AA rated commercial paper and similar non-financial sector securities with a lower rating. Again, positive expected sign.*
Stock market performance			
Stoxx	Stoxx	Daily	*This is a price index of the European stock market: Stoxx Country Total Market Indices (TMI). Negative expected sign. By difference with Germany.*
SP500	Federal Reserve Bank	Monthly	*Price index of stocks listed in the U.S.A. (closing price). Negative expected sign.*
Strains in the interbank market			
BOR3_EONIA	EURIBOR	Daily	*Spread between three-month EURIBOR interest rate and EONIA rate. Positive expected sign.*
BOR3_REPO3			*Spread between unsecured three-month EURIBOR interest rate and collateralized three-month EUREPO interest rate.*
Risk on corporate bond market/risk aversion			
CBT	ECB	Monthly	*Implied bond volatility on U.S. markets, based on futures contracts listed on the Chicago Board of Trade. Positive expected sign.*
EUREX			*Implied bond volatility in the Euro-zone (Eurex). Positive expected sign.*
Dummy variables			
EFSF	European Financial Stability Facility (EFSF); Hellenic Ministry of Finance; Agence France Presse (AFP)	Daily	*Disbursements to struggling countries thanks to debt instruments issued by the EFSF. First, we use "1" for the months involved (for Ireland and Portugal). Second, we also use "1" for settlements granted under the first aid plan for Greece, as follows:* *- First tranche: May 2010 (the 12th by IMF; the 18th by EU);* *- Second tranche: September 2010 (the 13th by EU; the 14th by IMF);* *- Third tranche: December 2010 (the 21st by IMF) and January 2011 (the 19th by EU);* *- Fourth tranche: March 2011 (the 16th);* *- Fifth tranche: July 2011 (the 15th);* *- Sixth tranche: December 2011 (the 14th).* *Ambiguous expected sign.*
EFSF_hyst			*Again, disbursements to struggling countries. However for each country we use "1" from the first month of payment up to the end of the reference period:* *- Ireland: from the first disbursement on February 2010 (the 1st);* *- Greece: from the approval of the aid plan on May 2010 (the 2nd);* *- Portugal: from the first disbursement on June 2011 (the 22th).*

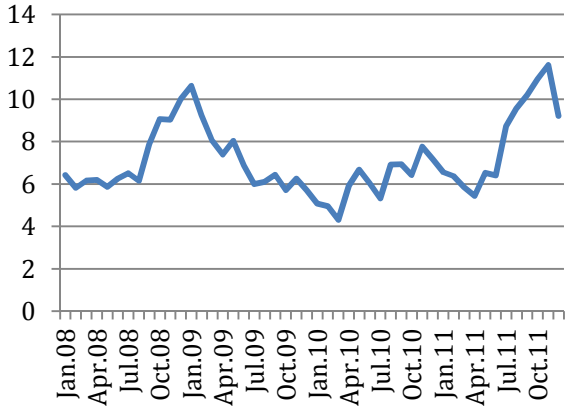
			Ambiguous expected sign.
piigs-break			*Impact of the first aid plan for Greece on all struggling countries, namely Greece, Ireland, Portugal, Italy, Spain. So for these countries we use "1" from May 2010 (first aid plan for Greece) until the end of the reference period.*
common-break			*Impact of the first aid plan for Greece on each European country in the sample. So for all countries we use "1" from May 2010 up to the end of the studied period.*
recap	E.U.		*Recapitalisation schemes (and government guarantees and banking restructuring):* *- Austria: 09/12/08 (IP/08/1933)* *- Belgium: 26/02/10, recorded from March 2010 (previous operations such as Ethias' restructuring are less important - IP/10/201)* *- Finland: 11/09/09 (IP/09/1303)* *- France: 08/12/08, as the October 2008 refinancing is less important (IP/08/1900)* *- Greece: 19/11/08, instead of the next recapitalisation scheme on 03/09/10 (IP/081742)* *- Ireland: first (toxic) asset-purchase program on 26/02/10, recorded from March 2010, instead of other numerous banking recapitalisation schemes or government guarantees* *- Italy: recapitalisation on 23/12/08, recorded from January 2009 (IP/08/2059)* *- Netherlands: capital injection on 10/12/08 (IP/08/1951)* *- Portuguese: 20/05/09 (IP/09/818)* *- Spain: 28/01/10, recorded from February 2010, instead of the asset-purchase Fund on 04/11/08.* *See also: http://europa.eu/rapid/press-release_MEMO-12-665_en.htm*
rating	Fitch ratings	Daily	*Main downgrades from Fitch ratings agency. Any change for Austria, Finland, and Netherlands. Positive expected sign.* *- France: negative outlook (16/12/11)* *- Belgium: negative outlook (23/05/11), but not the next negative outlook (16/12/11)* *- Greece: move to BBB+ (09/12/10), but not the negative watch (06/03/09) neither other downgrades* *- Ireland: move to BBB+ (09/11/10), but not the negative watch (06/03/09)* *- Italy: move to A+ with negative outlook (07/10/11)* *- Portuguese: move to BBB- (01/04/11), but not the negative outlook (03/09/09)* *- Spain: move to AA+ (28/05/10), recorded on June*

