

NOVA SCHOOL OF BUSINESS AND ECONOMICS

The Sovereign CDS-Bond Basis

From a Crisis Perspective

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Title: The Sovereign CDS-Bond Basis. From a Crisis Perspective.

Abstract: This work studies the determinants of the sovereign CDS-bond basis distortions, in the Euro area, during the last crises period.

Regression analysis showed four relevant conclusions. Credit rating and credit outlook downgrades have a huge impact on the sovereign credit instruments premiums, although not originating arbitrage opportunities. Moreover, the ECB rate has a smoother effect on the sovereign debt markets' functioning and the risk-transfer balance between the state and the financial sector seems to have shifted from one crisis period to the other. Finally, markets' liquidity is the most powerful force in driving arbitrage opportunities in the sovereign debt market.

Keywords: Sovereign CDS-bond basis; Rating Downgrades; Financial Sector; Liquidity.

1. Introduction

The crisis started in the US with the collapse of the subprime mortgage market, in 2007. The uncertainty about the dimension and value of securities collateralized by those subprime mortgages spread uncertainty and banks stopped lending to each other. Lehman Brothers' bankruptcy, in September 2008, resulted in the seizing up of interbank lending, on panic that no bank was safe anymore. In early October, the results were spread to Europe and the Emerging countries and the world witnessed a large-scale state support for banks¹.

In the first half of 2010, Eurozone sovereign debt markets were under an unprecedented stress and, eventually, some of the peripheral economies started having difficulties to re-finance their debt. As a consequence, Greece (May, 2010), Ireland (November, 2011) and Portugal (April, 2011) had to receive help from the International Monetary Fund and the Eurozone members to avoid defaulting on their massive debt².

The traditional view of developed economies sovereign debt instruments as risk-free assets gave place to a major repricing and re-assessment of their risk. There was a flight to safety phenomenon which originated heterogenic changes in the liquidity of debt instruments' markets across countries, such as liquidity shortages in the case of Portugal, Ireland or Greece. Rating Agencies increased heavily their activity in the Euro area (51 credit rating downgrades since 2009)³. The ECB made use of its instruments and decreased its official rate from 4,25% in July, 2008 to 1% in May, 2009. In addition, it started the so-called Securities Market Programme, which comprises the institution's intervention in the sovereign bond markets, although limited to a weekly

¹ The states' fiscal deficit got back to values last seen after the World War II, also fostered by other economic stimulus that overloaded the public sector.

² A more complete narrative of the crises can be found in Appendix 1 at the Appendices section of this work.

³ Reductions on the credit quality of their debt make it more difficult and costly for countries to issue new debt, eroding even further their financial condition.

purchase amount of EUR 20bn, as buying individual countries' debt can be seen as state financing.

The purpose of this work is to study the sovereign debt markets during the recent period of financial and economic distress, through an analysis of the CDS-Bond basis' determinants. The basis is the difference between the spread of the CDS and the spread of its underlying bond and, as it should be zero in times of regular market conditions, it is a good provider of information regarding sovereign credit markets' functioning⁴.

Since the start of the subprime crisis, the sovereign basis of euro area countries have reached abnormal values, as it can be observed in Table 1, as well as in Graph 1⁵. It has either widened significantly, or became negative, as in the cases of Portugal, Ireland or Greece.

The sample period goes from March, 2007 to October, 2011 and comprises weekly observations on the 5 years CDS spreads and bond yields of 8 Euro area countries.

The first main result is that credit rating and credit outlook do not have a big impact on the basis. However, by analyzing separately the basis' components, one can conclude that those factors do cause a massive impact on the sovereign debt markets' functioning. Also, results allow suggesting that the risk-transfer relationship between the state and the banking sector has shifted in the later crisis. Moreover, they confirm the stabilizer role of the European Central Bank, whose key rates changes have a smoother effect in the basis.

Finally, there is evidence supporting what previous studies have mentioned regarding the crucial role of liquidity in setting up the odds in credit market's functioning.

⁴ Nonetheless, being a useful instrument to help making inferences on the debt market's health, it can also be a potential source of profit, when it acquires abnormal values as it has been happening during the crises.

⁵ Indeed, the average basis rose by 50 basis points from the pre-crisis to the post-crisis period. With the exception of Portugal, Ireland and Greece, where the basis became negative at some points in time, all the other countries experienced ever high positive values.

Section 2 provides a detailed explanation on the CDS-Bond basis and Section 3 gives an overview of what has been studied about the subject. Section 4 provides information on the data sample and test procedures. Section 5 comprises a detailed analysis of each factor used in the research, as well as its main results. Section 6 concludes the work.

2. The CDS-Bond Basis⁶

The basis is the difference between the spread of a CDS and the spread of a senior fixed-rate bond, for the same underlying issuer and with similar maturity.

CDS stands for Credit Default Swap and is essentially an over-the-counter insurance contract that offers protection against default of a specific reference entity⁷. The protection buyer makes periodic premium payments⁸ to the protection seller until maturity or until some credit event occurs⁹.

CDS spreads are directly observed in the market and, traditionally, yield spreads were calculated using a risk-free sovereign bond as benchmark, which in this case would be German bunds. However, besides the inconvenient of letting Germany outside the sample, in the literature is becoming widespread the conviction that swap rates (IRS) are the most adequate benchmark to compute this variable. It seems that government bonds are less than an ideal proxy for the unobservable risk-free rate due to different taxation treatment, repo specials and scarcity premiums. Moreover, the Euro-swap benchmark comes with the advantages of being highly liquid and carrying relatively lower

⁶ A detailed narrative on the subject is provided in Appendix 2 at the Appendices section of this work.

⁷ Reference Entity is essentially the party upon which the two counterparties in the transaction are speculating. The seller of the transaction is selling protection against the default of the reference entity. The buyer of the securitized credit derivative believes that there may be a chance that the reference entity will default upon their issued debt and is therefore entering the appropriate position. It can be a corporation, government or other legal entity that issues debt of any kind.

⁸ The premium paid by the protection buyer to the protection seller, called the “spread”, is quoted in basis points per annum of the contract’s notional value and is usually paid quarterly.

⁹ A recent document published by ISDA (International Swaps and Derivatives Association) on Greek Sovereign Debt (31-10-2011) refers as credit events the following: Failure to Pay Principal or the Coupon when they are due; Repudiation/Moratorium and Restructuring.

counterparty risk¹⁰. On the other hand, this method can slightly increase the basis, as IRS are normally higher than German yields (this relation can be observed in the Germany section of Graph 1). Notwithstanding, in this work the bond spread is calculated by subtracting the Euro-swap rate of the correspondent maturity from the sovereign par bond yield of each country.

Under free arbitrage conditions, the basis should be zero (Jan de Wit in 2006 and Fontana and Scheicher in 2010), as both sovereign bonds and CDS offer exposure to the same sovereign debt and thus, buying a bond or sell protection on it should carry the same risk. Historically, however, the basis has been slightly above zero, meaning that CDS spreads have consistently overcome bonds' spreads¹¹.

When the opportunity is exploitable and the basis is positive, the arbitrage strategy on this deviation would consist on short-selling the bond, underwriting CDS protection, while buying the risk-free rate¹². On the other hand, if the basis is negative, the strategy would be the opposite: buying the bond and protection against its default, financed at the risk-free rate¹³.

¹⁰ These arguments are supported by Beber, Brandt and Kavajecz (2009), McCauley (2002), Hull, Predescu, and White (2004) and Blanco, Brennan, and Marsh (2005).

¹¹ This evidence is justified by Fontana and Scheicher, who state that bonds are cash instruments and CDS are derivative contracts and, as a result, from a trader's perspective, those are not perfect substitutes. Bond prices are affected by interest rate risk, default risk, funding risk and market liquidity risk, while CDS are affected mainly by default risk and counterparty risk.

¹² Palladini and Portes (2011) explain that the rationale behind this trading has to do with the fact that if the credit quality on the reference entity improves (and the basis gets narrow) no reimbursement will occur, while the CDS seller profits from the stream of premiums payments.

¹³ In this case, the rationale is betting that the basis will increase, or that the credit quality of the reference entity will get worse. If a credit event occurs the buyer will receive the compensation, but, even if it doesn't get to the point of default, CDS owned by the buyer will have a higher value, as the probability of default of the reference entity has eroded. Thus, the investor can still sell it on the market for a profit, assuming that the market would have enough liquidity to absorb it.

3. Literature Review

This study is in line with the 2010's, Fontana and Scheicher, paper about the Euro area sovereign CDS market, which comprises an examination of the basis' determinants. They rely mainly on variables which proxy for investors' risk appetite and find a significant positive impact of the Itraxx Financials 5y CDS index and a significant negative impact coming from the Country's debt relative to GDP.

