Instituto Superior de Economia e Gestão

UNIVERSIDADE TÉCNICA DE LISBOA

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FINANCE

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PROJECTO

CREDIT DEFAULT SWAPS – BROKEN BASIS AND COUNTERPARTY RISK

RICARDO FILIPE GODINHO MIRANDA DAS NEVES

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ORIENTAÇÃO:

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Abstract

This study aims to analyse whether periods of financial turmoil caused the relation between CDS and corporate bond spreads (CDS-Bond basis) to structurally break. We obtained evidence that a higher number of breaks were detected during the European sovereign debt crisis for the firms included in the sample. Besides, firm specific counterparty risk effect on the basis revealed also to have stronger impact on financial firms in the after-break period.

Keywords: CDS, Structural Break, Counterparty Risk, Basis, Cointegration

Resumo

Este estudo pretende analisar se períodos de turbulência nos mercados financeiros causaram uma quebra de estrutura na relação entre os spreads dos CDS e das Obrigações (Base). Obtivémos evidência que um largo número de quebras de estrutura foi detectado para as empresas incluídas na amostra durante o período da crise da dívida soberana Europeia. Para além disso, o efeito do risco de contra parte na base revelou ter também um maior impacto nas empresas do sector financeiro no período após a quebra de estrutura detectada.

Palavras chave: CDS, Quebra de estrutura, Risco de contraparte, Base, Cointegração

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Beforehand, i would like to thank my supervisor Raquel Gaspar for all the advices given along the process and for her critical and constructive spirit, particularly in the tough stages. I am also grateful to my colleagues that accompanied me in the brainstorming sessions and to my parents that always believed in me.

List of Abbreviations

CDS-Credit Default Swaps

Basis - CDS-Bond Basis

ECB - European Central Bank

ZA - Zivot and Andrews

US - United States of America

CCP - Central Clearing Counterparty

AIG - American Insurance Group

ADF - Augmented Dickey-Fuller

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2 Introduction

During the past decades, several innovative credit derivatives began trading in financial markets. Among those structured products, credit default swaps (CDS) took particular attention. A CDS acts like an insurance agreement between two parties, where the protection buyer pays a periodic fee (CDS spread) to the seller until the contract matures/expires or the reference entity's is subject to a credit event. In case a credit event occurs within/during the contract's time frame, two settlement methods are possible. First, a physical settlement where the buyer transfers the reference entity's bond and gets in return from the seller the bond's full face value. The alternative method builds on cash settlement where the seller pays the difference between face value and the bond recovery value. In this case an auction gets in place in order to reach this recovery rate and the consequent contract settlement.[1] According to the trade organization that guarantees the operability of the CDS market ISDA, a credit event for European corporate contracts occur in the presence of bankruptcy, failure to pay(default) or restructuring.

Besides hedging against a reference entitys default, CDS spreads can also provide an important continuous assessment of an entity's credit conditions. Increasing (decreasing) spreads should reflect deteriorating (improving) credit conditions and higher probability of default. CDS contracts are traded bilaterally in over-the-counter (OTC) markets negotiated privately between dealers and investors.

[1] For a more detailed explanation regarding the auction process, see Coudert and Gex(2011)

In the last quarter of 2008, AIG had to be bailed out by the US government due to their huge exposure on CDS as protection seller. The interconnectivity and lack of transparency of trades in OTC markets combined with AIG potential default could severely increase the risk of collapse in the financial system. This event as well as the subprime crisis in general, first alerted investors, regulators and supervisors for the potential dangers of counterparty risk in the CDS market.

In a simplistic way, CDS and bonds can be considered to reflect the same type of risk: inability of an entity to meet the required payments on its debt obligations. Several authors such as Duffie(1999) argue that both CDS premiums and corporate yield spreads share a theoretical equilibrium condition. This relation between these two markets is known as the CDS-Bond basis, henceforth mentioned just as basis.

The aim of this study is to assess the impact periods of financial instability had on the evolution of both CDS and bond markets. While previous studies focused primarily on the subprime crisis, this analysis contributes by also extending and including the more recent European sovereign debt crisis period. For that purpose, first we identify whether certain dates caused the CDS-Bond basis relation to structurally change. Then, the main point is to check for the possibility of relating those detected break dates to major events that occurred in the recent financial crisis such as the Lehman Brothers collapse in 2008 or the Greece government bail out in 2011. Lastly, explanatory power of several determinants that influence CDS-Bond basis dynamics is compared before and after the endogenously detected structural date in order to measure if risks began to be priced differently, particularly for counterparty risk.

The remainder of this text proceeds as follows.In Section 3 is presented theoretical guidance regarding some main concepts to be applied throughout the study. Section 4 describes both dataset and methodology employed in basis construction and subsequent analysis regarding stationarity, cointegration, structural break detection and determinants of basis dynamics. Presentation and analysis of the results is discussed in Section 5. Section 6 concludes and presents suggestions for future research.