Annex 3. Data shared by all countries – Monthly average on 2008-2011

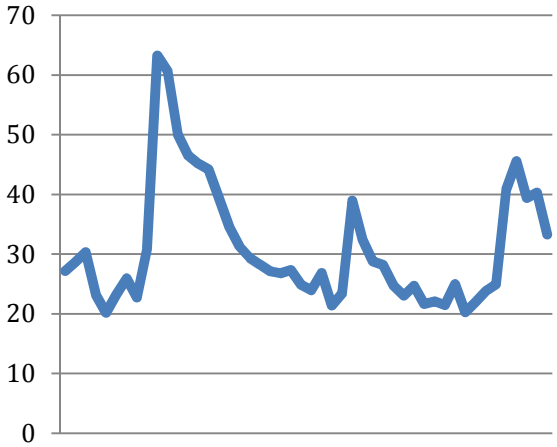
VIX



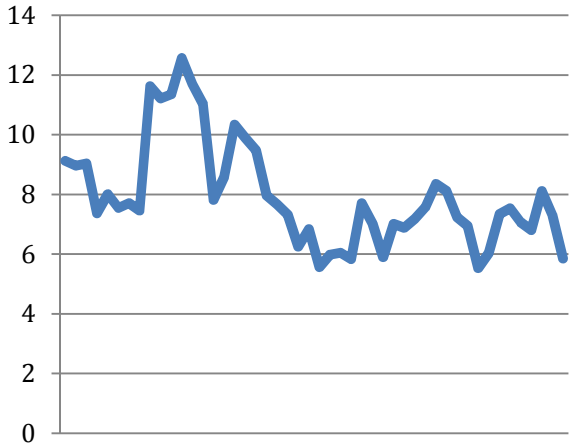
implied_volEurex



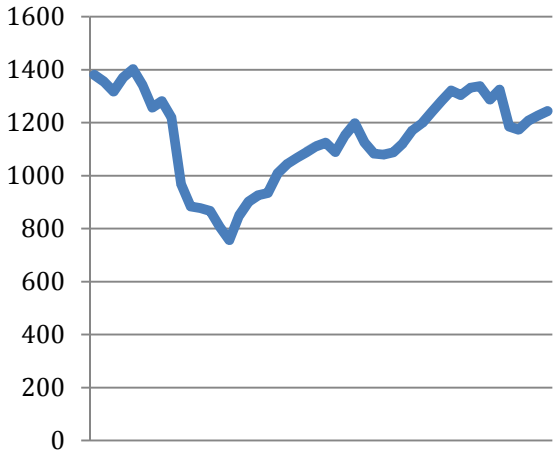
vstoxx