Moreover, Carboni and Carboni (2011) and Dieckmann and Plank (2011) state the importance of the financial system in this subject. Particularly, the financial sector condition has a strong explanatory power on the behavior of CDS spreads (influencing the basis), and the magnitude of that impact is related to what was the country's financial exposure before the crisis.

Palladini and Portes (2011), through their study on the price discovery relationship between the two basis' components of six Euro area countries, conclude that in the long run there is an equilibrium relationship between these two variables, which make them converge. However, in the short run, they find that cash and synthetic markets price credit risk differently to various degrees. This short term deviations persist longer than it would take for investors in one market to observe the price in the other, confirming the hypothesis of existent arbitrage opportunities in the relationship between the two instruments. Afterwards, through a VECM¹⁴ analysis and a Granger causality test¹⁵, they conclude that CDS market moves ahead of the bond market in terms of price discovery.

Previously, in 2006, Jan De Wit conducts a comprehensive analysis of the CDS-Bond Basis, which provides information regarding determinants that normally influence the basis, in a pure way (pre-crisis results). He mentions as drivers for a positive basis the

¹⁴ A Vector Error Correction Model can lead to a better understanding of the nature of any nonstationarity among the different component series and can also improve longer term forecasting over an unconstrained model.

¹⁵ Statistical Hypothesis test for determining whether one time series is useful in forecasting another.

CDS cheapest to deliver option¹⁶, bonds trading below par, the fact that CDS premiums are floored at zero and the difficulty in shorting cash-bonds; as for drivers of negative basis, he mentions counterparty default risk, which is more evident on a CDS contract, or bonds trading above par. Finally, he mentions as either influencing negatively or positively the basis, the relative liquidity in each segment market and coupon' specificities.

Picking up on the liquidity factor, during my research I also rely on Beber, Brandt and Kavajecz (2008) study on the flight-to-quality and flight-to-liquidity phenomenon. They state that investors do demand both credit quality and liquidity, but at different times and for different reasons. They explain that the size of sovereign yield spreads is explained by differences in credit quality. However, the destination of large flows into or out of the market is determined by liquidity and, in times of market stress, investors pursue liquidity, not credit quality.

Finally, Miles Weiss (December, 2011), a reporter at Bloomberg, writes about the riskiness associated with the credit swaps on European sovereign debt, mentioning two main sources of troubles: European leaders have been avoiding payout triggers, by preventing for instance the Greek bailout to be classified as a credit event (which would trigger a payout to CDS holders); and second, the strong possibility that banks, which wrote massive amounts in credit swaps on sovereign debt¹⁷, would not be able to meet their obligations if a country such as Greece would actually default.

The idea of this work is to add on the investigation about the determinants of the basis' deviations from the parity condition, by adding new explanatory factors and by leveraging on previously used factors and findings, which can help to interpret the present results.

¹⁶ In case of default of the reference entity the protection buyer is free to choose from a basket of eligible bonds.

¹⁷ Banking regulation defines sovereign credits as risk free, allowing banks to take sovereign-credit risk without having to set aside any capital.

4. Test Procedures

4.1. Data Set

This study examines the overall 5years Sovereign CDS-Bond basis' drivers of 8 Euro area countries: Portugal, Spain, France, Germany, Italy, Belgium, Austria and Greece¹⁸. The data¹⁹ was available at the Bloomberg terminal and comprise the period that goes from the 7th of March, 2007 to the 5th of October, 2011. Weekly data is used, more specifically, Wednesdays' values.

4.2. Methodology

The data sample comprises heterogeneities across periods and countries. Therefore, the work encloses separate panel regressions to deal with the first issue: period I (subprime crisis) goes from the 7th of March, 2007 to the 31st of December, 2008; period II (sovereign debt crisis) ranges between the 7th of January, 2009 and the 5th of October, 2011. To assess the second issue, there are separate regressions comprising either the whole group of countries, the bailed out countries separately from the remaining; or the southern European countries versus the central European ones. Moreover, to take a step further in understanding the factors' scope of impact, separate regressions using only the Bond Spread or the CDS Spread as dependent variables, were estimated.

Due to the presence of near multicollinearity²⁰ among explanatory variables, multiple regressions cannot be estimated²¹. Therefore, individual regressions of the form of (A), (B) or (C) are estimated for each explanatory variable. This way I intend to conclude, through the values of the r-squares and the sign and significance level of the

¹⁸ Countries like Ireland or the Netherlands had to be totally or partly left out of the analysis due to data availability constraints.

¹⁹ CDS spreads, bond yields, Euribor rates, Credit Rating news, Credit outlook news, ECB key rate, EURO STOXX Banks Index and the CDS and Bonds' BidAsk spreads.

²⁰ Non-negligible relationship between two or more explanatory variables, which causes distortions in the outcome of the regression.

²¹ A detailed explanation on this subject is provided in Appendix 3 at the Appendices section of this work.

coefficients, the magnitude of their impact on the dependent variable. The results are presented following a detailed explanation of each explanatory variable and the hypothesis lying behind its usage.

$$Basis_{it} = \alpha + \beta Explanatory\ variable_{it} + \varepsilon_i \text{ (A)},$$

$$Bond\ Spread_{it} = \alpha + \beta Explanatory\ variable_{it} + \varepsilon_i \text{ (B)}$$

$$CDS\ Spread_{it} = \alpha + \beta Explanatory\ variable_{it} + \varepsilon_i \text{ (C)}$$

Where “i” stands for country (some explanatory variables are the same for every country and therefore the “i” does not apply) and “t” stands for time. Basis is the difference between the CDS spread and the Bond spread of each country at a particular day (Wednesdays) and Explanatory variable is the representation of the explanatory variables used in this work.

5. Basis Determinants & Empirical Results

5.1. Credit Rating²²

There are three top credit rating agencies that predominantly influence investors' decisions and expectations regarding either companies' value or governments' credibility: Standard & Poor's, Moody's and Fitch²³.

The Eurozone countries' credit ratings had been predominantly stable until the beginning of the sovereign debt crisis, when some of the so-called peripheral countries started seeing their debt rating classification eroding. In the last 3 years, Standard & Poor's effectuated 19 credit rating changes, Moody's contributed with 17 and Fitch with 15, which totals 51 credit rating changes in the Euro area. The abundant and abnormally quick rating downgrades have been making more difficult and costly for countries to re-

²² According to Standard&Poor's, credit ratings are forward-looking opinions about credit risk. They express the agencies' opinions regarding the ability and willingness of an issuer, such as a corporation, a city government or a state, to meet its financial obligations in full and on time.

²³ Details about the three agencies and their rating classification scales are shown in Appendix 4 at the Appendices section of this work.

finance, which intensifies the problem, by eroding countries credibility even further. Moreover, Gande and Parsley (2003) found evidences of spillover effects, which mean that a rating change in one country has a significant effect on sovereign credit spreads of other countries.

Finally, by not sticking to only one of the three agencies' classifications²⁴, I am able to capture all the significant rating activity that has been going on in the markets.

Hypothesis 1.1: *It is expected that unforeseen ratings' downgrade activity has a significant, and negative, impact on sovereign credit markets functioning i.e. the basis.*

Hypothesis 1.2: *As Eurozone countries are related in so many dimensions, it is expected that the overall activity relative to the credit rating of a certain country does have a significant impact in the remaining Eurozone countries under analysis.*

I estimated the baseline regressions (A), (B) and (C) using each of the three agencies credit rating history. Those agencies attribute classification to the credit quality of sovereign debt instruments through an alphabetical scale, which vary from agency to agency. In order to make that scale regression-friendly I converted it into a numerical one, as Ferreira and Gama (2007) do and as is expressed in Table 2. This numerical coding goes from 0 to 20, where 20 represent the maximum classification (AAA in the case of Standard & Poor's and Fitch, and Aaa in the case of Moody's).

The results show that credit rating changes do not have a big impact on the basis – the r-squares of these regressions never go beyond 3%, as can be seen in Table 3. However, the credit rating changes do have a massive impact on the sovereign debt instruments. When looking separately at the spreads (Tables 4 and 5), it becomes clear the impact of this variable in the premiums: the r-squares range between 50 and 85% and the coefficients are significant and negative. Moreover, both the coefficients and the r-squares acquire very high values in period II (i.e. S&P coefficient goes from -6 in

²⁴ Ferreira and Gama (2006) and Gande and Parsley (2003) focus only on Standard & Poor's announcements.

period I to -70 in period II, when the bond spread is the dependent variable), which means that the higher the downgrade activity, the higher the impact in the premiums.