3 Theoretical Framework

Before proceeding to the analysis of the CDS-Bond basis, it is useful to provide theoretical guidance regarding some concepts to be applied in this study. In theory, CDS and bonds are two different securities exposed to the same type of risk: inability of entity's to meet the required payments on their debt obligations. Intuitively, if an investor is long on a par yield bond and simultaneously enters a Credit default swap contract as protection buyer, in principle the default risk exposure over that reference entity is eliminated.[2] Therefore, this theoretical equilibrium condition between CDS and bond spreads known as the CDS-Bond basis should be observed.[3] Formally:

$$CDS\_Bond\_Basis_t = CDS_t - (y_t - y_{rf}) \quad (1)$$

Where y_t and y_{rf} correspond respectively to the entity's bond yield and the benchmark risk free rate. Although the relationship between these two

[2]This portfolio strategy should provide the investor with a return equal to the yield of a risk-less security such as the Treasury Rate for example.

[3]Among several authors, Duffie (1999) and Brennan et al. (2005)

market segments should on average hold, authors document that during turbulent periods characterized by financial instability the basis deviates from parity. If perfect capital markets existed, investors could then exploit a theoretical arbitrage opportunity. If the basis turns negative, investors could benefit from buying the bond (higher yield makes it cheaper) and consequently buying protection through CDS contract.[4] Fontana (2010) documents that during the subprime crisis, counterparty risk and increasing funding liquidity shortage made it much more expensive to trade a persistently negative basis. Bai and Dufresne(2011) report that instead of a clear factor, several drivers particularly the risk of counterparty default and investors investments transfer to less risky and more liquid securities such as Treasury bills (flight to quality risk), dropped the CDS-Bond basis.

CDS and Bonds cannot be seen as perfect substitutes since they are exposed to different types of risk others than credit risk, such as counterparty risk. This type of risk lowers CDS premiums as dealers and investors could fail to meet their obligations and so are willing to pay a lower spread(Wit 2006).

In time series analysis, valid statistic inferences can only be made if variables have constant long-run mean and finite variance across observations i.e. are considered stationary. Otherwise, series is said to contain a unit root process and their use leads to a spurious regression as usual statistical inferences do not hold. Time series are considered to follow a unit root process if the value of the series in one period equals its previous period plus an unpredictable error. In case a time series appear to have a unit root, a successful method often relies on first difference in levels i.e. I(1).

[4] Inversely, investors should short sell the corporate bond and sell protection through a CDS contract in a positive basis scenario

However even if variables alone follow a unit root process, in the long-run they may share a linear combination. In that case, CDS and bond spreads are said to be cointegrated and therefore regressing involving their levels can proceed without generating spurious results (Engle and Granger 1987).

Recent empirical studies such as Perron (2005), alert for the similarities and interconnectivity between non-stationarity and structural changes. This topic brings questions whether do CDS follow a stationary process with the impact of a structural break somewhere along the time series rather than containing a unit rooting in the presence of market instability such as the collapse of Lehman Brothers for examples.

A structural break is stated to occur when at least one parameter in the model has shifted permanently at some point in the time series. (Hansen 2001). The point in time where that parameter change occurs in the model is termed as ”break date”.

4 Methodology

4.1 Data

The analysis comprises the period from March 2007 until March 2014. For that purpose, daily 5-year credit default swap quotes were retrieved from a Bloomberg financial terminal[5]. The sample consists of 74 investment-grade firms included in ITraxx Europe, a CDS index for the most liquid European companies. In Table 1 it is possible to observe the full dataset description divided by ratings, tickers and sector of activity.

[5]5-year maturity considered the most liquid tenor (Ericsson, Jacobs and Oviedo (2009)

4.2 CDS-Bond Basis

The CDS-Bond Basis enables investors to assess the perceived entitys default risk condition in two different markets by comparing its CDS spread with the corporate yield premium relative to a benchmark risk free rate. However, its computation is tied to two important issues. The first issue lies in the choice of the riskless benchmark for corporate bond spread computation. Nowadays, the common reference rate used by authors as risk-free benchmark is the interest rate swap curve, I-Spread, over the traditional Treasury rate. Unlike government bond yields that suffer from tax advantages, scarcity premium and repo specialness (Blanco et al. 2005), interest rate swaps benefit from being quoted on constant maturity basis and seen as a better approximate funding cost to investors. Nevertheless, since the analysis will take higher emphasis on counterparty risk impact on basis changes, European Central Bank (ECB) spot yield curve will be used as proxy riskless benchmark as swaps carry an amount (although small) of counterparty and default risk due to its floating leg being indexed to Euribor.