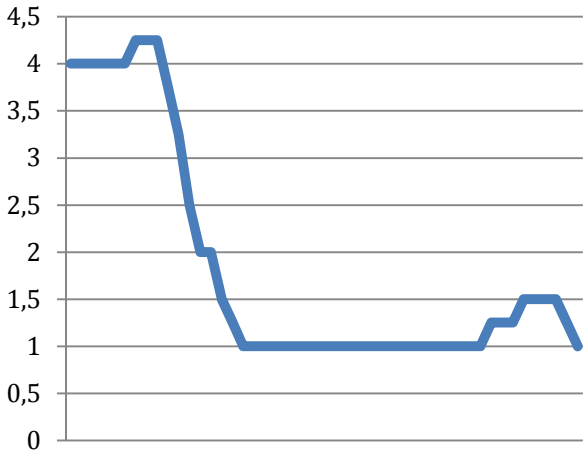
implied_volCBT



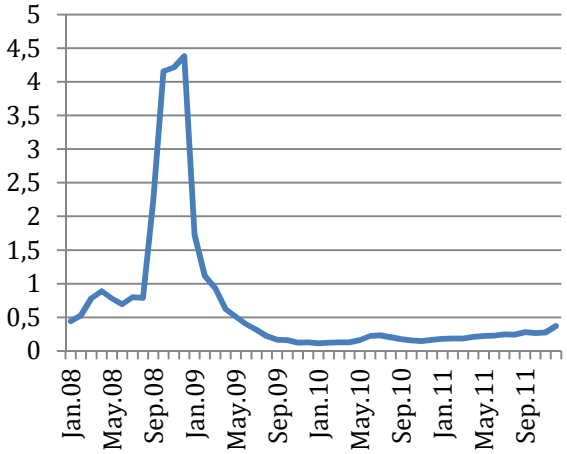
SP_500



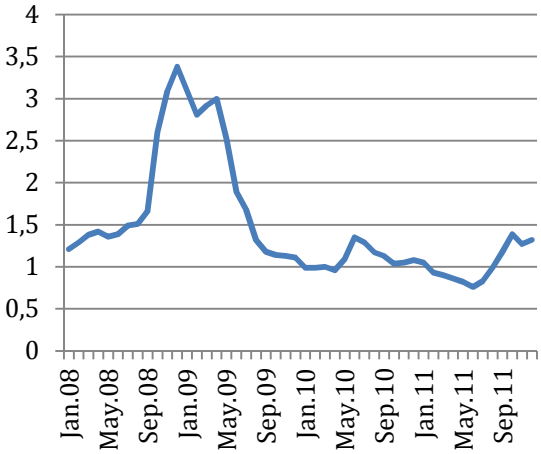
i_MRO



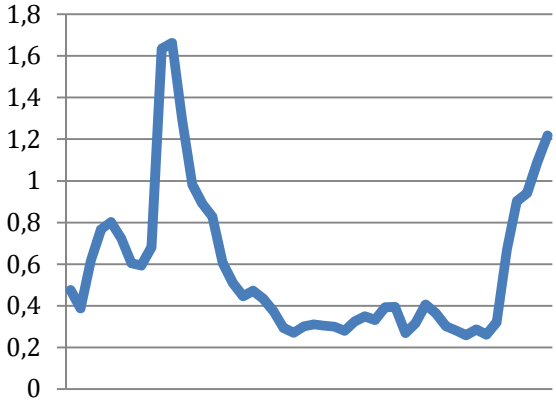
Spread A2/P2-AA