As bond and CDS spreads' move together (coefficients are very similar), the impact of this factor cannot be perceived by examining the basis alone²⁵.

Arbitrage opportunities may surge when the impact on the CDS spread is significantly higher than the impact on the bond spread. This seems to be happening in Portugal and Greece, during period II. Table 6 shows that the basis does suffer a higher impact from credit rating reductions in this particular case (R-squares between 8 and 21%, and coefficients ranging between -13 and -22).

Results seem to refute hypothesis 1.2: Other countries rating changes appear to not have a significant effect in the basis neither on the spreads. Instead of using the own country numerical scale, I estimated regression (A) using the sum of all rating changes (numerical scale) at every given week, with exception of the country itself.

5.2.Credit Outlook

Other instrument that Rating Agencies often use is the credit outlook²⁶. It provides investors with information on the potential evolution of a rating; hence, it increases its precision²⁷.

***Hypothesis 2:** Following the same rationale as for credit rating announcements, it is expected that credit outlooks originate a significant impact on the CDS-bond basis misalignment (negative outlooks will widen the basis), both in the country and on the other countries' basis.*

²⁵ A detailed analysis on the rating change days is presented in Appendix 5 at the Appendices section of this work.

²⁶ According to the Financial Times Lexicon a credit or rating outlook indicates the potential direction of a rating over the intermediate term, typically six months to two years.

²⁷ Gande and Parsley (2003) in their work regarding News Spillovers in the Sovereign Debt Market and Ferreira and Gama (2006) through their study about the sovereign debt rating news spillover to international stock markets, recall the importance of not missing the information embedded in credit outlooks.

Similarly to what have been done with the ratings' scale, I also used numerical coding to represent credit outlook news releases²⁸. As the goal is to capture the overall credit outlook activity, I did not differentiate between the originators of the news (i.e. agencies); their outcomes are considered together as an explanatory variable for the CDS-bond basis behavior. I estimated this impact through regression (A), (B) and (C). In addition, as there are no credit outlook releases during period I, the analysis relies only on period II data.

Similarly to the credit rating announcements, credit outlook changes have a significant and negative impact on the CDS and bond spreads, as observable in Tables 4 and 5 (r-squares of 60 and 69%), although this effect is hidden when looking solely at the basis (the coefficient is not significant).

The main difference relies on the effect of other Eurozone countries credit outlook changes, which is significant and negative, although not having a powerful explanatory capacity (r-square of 4%, as shown in table 5), which suggests that the surprise effect embedded in a credit outlook change is higher.

5.3.Liquidity²⁹

Even though we have been living times of global financial markets integration, blurring of frontiers, and witnessing an increasing number of arbitrageurs who are technically able to exploit price discrepancies, the crises have been causing significant disruptions in markets' liquidity (materialized in flight to safe German bunds or sell-off of peripheral countries debt, for instance), which have been inducing significant changes in the debt instruments' premiums.

²⁸ For instance, to a negative outlook announcement is associated -1, to a positive announcement, 1, to a positive credit watch 0,5 and to a negative credit watch -0,5 (the numbers change in the day of the announcement and thereafter assume that new value).

²⁹ Jan De Wit (2006), Fontana and Scheicher (2010), Tang and Yan (2007) and Beber, Brandt and Kavajecz (2008), among several other authors, mention the importance of relative markets' liquidity in the definition of the overall basis value and in the CDS spread in particular.

Hypothesis 3.1: *It is expected that diminished activity in the CDS and bond markets i.e. lower liquidity, to cause an increase in both the CDS and the bond spreads.*

Hypothesis 3.2: *It is expected that uncertainty and fear inherent to a crisis to induce higher disruptions in the CDS market than in the bonds', causing an impact in the basis explained by liquidity changes³⁰.*

As a proxy for the instrument's liquidity, which I used as explanatory variable in regressions (A), (B) and (C), I am using their bid-ask spreads. These spreads are the difference in price between the highest price that a buyer is willing to pay for an asset and the lowest price for which a seller is willing to sell it³¹. The higher the bid-ask spread, the lower the liquidity in the market and the higher the risk premium³².

The results show 2 main findings that support the above hypotheses: first, the coefficients and the r-squares for both the explanatory variables in both periods are higher when the CDS spread is the dependent variable, instead of the bond's spread³³ (this can be observed in Tables 4 and 5), justifying the positive and powerful effect on the basis that can be observed in Table 3; second, it is clear, particularly during period II, that the impact of liquidity is much higher in the Southern countries' basis (as can be seen in Table 7, the r-squares range from 28 to 51%, against 1% for the Central European countries), which goes in harmony with the fact that those countries were much more affected by loose of credibility and liquidity shortages during the sovereign debt crisis.

³⁰ While bonds are perceived as safer assets and its markets are regulated and transparent, CDS are credit instruments, traded over-the-counter and thus, its markets lack transparency.

³¹ It is usually assessed by subtracting the bid price from the ask price. However, for the CDS bid-ask spread I made the opposite calculus in order to obtain positive values.

³² The more buyers and sellers are competing in the market, the lower the premium will be, as few market makers will be able to get away with wider than normal spreads since traders can easily find a better bid (or offer) elsewhere.

³³ Period I: Bond spread coefficients are 738, for bond bid-ask, and 2,90 for CDS bid-ask; CDS spread coefficient are 1346 and 7,34; the r-squares are around 8% for the bond spread and 16 or 37% for the CDS spread. Period II: Bond spread coefficients are 1055 and 8,91; CDS spread's are 1253 and 12; the R-squares are around 52 and 67% for the bond spread and 78 or 80% for the CDS'.

5.4. Banking Sector

As Sgherri and Zola (2009) argued, the fiscal interventions on the banking sector that followed the widespread of the Subprime crisis from the US to the rest of the world were critical to prevent a further collapse of the Eurozone financial sector. However, they also brought a significant deterioration to the Eurozone budgets' positioning, as governments' debt burden came under a huge pressure. In addition, Dieckmann and Plank (2011), found evidence that supports a private-to-public risk transfer related to countries exposures to financial system during the recent economic crisis; their results shown that it led to a significant co-movement between the price of insurance against default and the performance of the financial sector. Furthermore, they found that different monetary authorities do have an impact and that countries using the Euro are more sensitive to the health of the financial system³⁴.

***Hypothesis 4:** There is a strong hint that the banking sector is strongly linked to the distortions on the sovereign markets functioning, particularly on the Credit Default Swap market. Moreover, it is expected a stronger impact of the banking sector during the first period (if in period I banks are causing disruptions in the public debt sector, in period II those disruptions have already been incorporated and it is most probably the opposite relation that is taking place).*

As a proxy for the European financial system I use the EURO STOXX Banks (Price) Index³⁵ (Graph 2) and introduce it in the baseline regressions (A), (B) and (C).

The results in Tables 3, 4 and 5 support Hypothesis 4. First of all, the coefficients are significant and negative, evidencing the impact that an eroding financial system has in

³⁴ Inflexibility in the monetary policy and inability to print domestic currency may affect a country's default probability. For this reason, Dieckmann and Plank believe that Eurozone CDS spreads may have exhibited more sensitivity to the health of financial system than their non-Eurozone counterparts.

³⁵ It is a capitalization-weighted index which includes countries that are participating in the European Monetary Union that are involved in the banking sector. The parent index is SXXE. The index was developed with a base value of 100 as of December 31, 1991.

widening the basis. Second, CDS spreads suffer a higher impact and the effect is stronger in period I (76% r-squared against 6% in period II).

Alter and Schuler (2011) found that after the states' support program implementation the sensitivity of banks' CDS premiums towards sovereign CDS spreads has increased significantly (before the implementation the impact was almost null, with the exception of Portugal and Italy). Knowing that Euro area sovereign debt has been under a tremendous pressure, and allied with the above mentioned evidence of much lower impact of the financial sector in the sovereign basis during period II, there is room to suggest that the risk-transfer relationship has shifted: nowadays, there is probably a contagion from the government to the financial sector (for example, we have been observing that the recent sovereign credit rating downgrades have been culminating in downgrades for the major part of the domestic banking sector).

5.5. ECB Key Rate

The European Central Bank assumes responsibility for monetary policy decision-making in the euro area since 1999 and its primary objective is to maintain price stability. Among the instruments that it uses to accomplish its goal, there is the official interest rate³⁶. Since the beginning of the global crisis, the ECB has been very active in reducing its key rate (it went from 4,25% in July 2008 to 1% in May 2009, through progressive rate reductions).