Thus the next step would be calculating the basis by comparing the CDS spread with the correspondent 5-year maturity bond. Yet, it often proves a difficult task to find bonds that exactly match CDS contracts constant maturity. So, in order to overcome this maturity matching problem, literature suggest three different ways. The first approach falls on the par-equivalent spread methodology, where the fair value of CDS is compared to market bond spread based on CDS-implied default probabilities (Elisade et al. 2009 and Bai and Dufresne 2011). Alternatively, Blanco et al. (2005) suggest retrieving for every observation date, at least a bond yield with ma-

turity above and below the desired. Then, they linearly interpolate those yields in order to estimate the desired constant risk free yield to maturity.

However, this study will follow the methodology presented in Longstaff et al.(2005). Their methodology builds on the following procedures: (1) a set of bonds is first selected to bracket the desired maturity. Their bond sample consists of only fixed coupon rate, large issues of senior debt obligations and excludes any that contain embedded option such as cheapest-to-deliver (CTD) or convertible bonds[6](2) Then, a riskless bond is created with the same coupon rate and maturity as the risky one using the provided daily ECB yield curve parameters as benchmark. For that purpose, daily discount factors y, are computed using the Nelson-Siegel-Svensson model (SSN):

$$\mathrm{y}(n) = \beta_0 + \beta_1 \left[\frac{1 - \mathrm{e}^{\left(-\frac{n}{\lambda_1}\right)}}{\frac{n}{\lambda_1}} \right] + \beta_2 \left[\frac{1 - \mathrm{e}^{\left(-\frac{n}{\lambda_1}\right)}}{\frac{n}{\lambda_1}} - \mathrm{e}^{\left(-\frac{n}{\lambda_1}\right)} \right] + \beta_3 \left[\frac{1 - \mathrm{e}^{\left(-\frac{n}{\lambda_2}\right)}}{\frac{n}{\lambda_2}} - \mathrm{e}^{\left(-\frac{n}{\lambda_2}\right)} \right] \quad (2)$$

The advantage of the Svensson model is that there is no need for interpolation since the estimation is adjustable for the desired maturity. After calculating the corporate yield spread for each bond included in the basket, the next step is to regress the spreads on their maturities and then use the predicted value at 5-year as the observation date bond spread. The CDS-Bond basis is then obtained by the difference of CDS premium relative to the regressed corporate yield spread. In Table 1 is presented an illustrative example for the energy sector firm Energias de Portugal (EDP),

[6]Authors present in Appendix B of their paper full criteria for the choice of bonds to be included in the computations

regarding a risk-less yield computation on 20thMarch 2007 for a bond that pays semi-annual coupons.

Table 1 Yield spread computation for ELEPOR 6.4 10/29/2009 Corp

	29/04/2007	29/10/2007	29/04/2008	29/10/2008	29/04/2009	29/10/2009
C.Flow	3.2%	3.2%	3.2%	3.2%	3.2%	103.2%
n	0.1096	0.6110	1.1123	1.6137	2.1123	2.6137
y(n)	3.57	3.81	3.87	3.87	3.86	3.84
d(t)	0.9962	0.9774	0.9586	0.9405	0.9231	0.9061

Dirty price$_{Rf}$	Accr. Int	Clean price$_{Rf}$	Bond yield	Rf yield
108.86	2.5495	106.31	4.20%	3.83%

Bond spread	(basis points)	46.82

Applying the methodology described previously to the remaining firms of the sample, Figure 1 and Figure 2 represent respectively the average CDS spreads and CDS-Bond basis evolution during the covered period for financial and non-financial sector.