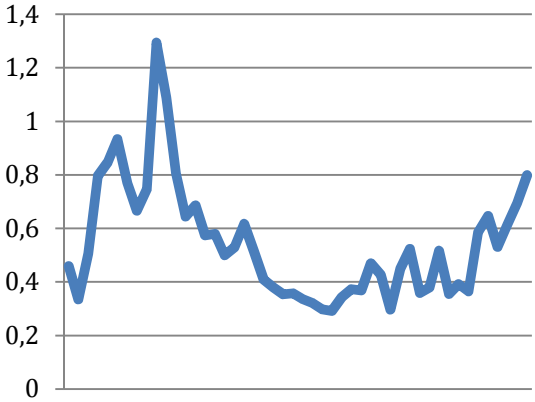
Spread corporate BAA-AAA



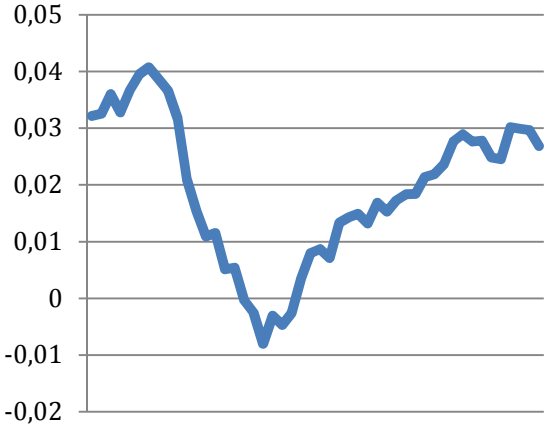
Euribor_Eurepo



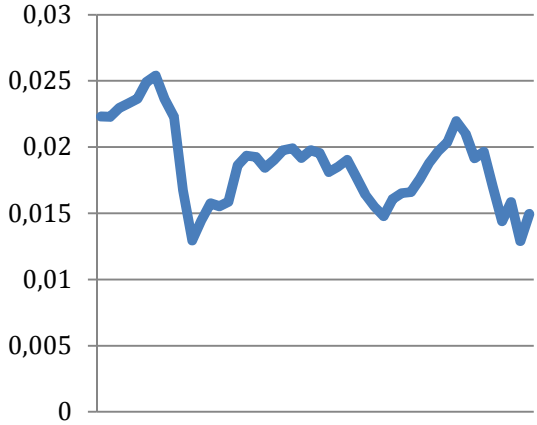
Euribor3_EONIA



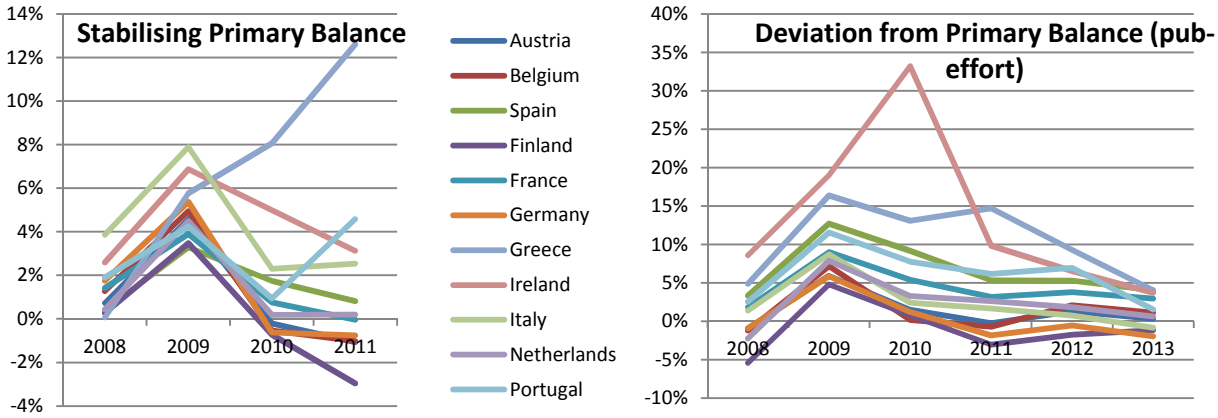
NGP_zone