***Hypothesis 5.1:** If the European Central Bank has mainly a stabilizer role, then a rate change should mean a decrease in the basis (smoother effect).*

³⁶ A change in this rate directly affects money-market interest rates and indirectly banks (lending and deposit rates). It also affects expectations regarding future interest rates and inflation - the goal is to anchor firmly expectations of price stability. In addition, it influences asset prices and exchange rates, saving and investment decisions, the supply of credit and the supply of bank loans (Source: European Central Bank).

Available in the Bloomberg terminal, there is the historical evolution of the ECB's official interest rate (it can be observed in Graph 3) which was used as explanatory variable in regression (A).

The stabilizer impact of the ECB can be observed by looking at results in Table 3 and Graph 3 at the same time: During period I, when the ECB was still increasing or maintaining its official rates, the coefficient has a significant negative sign (-27), which means that as the rate was increasing the basis was getting narrower. During period II, the coefficient is significant and positive (54) at the same time that the ECB official rate had been cut for several times, meaning that it was inducing a basis reduction.

Moreover, as during the sovereign debt crisis (period II) other relevant factors, such as liquidity constraints, flight to safety or risk-free perception changes, surged stronger in investors' decision matrix, the impact of the ECB rate became lower (the r-square for the basis goes from 14% to 2,19%).

6. Conclusions

The recent crises of the developed world led to massive repricing and risk reassessments of sovereign credit instruments. This work approaches the subject by studying the determinants of the Sovereign CDS-Bond basis' distortions of 8 Euro area countries during that period.

The first main finding shows that credit rating agencies do have a massive impact on the sovereign debt instruments premiums. The recent abnormal downgrades' activity in the Euro area is powerful in explaining the sovereign CDS and bond spreads of the region. Although, as the spreads move together, the ultimate impact of credit rating and credit outlook changes on the basis is low.

Second, results confirmed the stabilization role of the European Central Bank, as its official rate changes proved to be partly explaining reductions in the basis. However, its limitations were also shown, as during the sovereign debt crisis its impact has lowered significantly. In fact, it has not been able to prevent countries insolvency, or investors' abnormal risk aversion towards the peripherals' debt instruments, which caused ever low prices on those.

The work also supports previous studies statements on the major role of markets' liquidity in causing disruptions in arbitrage-free relationships. The r-squares of the regressions which have the CDS and bonds' bid-ask spreads as explanatory variables, are the highest of all the regressions estimated in this work.

Finally, it seems that the risk transfer relationship between the states and the financial sector has shifted from one crisis period to the other. While in period I the financial system tension caused huge pressures on states' financial burden, during period II the opposite relation appears to be taking place. However, further analysis on the banks' basis behavior would clarify this thesis.

7. Tables and Charts

Table 1: Descriptive statistics of the basis

The sample sub-periods go from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The basis is defined as CDS spread minus bond spread (relative to the 5y swap rate). All statistics are in basis points. Coefficients marked *** are significant at 1 %, ** are significant at 5 % and * are significant at 10 %.

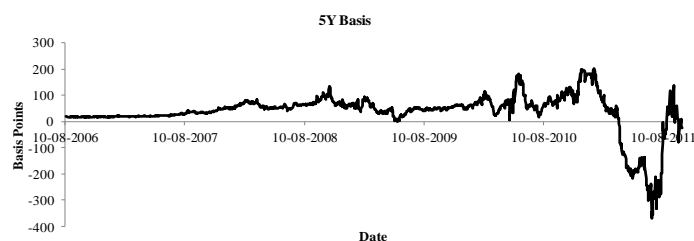
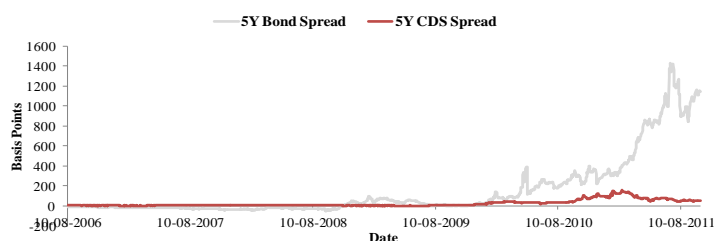
2007-2008	Average	Standard Deviation	Maximum	Minimum
Portugal	21,66	9,48	54,98	-3,02
Spain	22,97	8,85	59,51	7,38
France	21,27	7,46	59,85	3,62
Germany	23,25	9,01	62,68	-6,41
Italy	20,55	6,88	49,56	4,57
Belgium	20,81	7,12	49,40	6,77
Austria	26,56	7,80	51,40	17,41
Greece	24,10	8,30	44,60	13,44

2009-2011	Average	Standard Deviation	Maximum	Minimum
Portugal	40,51	88,81	202,77	-370,22
Spain	87,82	23,85	174,32	45,15
France	81,34	37,25	218,96	29,05
Germany	88,30	30,72	207,56	42,19
Italy	81,40	31,52	224,84	23,59
Belgium	65,25	36,12	181,73	-19,65
Austria	83,21	33,75	223,73	35,76
Greece	61,27	207,99	2711,30	-275,36

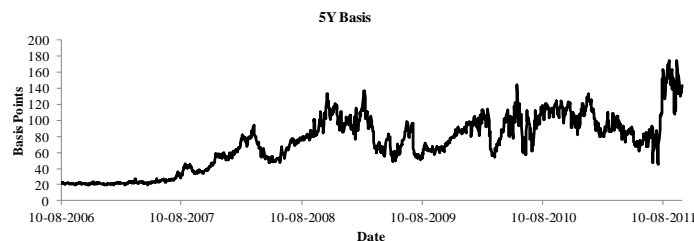
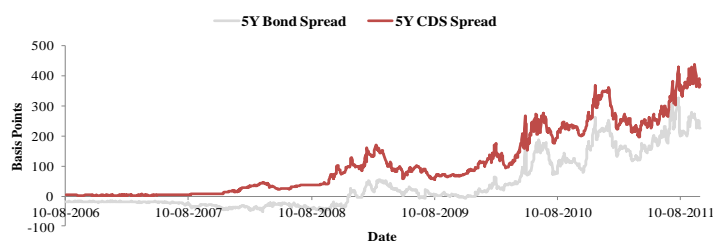
Graph 1: 5y Bond spread, 5y CDS spread and 5y Basis, by country

The data goes from August, 2006 to October, 2011.

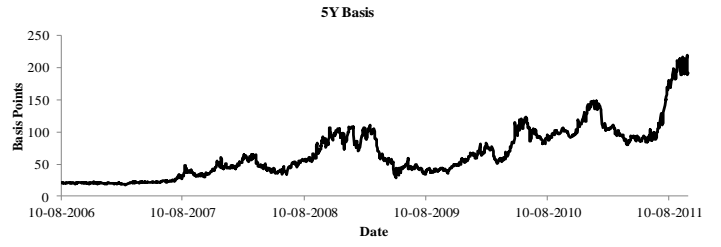
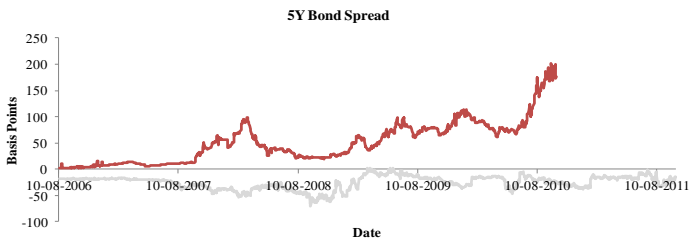
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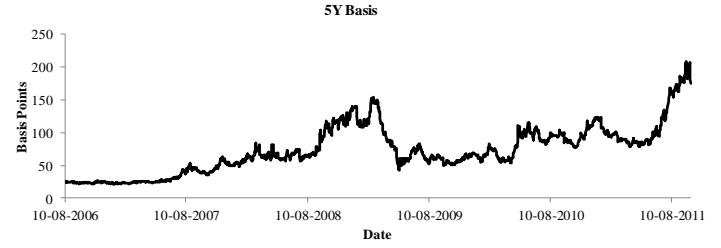
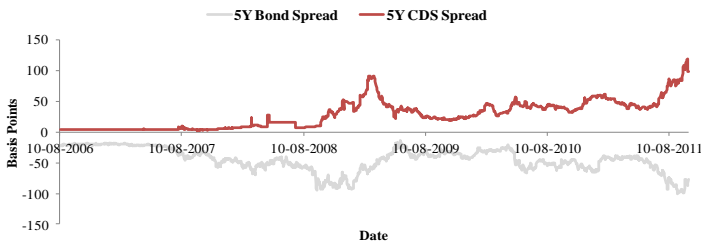
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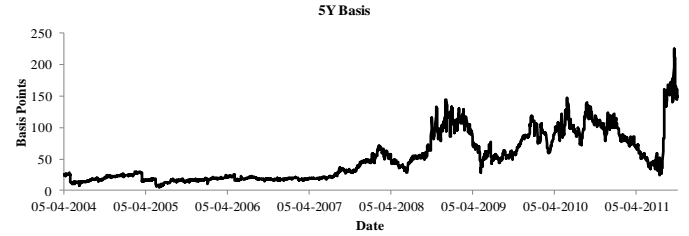
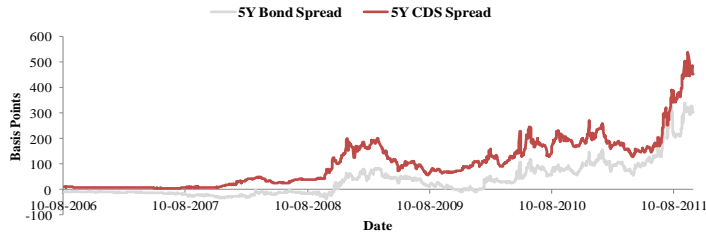
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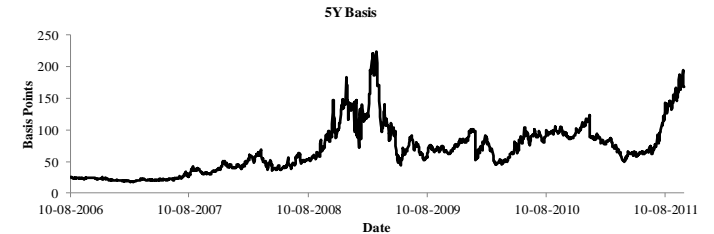
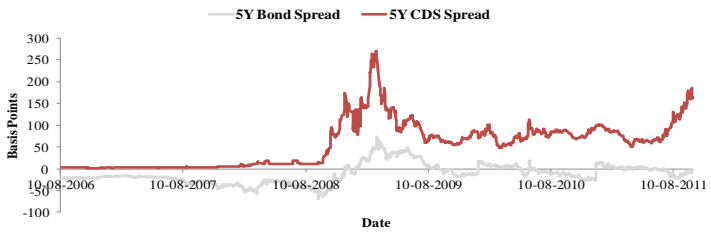
Germany