Figure 1 CDS premiums

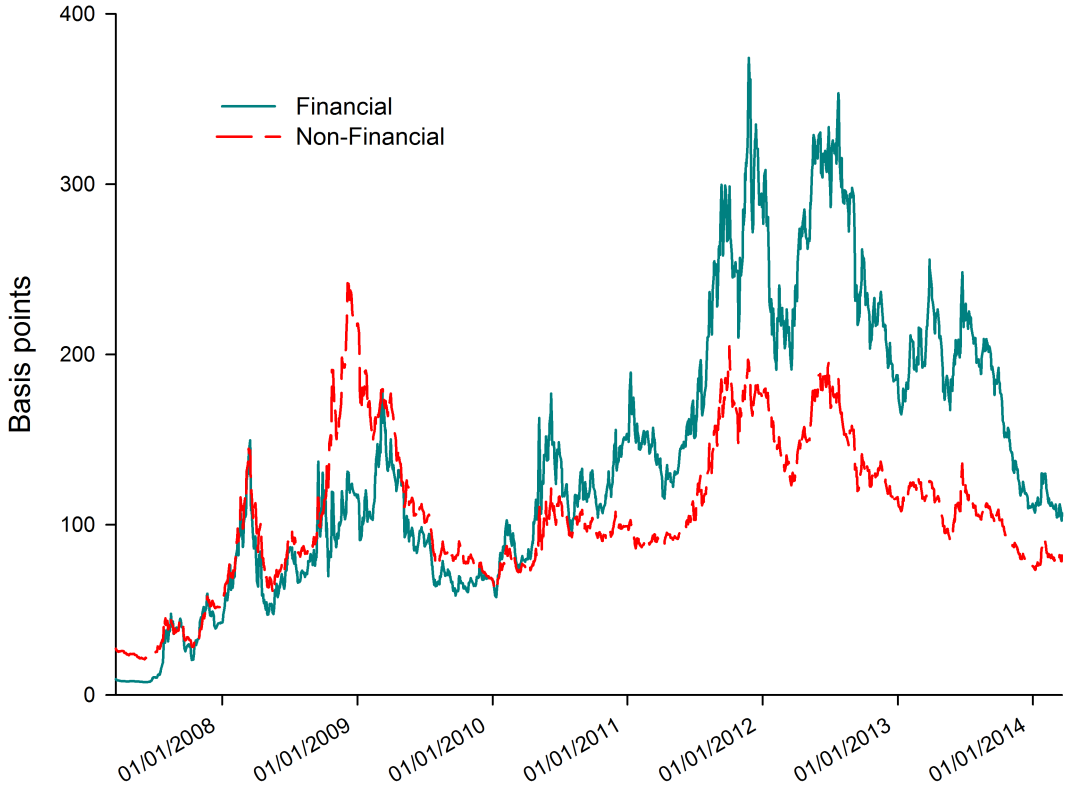
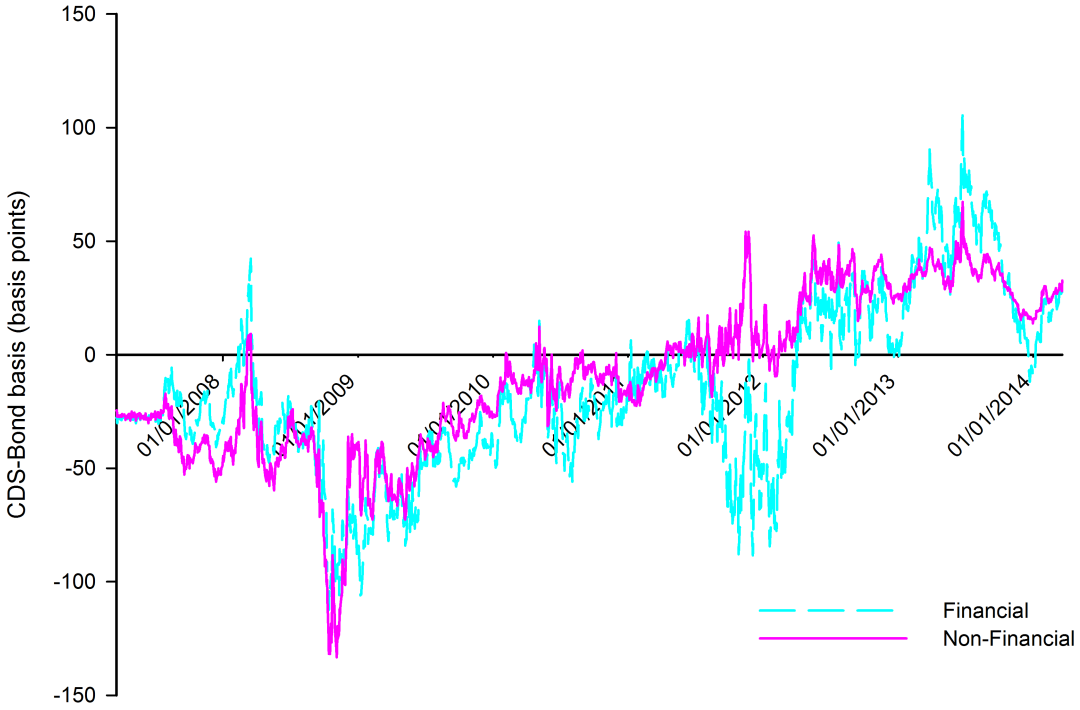


Figure 2 CDS-Bond basis evolution



Descriptive statistics regarding the CDS premiums, bond spreads and the correspondent CDS-Bond basis are presented in Table 2. The timeline addressed in the analysis will be divided in four different periods to compare the evolution of the variables in question. Once again, distinction will be made between financial and non financial firms. The first period will include the pre-subprime crisis until the acquisition of Bear Sterns by JPMorgan Chase in March 2008. The next period comprises the financial turmoil characterized by the collapse of Lehman Brothers until March 2009, wherein markets began to stabilize. Thereafter, up to July 2011 following the changes implemented in the CDS market through the Big Bang protocol and the forthcoming of European sovereign debt crisis.