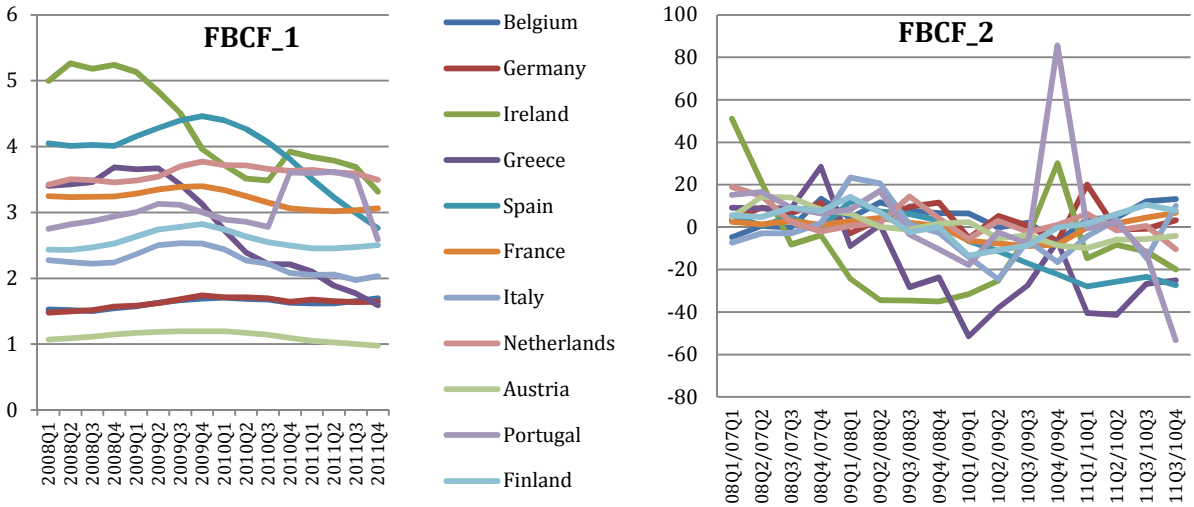


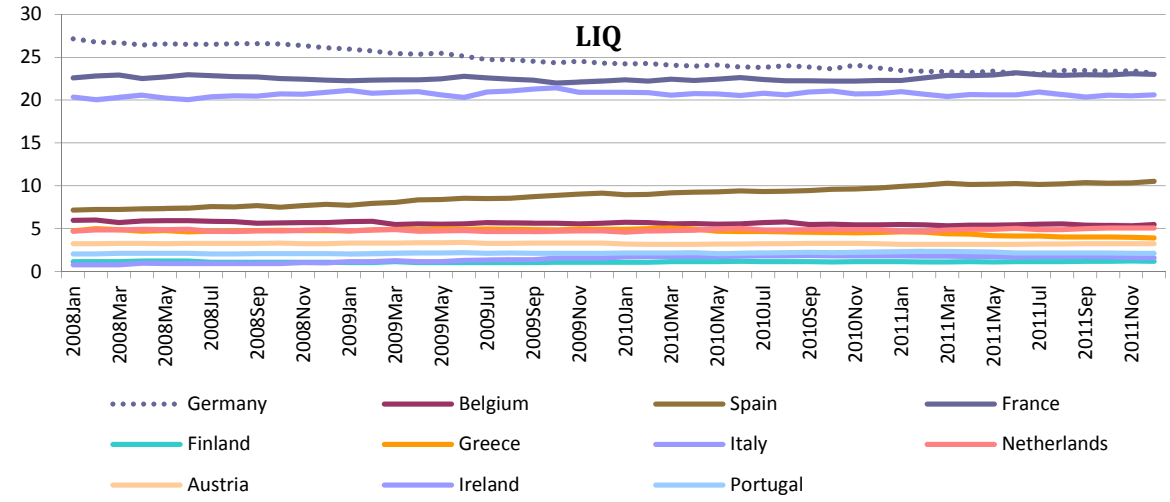
breakeven

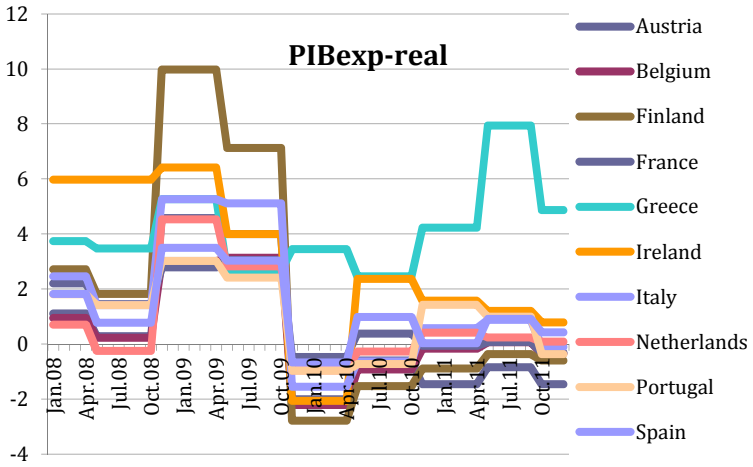


Annex 4. Country-related series (here not expressed by difference with Germany)