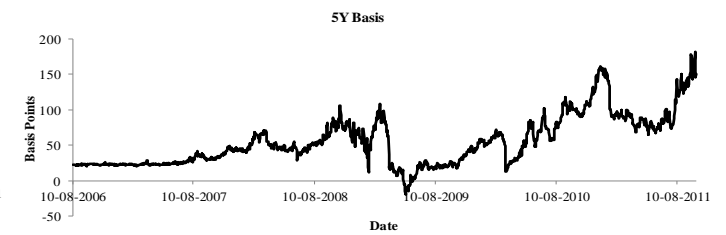
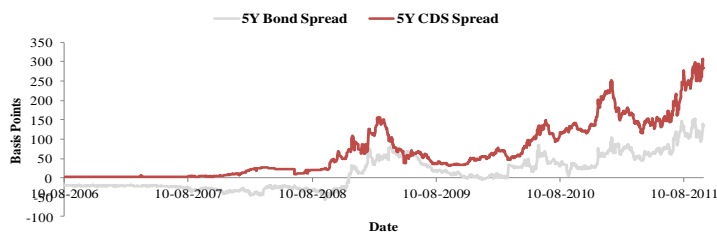
Italy



Austria



Belgium



Greece

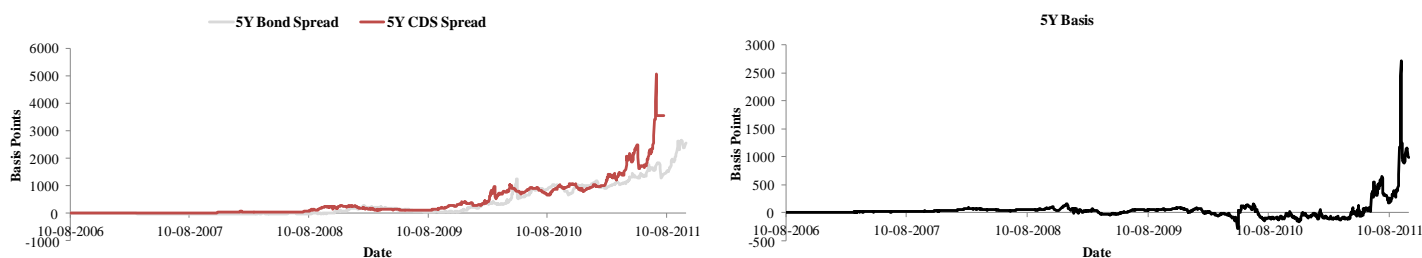


Table 2: Conversion of Rating Classifications into a Numerical Code, per Agency

Numerical Scale	S&P	Fitch	Moody's
20	AAA	AAA	Aaa
19	AA+	AA+	Aa1
18	AA	AA	Aa2
17	AA-	AA-	Aa3
16	A+	A+	A1
15	A	A	A2
14	A-	A-	A3
13	BBB+	BBB+	Baa1
12	BBB	BBB	Baa2
11	BBB-	BBB-	Baa3
10	BB+	BB+	Ba1
9	BB	BB	Ba2
8	BB-	BB-	Ba3
7	B+	B+	B1
6	B	B	B2
5	B-	B-	B3
4	CCC+	CCC	Caa1
3	CCC		Caa2
2	CCC-		Caa3
1	CC		Caa1
1	C		Ca
0	SD/D	DDD	C
		DD	C
		D	C

Table 3: Descriptive statistics of panel regressions - Basis

The sample sub-periods go from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The dependent variable is the group of the 8 countries' basis.

The basis is defined as CDS spread minus bond spread (relative to the 5y swap rate). All statistics are in basis points.

Period I	Coefficient	T-stat	R-squared	Period II	Coefficient	T-stat	R-squared
S&P Rating	1,21	2,54***	0,84%	S&P Rating	-5,05	-5,67***	2,72%
Fitch Rating	1,57	2,77***	0,99%	Fitch Rating	-2,08	-2,06**	0,37%
Moody's Rating	2,30	3,33***	1,43%	Moody's Rating	-2,45	-2,49***	0,54%
Bond Bid_Ask	624,70	7,03***	6,06%	Bond Bid_Ask	197,33	18,95***	23,81%
CDS Bid_Ask	4,62	-24,81***	44,6%	CDS Bid_Ask	2,65	-31,25***	45,92%
ECB Key Rate	-27,11	-10,99***	13,63%	ECB Key Rate	53,56	5,07***	2,19%
SX7E Index	-0,23	-48,97***	75,79%	SX7E Index	-0,78	-8,68***	6,15%
				Other Countries Rating	0,59	0,30	0,01%
				Other Countries Credit Outlook	-3,25	-6,61***	3,66%
				Own Country Credit Outlook	-2,02	-1,19	0,12%

Table 4: Descriptive statistics of Panel Regressions - Bond Spreads

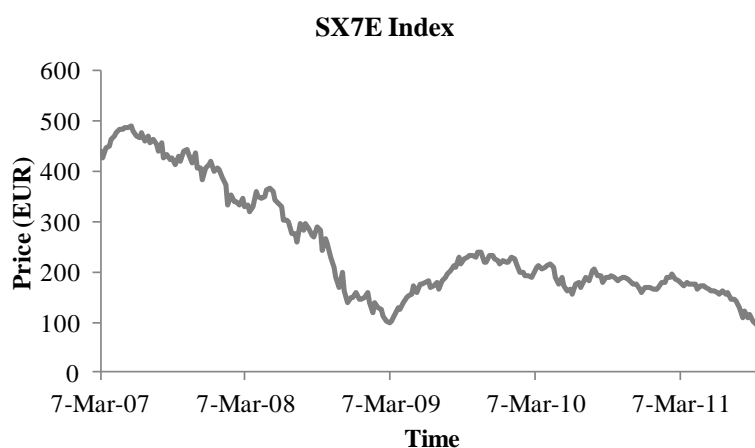
The sample sub-periods go from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The dependent variables are the 8 countries bond spreads (relative to the 5y swap rate).