Table 2 Descriptive Statistics

Financial			CDS Spreads				
Periods	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Obs
I	38.51	31.45	7.46	149.59	1.27	4.39	257
II	93.05	27.99	93.00	179.13	0.60	2.96	255
III	110.18	32.18	57.42	189.42	0.02	1.77	585
IV	218.81	61.02	102.30	374.25	0.05	2.42	697
Non-Financial							
I	46.96	28.87	20.89	144.57	1.61	4.96	257
II	127.94	51.1	58.95	241.87	0.49	1.92	255
III	94.62	18.47	60.79	176.96	1.64	7.64	585
IV	129.87	32.83	73.4	204.9	0.21	2.04	697
Financial			Bond Spreads				
I	59.76	20.81	34.16	110.09	0.42	2.18	257
II	147.22	43.86	88.63	219.15	-0.1	1.25	255
III	139.6	26.9	92.48	214.5	0.35	2.49	585
IV	207.1	78.78	77.06	393.84	0.33	1.86	697
Non-Financial							
I	79.88	26.79	47.34	138.67	0.48	1.98	257
II	186.31	65.78	114.49	300.43	0.33	1.48	255
III	119.16	29.21	82.65	232.35	1.94	6.83	585
IV	112.52	39.9	53.33	200.18	0.36	1.86	697
Financial			CDS-Bond Basis				
I	-20.97	14.13	-40.69	42.38	1.87	6.95	257
II	-54.28	25.48	-112.33	-10.30	-0.43	2	255
III	-29.33	20.69	-84.08	17.57	-0.35	2.65	585
IV	11.80	38.83	-88.42	107.48	-0.48	2.7	697
Non-Financial							
I	-33.03	12.06	-55.94	9.20	0.76	4.45	257
II	-56.82	26.78	-133.30	-23.06	-1.4	3.97	255
III	-19.33	17.55	-72.66	12.38	-0.94	3.29	585
IV	25.60	14.87	-18.66	67.32	-0.54	2.6	697

Relative to average CDS premiums, period I exhibits the lowest value during the period covered. Despite being characterised as the tranquil period, a negative CDS-Bond basis of -20 basis points is observed which barely holds the equilibrium condition between both markets (CDS and

bond). A possible explanation for this behaviour could be related with liquidity issues in the choice of the ECB yield curve for riskless benchmark as mentioned previously, such as tax advantages or scarcity premium. Up to this point, different sectors follow the same evolution pattern. Yet, it is during financial crisis that we observe differences on cross-sectional behaviour.

During the sub-prime crisis, CDS spreads increased and the average basis fell to -133 basis points for financial firms and -112 to non-financial. This behaviour is somewhat surprising as it contrasts with other studies such as Fontana(2010) and Augustin(2012), where the basis went down in a more dramatically way, particularly for financial firms. In their case, they reported an average negative basis of 145 basis points. Nevertheless, their studies are based on the US financial sector where the financial turmoil was originated, so in theory a stronger impact was expected there, at least in the short term. With the exception of the first period in analysis, the variables present negative skewness and excess kurtosis.

In period III is observed the stabilization of market conditions. While in the industry sector is seen a reduction, financial firms suffer from spread enlargement. It was also by that time that significant changes were implemented on the CDS market, such as Clearing House implementation. In Period IV following European sovereign debt crisis and major events concerning financial assistance programs to Portugal, Spain and Greece the inverse situation is observed, being the financial sector more affected than non-financial firms, particularly driven by financing issues. In 2012 with markets experiencing sovereign debt crisis and the trigger of CDS pay-

ments through Greece default in March of that year, premiums enlargement can be observed specially for the financial sector, where spreads reached higher values than during 2008 financial crisis (over 300 basis points). With the ban of naked sovereign CDS in 2012, investors began to hedge their risks by shifting their investment to financial companies. Allied with the difficulty in financing themselves, credit risk perception by investors increased and consequently CDS premiums.

4.3 Long-Term Relationship Between CDS and Bond Spreads

4.3.1 Unit Root Tests

Previous studies proved that in most cases CDS and bond spreads do not follow a stationary process, either by applying Augmented Dickey-Fuller(ADF) or KPSS test to check for that condition.

Nevertheless, recent empirical studies alerted for the similarities and interconnectivity between a unit root process and the occurrence of a break at a given time in the sample. As addressed by Perron (1989), failure to reject the hypothesis of a unit root process could be misleading as it could rather imply the presence of a structural break in the series. Different from Nelson and Plosser (1982), the author states that instead of unit root, time series may follow a stationary process around a trend function allowing for a large infrequent shock at some point in their intercept and slope. For that purpose, a modified ADF test was proposed, including a time dummy variable in the regression for the presence of a break under both the null and alternative hypothesis. Yet, this method presents the disadvantage of only allowing for testing one already known exoge-

nous break. So, in order to overcome the limitation described, Zivot and Andrews (1992), Lumsdaine and Papell (1998), Lee and Strazicich (2003) among others, developed unit root tests to endogenously detect a structural break, indicating that this way, the bias related to usual tests could be reduced.