PIBexp-real
12
10
8
6
4
2
0
-2
-4
Jan.08
Apr.08
Jul.08
Oct.08
Jan.09
Apr.09
Jul.09
Oct.09
Jan.10
Apr.10
Jul.10
Oct.10
Jan.11
Apr.11
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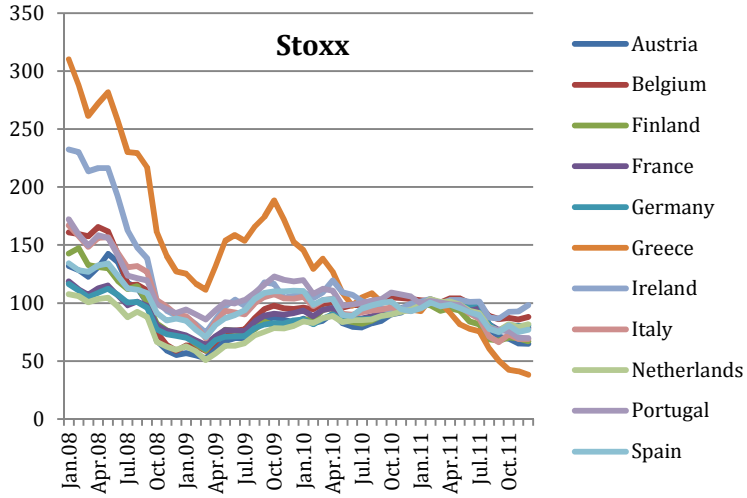
Austria
Belgium
Finland
France
Greece
Ireland
Italy
Netherlands
Portugal
Spain


Stoxx
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300
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100
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Jan.09
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Oct.10
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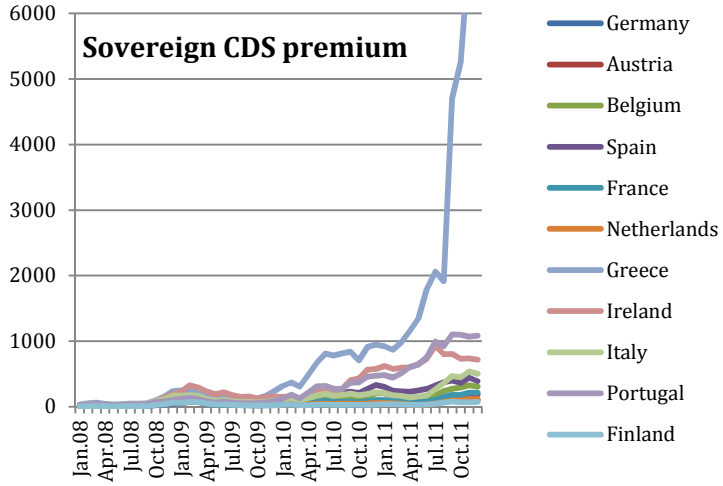
Germany
Greece
Ireland
Italy
Netherlands
Portugal
Spain


Sovereign CDS premium
6000
5000
4000
3000
2000
1000
0
Jan.08
Apr.08
Jul.08
Oct.08
Jan.09
Apr.09
Jul.09
Oct.09
Jan.10
Apr.10
Jul.10
Oct.10
Jan.11
Apr.11
Jul.11
Oct.11
Germany
Austria
Belgium
Spain
France
Netherlands
Greece
Ireland
Italy
Portugal
Finland