Period I	Coefficient	T-stat	R-squared	Period II	Coefficient	T-stat	R-squared
S&P Rating	-6,28	-15,04***	22,81%	S&P Rating	-69,93	-35,21***	51,87%
Fitch Rating	-7,85	-15,96***	24,95%	Fitch Rating	-99,44	-76,46***	83,56%
Moody's Rating	-9,53	-15,91***	24,95%	Moody's Rating	-100,67	-102,75***	83,56%
Bond Bid_Ask	738,44	8,46***	8,55%	Bond Bid_Ask	1055,77	49,15***	67,75%
CDS Bid_Ask	2,90	12,83***	17,7%	CDS Bid_Ask	8,96	35,43***	52,19%
ECB Key Rate	-33,03	-14,02***	20,43%	ECB Key Rate	88,24	2,61***	0,59%
SX7E Index	-0,04	-4,38***	2,45%	SX7E Index	-2,20	-7,64***	4,84%
				Other Countries Rating	-7,48	-1,18***	0,12%
				Other Countries Credit Outlook	-7,00	-4,44***	1,69%
				Own Country Credit Outlook	-151,75	-50,54***	68,96%

Table 5: Descriptive statistics of Panel Regressions - CDS Spreads

The sample sub-periods go from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The dependent variables are the 8 countries CDS spreads.

Period I	Coefficient	T-stat	R-squared	Period II	Coefficient	T-stat	R-squared
S&P Rating	-5,37	-8,93***	9,42%	S&P Rating	-74,99	-33,92***	50,01%
Fitch Rating	-6,60	-9,20***	9,94%	Fitch Rating	-101,52	-55,81***	73,03%
Moody's Rating	-7,35	-8,35***	9,94%	Moody's Rating	-103,11	-66,44***	73,03%
Bond Bid_Ask	1346,29	12,10***	16,05%	Bond Bid_Ask	1253,10	67,88***	80,03%
CDS Bid_Ask	7,34	36,95***	64,05%	CDS Bid_Ask	11,52	56,44***	78,48%
ECB Key Rate	-58,80	-21,01***	36,56%	ECB Key Rate	141,80	3,86***	1,28%
SX7E Index	-0,26	-31,09***	55,79%	SX7E Index	-2,98	-9,62***	7,45%
				Other Countries Rating	-6,89	-1,00	0,09%
				Other Countries Credit Outlook	-10,25	-6,00***	3,04%
				Own Country Credit Outlook	-153,77	-40,99***	59,37%

Graph 2: Banking Sector Proxy (SX7E Index)

Graph 3: European Central Bank Official Rate

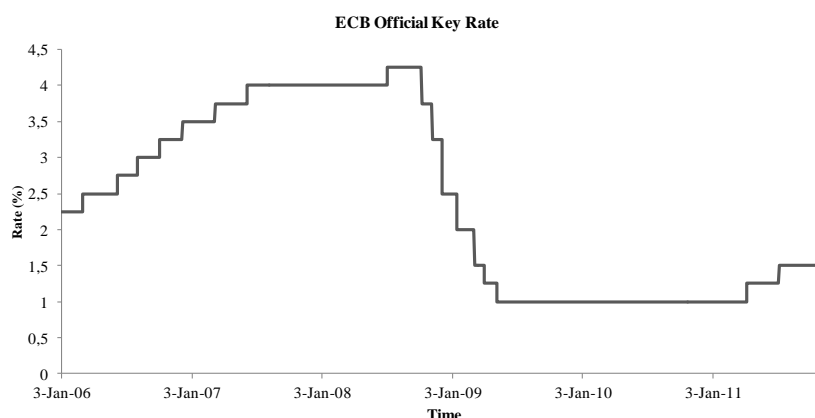


Table 6: Descriptive statistics of panel regressions (Portugal, Greece Vs. Others)

The sample sub-periods are from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The dependent variables are Portuguese and Greek basis on one side and the remaining countries' on the other. The basis is defined as CDS spread minus bond spread (relative to the 5y swap rate). All statistics are in basis points.

S&P Rating					ECB Key Rate				
	PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)		PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)
Beta	-1,76	1,43	-22,02	-0,29	Beta	-9,14	-33,10	98,50	38,57
R ²	0,42%	0,60%	21,56%	0,01%	R ²	1,96%	19,13%	2,05%	11,34%
T-stat	-0,90	1,86*	-8,87***	-0,35	T-stat	-1,95*	-11,65***	2,45***	10,50***
Fitch Rating					SX7E Index				
	PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)		PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)
Beta	1,70	1,37	-14,93	1,16	Beta	-0,19	-0,24	-1,42	-0,57
R ²	1,19%	0,29%	8,31%	0,13%	R ²	64,39%	80,15%	5,63%	32,47%
T-stat	1,52*	1,30*	-5,09***	1,05	T-stat	-18,53***	-48,18*	-4,13***	-20,36***
Moody's Rating					Other Countries Rating				
	PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)		PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)
Beta	2,55	3,61	-13,55	1,14	Beta			9,77	-0,40
R ²	1,19%	1,04%	8,17%	0,07%	R ²			0,36%	0,04%
T-stat	1,52*	2,46***	-5,04***	0,79	T-stat			1,01	-0,58
Bond Bid_Ask					Other Countries Credit Outlook				
	PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)		PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)
Beta	1258,19	516,14	254,84	264,30	Beta			-6,13	-2,30
R ²	18,52%	4,42%	37,80%	2,15%	R ²			1,97%	19,98%
T-stat	6,57***	5,15***	13,18***	4,35***	T-stat			-2,40***	-14,67***
CDS Bid_Ask					Own Country Credit Outlook				
	PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)		PT+GREECE (07-08)	OTHERS (07-08)	PT+GREECE (09-11)	OTHERS (09-11)
Beta	2,73	5,82	3,09	1,86	Beta			-18,65	-8,80
R ²	29,52%	55,11%	62,71%	2,81%	R ²			4,35%	4,04%
T-stat	8,92***	25,55***	21,93***	4,99***	T-stat			-3,61***	-6,03***

Table 7: Descriptive statistics of panel regressions (Southern Vs. Central countries)

The sample sub-periods are from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II). The dependent variables are Portuguese, Greek, Spanish and Italian basis on one side and the remaining countries' on the other. The basis is defined as CDS spread minus bond spread (relative to the 5y swap rate). All statistics are in basis points.

S&P Rating					ECB Key Rate				
	PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)		PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)
Beta	1,99	8,06	-11,40	21,22	Beta	-21,19	-33,03	60,03	47,08
R²	2,11%	1,75%	8,57%	6,03%	R²	8,45%	19,95%	1,47%	14,52%
T-stat	2,87***	2,61***	-7,34***	6,07***	T-stat	-5,94***	-9,76***	2,92***	9,87***
Fitch Rating					SX7E Index				
	PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)		PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)
Beta	2,93	8,06	-5,91	21,22	Beta	-0,23	-0,23	-0,88	-0,69
R²	2,78%	1,75%	2,00%	6,03%	R²	73,71%	77,90%	4,15%	40,46%
T-stat	3,30***	2,61***	-3,43***	6,07***	T-stat	-32,73***	-36,67***	-4,98***	-19,75***
Moody's Rating					Other Countries Rating				
	PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)		PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)
Beta	3,26	8,06	-5,33	21,22	Beta			4,13	-1,76
R²	3,15%	1,75%	1,96%	6,03%	R²			0,17%	0,66%
T-stat	3,52***	2,61***	-3,39***	6,07***	T-stat			0,99	-1,95**
Bond Bid_Ask					Other Countries Credit Outlook				
	PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)		PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)
Beta	1062,59	501,38	214,10	236,30	Beta			-3,75	-2,69
R²	8,37%	5,80%	28,38%	1,39%	R²			2,13%	24,48%
T-stat	5,91***	4,85***	15,08***	2,85***	T-stat			-3,53***	-13,64***
CDS Bid_Ask					Own Country Credit Outlook				
	PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)		PIGS (07-08)	CENTRAL'S (07-08)	PIGS (09-11)	CENTRAL'S (09-11)
Beta	3,91	5,69	2,79	1,47	Beta			-5,77	-14,65
R²	39,14%	53,37%	52,11%	1,23%	R²			0,73%	2,56%
T-stat	15,55***	20,91***	25,12***	2,67***	T-stat			-2,05**	-3,88***

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APPENDICES

The Sovereign CDS-Bond Basis

From a Crisis Perspective

Sara Maria Vinhas Maia Pereira (331)

6th of January, 2012

Appendix 1 -The Crisis, Macro View

The 2007-2008 crisis started in the US with the collapse of the subprime mortgage market in early 2007, at the same time that the real estate bubble, that had been around for the previous two years, went bust. Both subprime lending and one-way-only house prices were a consequence of a prolonged period of low interest rates and major relaxations on bank's lending standards. If the first made the credit market seem more accessible and attractive, the second allowed that indeed it became accessible to everyone, even to those who under normal risk standards would not be eligible to contract a loan. In the end, the belief that housing prices could only go one way, and that way was up, supported all that easiness in lending – in case of default by the borrower, the bank would be the new owner of a valuable asset that was always getting more valuable.