Therefore, since the period in analysis comprises at least two major events, the 2008 subprime crisis and the 2010 sovereign debt crisis, a unit root process in the presence of structural break should also be tested. For that purpose, tests suggested by Zivot and Andrews (1992) are applied. Zivot and Andrews test proceed as follows: First, for every observation date in the sample a dummy variable is created and regressed sequentially using the ADF test. Then, amongst all the selected potential break dates (TB), the one which minimizes the t-statistic of the unit root test is the selected as a break in the time series. The null hypothesis of unit root versus a one-time endogenously detected structural break where y represents the variable tested, can be applied through three different models:

$$
\begin{aligned}
y_t &= c + \alpha_{t-1} + \beta * t + \gamma * DU_t + \textstyle\sum_{j=1}^{k} d_j \, y_{t-j} + \varepsilon_t \\
y_t &= c + \alpha_{t-1} + \beta * t + \theta * DT_t + \textstyle\sum_{j=1}^{k} d_j \, y_{t-j} + \varepsilon_t \\
y_t &= c + \alpha_{t-1} + \beta * t + \theta * DU_t + \gamma * DT_t + \textstyle\sum_{j=1}^{k} d_j \, y_{t-j} + \varepsilon_t
\end{aligned}
$$

(3)

While model A allows for a one-time level shift in the time series, Model B checks for a one-time slope change. . On the other hand, model C incorporates both mean and trend shift where DU_t and DT_t account for a break occurrence in the mean and trend respectively. The next question lies in which model should the interpretation be inferred. For variables that

appear to exhibit a deterministic trend, unit root analysis is made to account for both a change in the intercept and slope (model C). Otherwise, only a break in the intercept through model A is analysed.[7] Firms that in their levels refuted the null hypothesis in both CDS and bond spreads will be treated from now on as I(1), as they proved to be stationary in their first-differences.

4.3.2 Cointegration Tests

As mentioned before, regressing non-stationary variables may lead to spurious regressions and their economic interpretation will not be meaningful. Nevertheless, if the linear combination between two non-stationary variables happens to be stationary, they are said to possess a long-run equilibrium condition i.e. cointegrated. That way, while variables may deviate from each other on the short term, ultimately they will mean revert. If cointegration is found on CDS and bond spreads, that is, non stationary variables follow a long-run relationship, regression can be applied without generating spurious results.

Several authors like Fontana (2010), and Blanco and Brennan (2005), applied the Johansen (1988, 1991) procedure to assess the long-run equilibrium between CDS and bond spreads. Nevertheless, the Johansen test is better fit to analyse multivariate time series which test for multiple cointegrating ranks. So, Wit (2006) and Gaspar and Fonseca (2011) simpler approach is then employed through the Engle and Granger (1987)

[7] Perron (1997) suggest that either model A or C adequately model financial time series

methodology.[8] First, residuals are OLS estimated by regressing CDS on bond spreads. Then, predicted residuals stationarity is tested through the standard ADF test. When that condition is observed, errors variance is time-invariant and variables are considered to move together in the long run. That way, OLS regressing first difference cointegrated variables does not lead any more to misleading inferences.

However these findings are only indicative since long-run equilibrium condition between two markets allowing for a possible structural change cannot be tested through Engle and Granger method, such as Lehman Brothers for example.Therefore, we apply the Gregory and Hansen (1996) approach, where a single unknown structural change in the cointegrating relationship is tested under the alternative hypothesis. The authors argue that instead of thinking in a time invariant relationship between variables, cointegration could hold for some period of time, and then shifting to a new "long-run" equilibrium after the occurrence of a break in the time series. In order to account for a possible structural change, a dummy variable is incorporated in the regression:

$$\varphi_t = \begin{cases} 0, & \text{if } t \leq [n * \tau] \\ 1, & \text{if } t > [n * \tau] \end{cases}$$

Where the unknown parameter $\tau \in$ (0, 1) denoted the relative timing of the change point and [ ] denotes the integral part (Gregory Hansen 1996). This approach allows the testing of one structural change through the three forms:

$Bond\_Spread_t = \mu_1 + \mu_2 \varphi_{t\tau} +_t +\varepsilon_t$

[8] Results not illustrated here to save space, but available upon request

$$Bond\_Spread_t = \mu_1 + \mu_2\varphi_{t\tau} + \beta_t + _t + \varepsilon_t$$
$$Bond\_Spread_t = \mu_1 + \mu_2\varphi_{t\tau} + \alpha_1 CDS_t + \alpha_2 CDS_t\varphi_{t\tau} + \varepsilon_t$$
(4)

The first model tests for cointegration in the presence of a level shift in the time series (C), where μ_1 and μ_2 represent respectively the intercept before the break and the change in the intercept at the time of the level shift. Similar to the first model, model 2 tests for a constant shift while introducing a trend vector in the regression as well (C/T). In this case, β_t is the trend slope before the break and at the slope coefficient which is assumed to be constant. Under model 3, the cointegrating vector is allowed to both slope and shift parallel which is mentioned by authors as the regime shift model. The slope coefficient changes are represented in the α_{2t} variable while α_{1t} denotes the coefficients before the shift. Similar to Engle and Granger (1996), residuals are OLS regressed and then unit root tests are applied to the estimates. Then, both ADF and Philips-Perron Z_a and Z_t tests are sequentially employed across the break points, where the one that contains the smallest value (largest negative) is presented. For that break date, if the test statistic is lower than critical value, there is evidence of cointegration between the variables.