Annex 5. Development of the baseline model

Table 2. Global risk and economic performance

	1	2	3	4	5	6
CDS_**1**	0,45***	0,53***	0,53***	0,53***	0,51***	0,52***
	(0,04)	(0,03)	(0,03)	(0,03)	(0,04)	(0,04)
LIQ	11,49*	29,57***	33,82***	35,61***	22,27**	37,73**
	(6,78)	(10,44)	(9,85)	(11,63)	(9,00)	(15,15)
Stoxx	-3,15***					
	(0,59)					
SP500		0,02				
		(0,03)				
spreadBAA_AAA			12,40			
			(7,67)			
spreadNF_A2_P2				12,82***		
				(3,05)		
PIB					-13,96*	
					(8,34)	
PIBexp_real						9,77
						(6,44)
Constant	342,47***	563,54***	651,51***	692,02***	459,25***	722,98***
	(111,06)	(148,10)	(177,30)	(201,16)	(154,30)	(255,81)
R2	0,938	0,910	0,911	0,911	0,917	0,914

Fixed-effects regression (47 periods, 10 u. of cross-section, 470 obs., monthly; dependent variable: spread)
*Note: (standard error). *** Significant at 1%, ** Significant at 5%, * Significant at 10%.*

Table 3. Volatility and risk aversion

	1	2	3	4	5	6	7	8	9
CDS_1	0,45***	0,44***	0,44***	0,44***	0,53***	0,53***	0,52***	0,53***	
	(0,04)	(0,04)	(0,04)	(0,04)	(0,03)	(0,03)	(0,03)	(0,03)	
LIQ	11,52	9,82	13,17*	8,65	33,85***	35,17***	29,70***	36,93***	5,67
	(7,25)	(7,52)	(7,51)	(8,69)	(11,80)	(11,76)	(11,27)	(11,42)	(14,25)
stoxx	-3,15***	-3,22***	-2,98***	-3,22***					-7,50***
	(0,65)	(0,65)	(0,70)	(0,66)					(1,26)
SpreadNF_A 2_P2					0,59	3,61	-4,18	8,49***	
					(6,59)	(6,36)	(5,26)	(2,47)	
Vstoxx	0,01				1,47***				
	(0,64)				(0,56)				
VIX		-0,38				1,02**			
		(0,72)				(0,48)			
Eurex			8,61**				16,32***		19,67**
			(3,54)				(4,44)		(8,77)
CBT				-3,20				4,15	
				(5,03)				(2,67)	
Constant	342,71***	325,54***	308,14***	320,53***	624,83***	662,59***	488,09***	684,67***	237,35
	(111,91)	(112,98)	(107,05)	(117,90)	(207,32)	(209,24)	(184,57)	(203,72)	(233,23)
R2	0,938	0,938	0,940	0,938	0,912	0,912	0,916	0,911	0,693

Fixed-effects regression (models 1 to 8: 47 periods, 470 obs.; model 9: 48 periods, 480 obs.): 10 u. of cross-section, monthly; dependent variable: spread
*Note: (standard error). *** Significant at 1%, ** Significant at 5%, * Significant at 10%.*

Table 4. Structural break

	1	2	3	4	5
CDS_1	0,44*** (0,04)	0,40*** (0,01)	0,44*** (0,04)	0,43*** (0,03)	
LIQ	13,08* (7,18)	11,79** (4,58)	0,56 (8,39)	-1,27 (4,78)	5,03 (10,06)
stoxx	-2,87*** (0,69)	-1,75*** (0,19)	-2,91*** (0,63)	-2,19*** (0,62)	-4,62*** (0,65)
Eurex	8,84** (3,52)	8,23*** (2,67)	6,32 (3,93)	8,38*** (3,08)	16,96* (9,46)
EFSF	87,56* (51,07)				
EFSF_hyst		297,45*** (35,08)			528,88*** (55,00)
Common_break			50,47 (33,27)		
Piigs_break				151,17*** (49,50)	
Constant	302,08*** (102,57)	254,47*** (74,64)	86,71 (115,71)	22,09 (57,04)	164,11 (206,66)
R2	0,941	0,966	0,942	0,952	0,785

Fixed-effects regression (models 1 to 4: 47 periods, 470 obs.; model 5: 48 periods, 480 obs.): 10 u. of cross-section, monthly; dependent variable: spread
*Note: (standard error). *** Significant at 1%, ** Significant at 5%, * Significant at 10%.*