The default on a significant amount of subprime mortgages, allied with the end of the housing boom, caused a spillover effect from the US to the rest of the world. Balance sheets of major financial institutions (actually those were OTC products, off-balance sheet, which only made harder to understand the proportion of the defaults' damages) around the globe were full of securitized products, attached to those subprime mortgages.

The uncertainty about the dimension and value of securities collateralized by these subprime mortgages, spread uncertainty and banks stopped lending to each other.

The crisis eroded further when in March 2008, Bear Stearns, whose exposure to counterparties was considered too extensive and risky, had to be bought by J.P. Morgan, backstopped with funds from the Federal Reserve. The last minute bailout went on with

J.P. Morgan acquiring by \$2 a share one of the world's largest and most storied investment banks. A year before, Bear Stearns shares were selling for \$170 each.

The events got worse when on the on the 15th of September 2008, Lehman Brothers, holder of \$600 billion in assets, filed for Chapter 11 bankruptcy protection. It remains the largest bankruptcy filing in the U.S. history. The Fed allowed for this major bankruptcy in order to avoid feeding the belief that all insolvent institutions would be rescued – it fought moral hazard. It also claimed that Lehman was in a worse financial shape and less exposed to counterparty risk than Bear Stearns was. However, the next day, AIG (the world's biggest insurance company) had to be nationalized on the basis of fears of the systemic consequences that could result from the collateralized default swaps they had been underwriting in the past few years – moral hazard was no longer the issue.

The Lehman's bankruptcy resulted in the seizing up of interbank lending, on panic that no bank was safe anymore. In early October, the results were spread to Europe and the Emerging countries and the world witnessed a large-scale state support for banks. The states' fiscal deficit got back to values last seen after the World War II, inflated not only by the state interventions in the banking sector but also due to a generalized increase in public spending targeted at softening the impact of the reduction of private spending on the economy.

Therefore, in the first half of 2010, the euro zone sovereign debt markets were under an unprecedented stress and massive sell-offs of the so-called peripheral economies government bonds took place, while a flight to safety phenomenon occurred.

Under the Stability and Growth Pact³⁷ Government Debt of the European Union members is limited to 60% of GDP. However, according to the Central Intelligence Agency World Fact Book the predictions for 2010's public debt levels revealed 142,7% Government Debt to GDP ratio for Greece (4th highest public debt to GDP in the World), 119% for Italy, 93% for Portugal, 100,7% for Belgium, 72,3% for Austria and 62,7% for the Netherlands. Not even Germany (83,4%) or France (82,4%) met the Pact requirements and only Spain followed the limit, with a ratio of 60,1%.

Eventually, some of the peripheral economies started having difficulties to re-finance their debt at the same time that were facing historical high yields (since the euro's establishment) every time they were issuing new debt. Consequently to all these, on the 2nd of May, 2010, Eurozone members, together with the International Monetary Fund (IMF) had to help Greece on preventing default on its massive debt. The rescue package included €80bn from the EU and €30bn from the IMF, on exchange for severe austerity measures to the Hellenic economy.

This was the first of three sovereign bailouts. After Greece, Ireland asked for external help in the following November, 21st. The rescue package included €67,5 billion in loans from the EU and the IMF.

Finally, Portugal asked for external help in April 2011. Facing increasingly higher interest rates and rating downgrades, the country surrendered to the €78bn, 3 year loan, package that included €12bn to support the banking sector, on compromise that the 2011's deficit would be reduced to 5,9% (from 9,1%) of GDP. Public sector wages would have to be frozen, job promotions limited and new public investment suspended. Furthermore, among other measures, Government stakes in national companies needed to be privatized.

³⁷ The Stability and Growth Pact is a framework for coordinating fiscal policy between the EU Member States - includes a set of rules for fiscal policies in the Member States, including limits on government deficits and debt to ensure sound public finances. It is an important element of Economic and Monetary Union.

The once perceived risk-free government debt instruments ceased to be so – Portugal's 2 year Government Bond moved from a 2,5% yield in 2004 to 17% on September, 2011; Greece saw its 1 year Government Bonds' yields surge to as abnormal values as 133%. At the same time, CDS Spreads reached the four digits numbers of 3.000 to 4.000 basis points, from around 9 to 20 basis points in 2006.

Appendix 2 – The CDS-Bond Basis

The CDS-Bond Basis comes in as an interesting instrument through which one can observe the abnormal sovereign's markets functioning. Nonetheless, being a useful instrument to help making inferences on the debt market's health, it can also be a potential source of profit, when it acquires abnormal values as it has been happening during the crises.

The basis is the difference between the spread of a CDS and the spread of a fixed-rate bond, for the same underlying issuer and with similar maturity.

CDS stands for Credit Default Swap, and is essentially an over-the-counter insurance contract that offers protection against default of a specific reference entity³⁸. The protection buyer makes periodic premium payments to the protection seller until maturity or until some credit event occurs³⁹. If and when a credit event occurs, the protection buyer delivers a bond, from a pool of eligible bonds to the protection seller, in exchange for its par value – physical settlement, as explained by Jan De Wit (2006) - or, less commonly, a cash settlement is established where the protection seller pays the difference between the bond's recovery value and its par.

The premium paid by the protection buyer to the protection seller, called the “spread”, is quoted in basis points per annum of the contract's notional value and is usually paid quarterly.

Differently from the CDS, which spreads are directly observed, bond spreads are a more complex issue. Traditionally, yield spreads were calculated using a risk-free sovereign

³⁸ Reference Entity is essentially the party upon which the two counterparties in the transaction are speculating. The seller of the transaction is selling protection against the default of the reference entity. The buyer of the securitized credit derivative believes that there may be a chance that the reference entity will default upon their issued debt and is therefore entering the appropriate position. It can be a corporation, government or other legal entity that issues debt of any kind.

³⁹ A recent document published by ISDA (International Swaps and Derivatives Association) on Greek Sovereign Debt (31-10-2011) refers as credit events the following: Failure to Pay Principal or the Coupon when they are due; Repudiation/Moratorium and Restructuring.

bond as benchmark, which in this case would be the German bunds. However, besides the inconvenient of letting Germany outside the sample, in the literature it is becoming widespread the conviction that swap rates are the most adequate benchmark to compute this variable. Beber, Brandt and Kavajecz (2009) support the arguments of McCauley (2002); Hull, Predescu, and White (2004) and Blanco, Brennan, and Marsh (2005). Together they argue that government bonds are less than an ideal proxy for the unobservable risk-free rate because of different taxation treatment, repo specials, and scarcity premiums. Moreover, the Euro-swap benchmark comes with the advantages of being highly liquid and carrying relatively lower counterparty risk. Fontana and Scheicher add that the benchmark role of Bunds may lead to the existence of a significant convenience yield⁴⁰. On the other hand, this method can slightly increase the basis, as IRS are normally higher than German yields.

Under normal market conditions and for no-arbitrage theory to hold, the basis should be zero (Fontana and Scheicher, 2010 and Jan de Wit, 2006) because both Sovereign bonds and CDS offer exposure to the same sovereign debt and thus, buy a bond or sell protection on it should carry the same risk. Historically, however, the basis has been slightly above zero, meaning that CDS spreads have consistently overcome bonds' spreads. This evidence is justified by Fontana and Scheicher, who state that bonds are cash instruments and CDS are derivative contracts and, as a result, from a trader's perspective, those are not perfect substitutes. Bond prices are affected by interest rate risk, default risk, funding risk and market liquidity risk, while CDS are affected mainly by default risk and counterparty risk.

⁴⁰ Reference Entity is essentially the party upon which the two counterparties in the transaction are speculating. The seller of the transaction is selling protection against the default of the reference entity. The buyer of the securitized credit derivative believes that there may be a chance that the reference entity will default upon their issued debt and is therefore entering the appropriate position. It can be a corporation, government or other legal entity that issues debt of any kind.

As the spreads' difference diverges from zero, there should be at least a theoretical arbitrage opportunity. Some authors have defended that those arbitrage opportunities which surged during the crisis, do not seem to be exploitable, due to market frictions and structural changes⁴¹.

When the opportunity is exploitable and the basis is positive, the arbitrage strategy on this deviation would consist on short-selling the bond, underwriting CDS protection, while buying the risk-free rate. Palladini and Portes (2011) explain that the rationale behind this trading has to do with the fact that if the credit quality on the reference entity improves (and the basis gets narrow) no reimbursement will occur, while the CDS seller profits from the stream of premium payments.