4.3.3 Structural Break Detection

In previous sections, testing for cointegration between CDS and bond market or for a stationary process were checked allowing for the occurrence of a single structural break in the time series. However, assuming that the CDS-Bond basis presents only one structural change during the comprised period could be misleading, particularly since it comprises several financial turbulent periods like the collapse of Lehman Brothers or the

European sovereign debt crisis. Therefore, it is proposed to test for the existence of multiple structural breaks in the CDS-Bond basis during the covered period.

Regarding this subject, an earlier method was presented by Garcia and Perron (1996) testing for the presence of two regime shifts in the US real interest rate through the sup-Wald test. The drawback behind their approach is again the limited number of structural breaks allowed.

In order to overcome the mentioned limitation, endogenously detected multiple structural change tests are applied through Bai and Perron (1998, 2003) methodology. The process allows to detect up to five break points and is disentangled in two different parts. First, a number of breaks limited to an upper bound (m) previously chosen are estimated based on the least squares principle (global optimization). Then, the breaks statistical significance using asymptotical critical values is tested through: (1) sup F type test where is tested the hypothesis of zero versus less or equal to *m* structural changes, (2) double maximum tests, *UDmax* and *WDmax*, where the null hypothesis of no structural breaks is tested against *m* structural changes and (3) sequential test sup F_t(l+1/l), for null hypothesis of l versus l+1 structural breaks. The optimal number of breaks is detected when the null hypothesis can no longer be rejected, that is, the critical value exceeds the test statistic. As suggested by Perron (2005), double maximum tests are first used in order to ascertain if any break is present.[9] In that case, break dates are then estimated through the sequential test

[9]The procedure of Bai and Perron (2003) also corrects for serial correlation and heteroskedasticity

sup F_t(l+1/l) test until it fails to reject the null hypothesis.[10]

4.4 The Determinants Of Basis Spread Changes

This section concludes by describing the main basis drivers used in literature and then present the ones to be applied in the study. According to several authors, namely Colin-Dufresne, Goldstein, et al. (2001), Ericsson, Jacobs and Oviedo (2009) among others, determinants like a firms leverage or market implied volatility increase and contain high explanatory power in explaining default risk. Hull, Pedrescu and White (2004) argue that credit rating downgrades lead in half of the cases CDS spreads and that negative correlation exists between them. On the other hand, authors document that positive credit rating events impact were less significant.

Blanco, Brennan et al.(2005) relied especially on market variables to analyse basis dynamics such as Stoxx indices implied volatility or the changes between 10- and 2-year treasury bonds to capture the slope of the yield curve. They concluded that the theoretical no arbitrage relation between CDS and bond spreads held for most firms included in their sample. Yet, for some European companies that was not the case, probably due to the cheapest-to-deliver option incorporated in some CDS contracts. Since the protection buyer delivers the most favourable (cheapest) bond in case of a credit event, the seller will require a higher premium to compensate for that risk which consequently increases the basis (Wit 2006).

Longstaff (2005) approach differentiates between default and non-default

[10]Only the break dates will be presented in order to save space, but the statistics are also available upon request

components when comparing CDS spreads to corporate yield spreads. The author states that default risk is predominantly priced in yield spreads, increasing particularly for speculative grade firms. Nevertheless, non-default factors such as corporate bond illiquidity are still significant at explaining credit spread changes, particularly bonds maturity, notional amount outstanding and bid-ask spreads. On the other hand, special treatment regarding tax asymmetry relative to Treasury over corporate bonds since the latter are not exempt, proved less significant.

Similar to Blanco et al. (2005), Zhu (2006) states that the equilibrium condition between CDS and tend to move together on the long-run i.e. are cointegrated, while in the short-term this no-arbitrage premise does not hold. For that purpose, the author provides several determinants to model the basis dynamics in panel organised data. They include equity indices as market conditions but also firm specific variables, such as lagged basis changes or incorporation of dummy variables relative to rating events, currency denomination, credit type and restructuring clause[11]. Besides, CDS aggregate number as well as bond bid-ask spreads are meant to infer the evolution of the firms liquidity condition.

With the advent of the financial crisis in 2008, several authors present a persistent negative basis during that period, namely Augustin (2012), Bai-Dufresne (2011), among others. As mentioned previously, before the financial turmoil literature focus fell particularly on default and liquidity risk in credit spreads. However, the persistent negative CDS-Bond basis during financial turmoil brought the attention of counterparty risk to the au-

[11] Modified Restructuring or Ordinary Restructuring

thors.