On the other hand, if the basis is negative, the strategy would be the opposite: buying the bond and protection against its default, financed at the risk-free rate. In this case, the rationale is betting that the basis will increase, or that the credit quality of the reference entity will get worse. If a credit event occurs the buyer will receive the compensation, but, even if it doesn't get to the point of default, CDS owned by the buyer will have a higher value, as the probability of default of the reference entity has eroded. Thus, the investor can still sell it on the market for a profit, assuming that the market would have enough liquidity to absorb it.

⁴¹ For instance, in 2008, short-selling exacerbated by naked short-selling⁴¹, was seen as a major contributor for the high market volatility that was verified. As a consequence, this investment strategy was prohibited by the US Securities and Exchange Commission (SEC) for a total of 799 financial companies, during a period of three weeks. The United Kingdom Financial Services Authority (FSA) did the same for a smaller range of 32 financial companies. Australia authorities went even further, by prohibiting short-selling in its totality.

Appendix 3 – Near Multicollinearity

According to Chris Brooks in *Introductory Econometrics for Finance* (2008), near multicollinearity occurs when there is a non-negligible relationship between two or more explanatory variables, which causes distortions in the outcome of the regression. One of the problems that it comprises is the r-squares being high but the individual coefficients having high standard errors so that the regression will appear to be good as a whole, but the individual coefficients will not be significant. In addition, the regression becomes very sensitive to small changes in the specifications, so that adding or removing an explanatory variable leads to changes in the coefficient values or significances of the other variables.

The presence of near multicollinearity can be detected by observing variables' correlation with each other, as a high correlation means potential presence of multicollinearity. By observing Table 8.1 and 8.2 it becomes clear the presence of this distortive effect.

Table 8.1 and 8.2: Correlation between explanatory variables

The sample sub-periods are from March, 2007 to December 2008 (period I) and from January 2009 to October 2011 (period II).

<i>2007-2008</i>	S&P Rating	Fitch Rating	Moody's Rating	Bond Bid_Ask	CDS Bid_Ask	ECB Key Rate	SX7E Index
S&P Rating	100,00%						
Fitch Rating	93,95%	100,00%					
Moody's Rating	95,92%	96,74%	100,00%				
Bond Bid_Ask	-14,85%	-15,51%	-12,90%	100,00%			
CDS Bid_Ask	-8,46%	-5,46%	-2,09%	-14,48%	100,00%		
ECB Key Rate	0,37%	-0,04%	-0,09%	-14,81%	61,35%	100,00%	
SX7E Index	2,57%	0,03%	0,07%	-37,27%	59,24%	41,12%	100,00%

<i>2009-2011</i>	S&P Rating	Fitch Rating	Moody's Rating	Bond Bid_Ask	CDS Bid_Ask	ECB Key Rate	SX7E Index	Others' Rating	Others' Outlook	Own Outlook
S&P Rating	100,00%									
Fitch Rating	83,44%	100,00%								
Moody's Rating	81,55%	96,80%	100,00%							
Bond Bid_Ask	-49,19%	-69,82%	-74,16%	100,00%						
CDS Bid_Ask	50,27%	62,02%	65,27%	-88,98%	100,00%					
ECB Key Rate	1,95%	-4,70%	-6,10%	13,67%	-15,53%	100,00%				
SX7E Index	2,34%	11,89%	15,63%	-23,66%	24,14%	-70,22%	100,00%			
Others' Rating	-5,12%	-2,00%	0,47%	-2,87%	-0,06%	-1,90%	9,12%	100,00%		
Others' Outlook	-9,20%	-0,31%	4,91%	-15,29%	9,70%	12,60%	22,01%	25,80%	100,00%	
Own Outlook	65,00%	78,92%	80,04%	-61,12%	52,18%	2,58%	10,99%	2,89%	14,87%	100,00%

Appendix 4 – Rating Agencies

Standard & Poor's

Standard & Poor's is a United States-based financial services company. It has offices in 23 countries and a history that dates back more than 150 years. It is known to investors worldwide as a leader in financial markets' intelligence. As a Credit Rating Agency, the company publishes credit ratings for the debt of public and private corporations and states. It issues both short and long term credit ratings.

Moody's

Moody's Investors Service, whose parent's company is Moody's Corporation (headquarters in New York City), is a leading provider of credit rating, research and risk analysis. The firm's ratings and analysis track debt covering more than 110 countries, 12.000 corporate issuers, 25.000 public finance issuers, and 106.000 structured finance obligations.

Fitch

Fitch Ratings, part of the Fitch Group, is dual-headquartered in New York and London and was founded in 1913. It comprises 51 offices worldwide and positions itself as a global rating agency dedicated to providing value beyond every opinion.

Standard & Poor's, Moody's Investor Services and Fitch Ratings are the Big Three credit rating agencies that dominate 90% of the world market for ratings of governments and companies. They are the only agencies recognized by the Securities and Exchange Commission as nationally recognized statistical rating organizations, since 1975. Also in the European Union the ratings issued by these three institutions have been used as legal benchmarks in investment and lending rule for banks, insurances, many investment funds and other institutional investors.

Table 9: Credit Rating Classifications and their meaning

Long-term and Short-term credit rating classifications, per agency.

Moody's		S&P		Fitch		
Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	
Aaa	P-1	AAA	A-1+	AAA	F1+	Prime
Aa1		AA+		AA+		High grade
Aa2		AA		AA		
Aa3		AA-	AA-			
A1		A+	A-1	A+	F1	Upper medium grade
A2		A		A		
A3	P-2	A-	A-2	A-	F2	Lower medium grade
Baa1	BBB+		BBB+			
Baa2	P-3	BBB	A-3	BBB	F3	
Baa3		BBB-		BBB-		
Ba1	Not prime	BB+	B	BB+	B	Non-investment grade speculative
Ba2		BB		BB		
Ba3		BB-		BB-		
B1		B+		B+		
B2		B		B		
B3		B-	B-			
Caa1		CCC+	C	CCC	C	Substantial risks
Caa2		CCC				Extremely speculative
Caa3		CCC-				In default with little prospect for recovery
Ca		CC				
C	C					
-	D		DDD	-	In default	
-			DD			
-			D			

Appendix 5 - Credit Rating, a step further

Besides being able to capture all the significant rating activity that has been going on in the markets, by using the information of all the three agencies it is also possible to assess if there is a stronger impact on the basis when there is more than one agency's credit rating change.

***Hypothesis 1.3:** If agencies move in tandem, then the impact on the basis should be higher. Moreover, by bringing a definitive impact to the market, the last change should be stronger.*

This hypothesis was assessed through the hypothesis test method. This analysis focuses on the credit rating changing days, in order to provide more detailed conclusions. I tested the null hypothesis of the average impact of a rating change not impacting the basis (or the null hypothesis of the average impact to be equal to zero) against the alternative hypothesis of that average being different from zero, as shown below:

$H_0 = \text{Average change in the basis is zero}$

$H_1 = \text{Average change in the basis is different from zero}$

$$z = \frac{\overline{\Delta Basis}}{\frac{\sigma}{\sqrt{N}}}$$

The average basis changes are measured during the period that goes from 7 days before to 1 one day after the day of the credit rating change. To assess the basis behavior during periods of more increased rating changes activity I picked-up the events that were followed or preceded by other rating announcement(s) in short periods of time that can go from 0 to 12 days. As expected, the impact of 2 or more rating changes in the countries' basis is significant (on the contrary, through this method, isolated rating changes did not prove to impact significantly on the basis) - the test statistic (z)

compares with the critical value 2,09 (t-student) and overcomes it (Image 1) - probably, a reinforcement of the credit quality depreciation causes a higher erosion in the CDS market. Finally, the first change occurring in that short period of time has a significant impact on the basis, while the last change does not (Image 1). It seems that the first is bringing in the information, whereas the last arrives when the basis has already incorporated the potential severity of markets conditions during that period. So, the effect of new information is stronger than the reinforcement effect, refuting, in part, hypothesis 1.3.

Image 1: Hypothesis testing – More than one credit rating downgrade

The impact on the basis is calculated by computing the difference between 7 days earlier and one day after the announcement. The periods that comprise more than one downgrade range between 0 and 12 days.

The test statistic has to be compared with the T-Student distribution's critical values whenever the number of observations (i.e. credit rating changes) is less than 30.

Otherwise it is compared with the Normal distribution's critical values.

More than one	
Average	148,4
Std. Dev	217,8
N	20,0
Z	3,0 > 2,09 (t-student), statistically significant

Last downgrade	
Average	154,4
Std. Dev	237,9
N	9,0
Z	1,9 < 2,26 (t-student), not significant

First downgrade	
Average	182,2
Std. Dev	215,1
N	9,0
Z	2,5 > 2,26 (t-student), statistically significant