Fontana (2010) and Bai-Dufresne (2011) argue that no single factor can be appointed as the cause of breaking the no-arbitrage condition between CDS and markets but rather a set of drivers, namely funding, counterparty risk and collateral quality. Both authors emphasized the funding liquidity shortage and increase of counterparty risk during that period, through the Libor-OIS spread. The Libor-OIS spread should reflect the risk premium related to inter-bank lending and a higher gap increases the likelihood of counterparty default since lending conditions get severed between systemically important firms.

Therefore, this explanatory variable has a negative effect on the CDS-bond basis since a CDS buyer will be willing to pay less for protection if the counterparty probability to default increases. Augustin (2012) argues that during the subprime crisis, the basis dropped significantly less for the financial sector relatively to non-financial firms. The author argues that financial firms, particularly banks, were considered by governments as systemically important and often seen as *too big to fail*. Nevertheless, Lehman Brothers collapse could have changed that view and investors rushed to get protection on those firms which consequently increased CDS spreads and consequently the basis. In order to reach this conclusion, dummies were applied to differentiate between periods and sectors of activity.

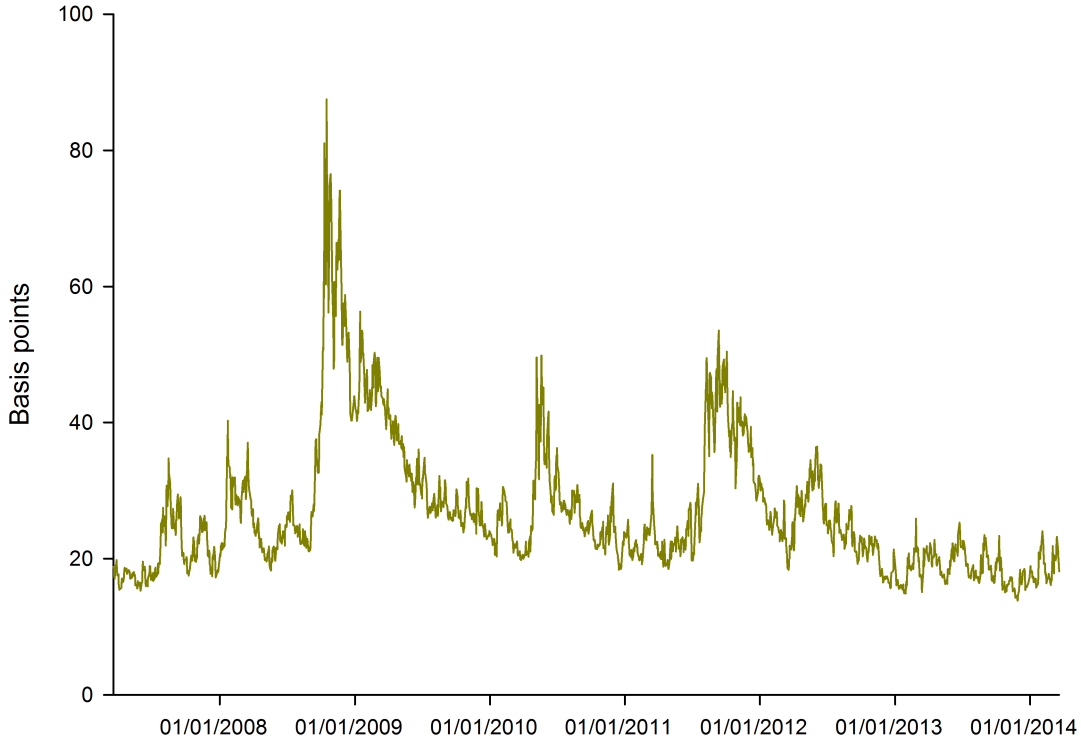
Based upon the literature regarding determinants of basis changes, the regression will apply the following variables:

4.4.1 Liquidity Factors and Market Volatility

Following Longstaff (2005) and Fontana (2010), CDS and bonds bid-ask spread (BAS) will be applied in order to assess how liquidity influences the basis dynamics during the period covered. Quotes for bid and ask CDS 5-year tenor were retrieved from Bloomberg financial terminal. Then, the spread is simply computed as the difference between ask and bid quotation. Regarding bond spreads, as we face the same maturity matching problem mentioned previously, the same procedure when computing the CDS-Bond basis is applied. For every bond included in the basket of bonds, the bid-ask spread is calculated and then regressed on their maturities to obtain the constant 5-year tenor.(Gaspar and Fonseca 2011)

Following the advices from Oviedo (2009), Zhang, Zhou and Zhu (2009), Blanco et al. (2005), among others, VSTOXX,a volatility index based on Euro Stoxx 50 option meant to measure the overall European market long-term volatility is also included in the analysis. Figure 3 reports the index evolution in the comprised period:

Figure 3 VSTOXX evolution

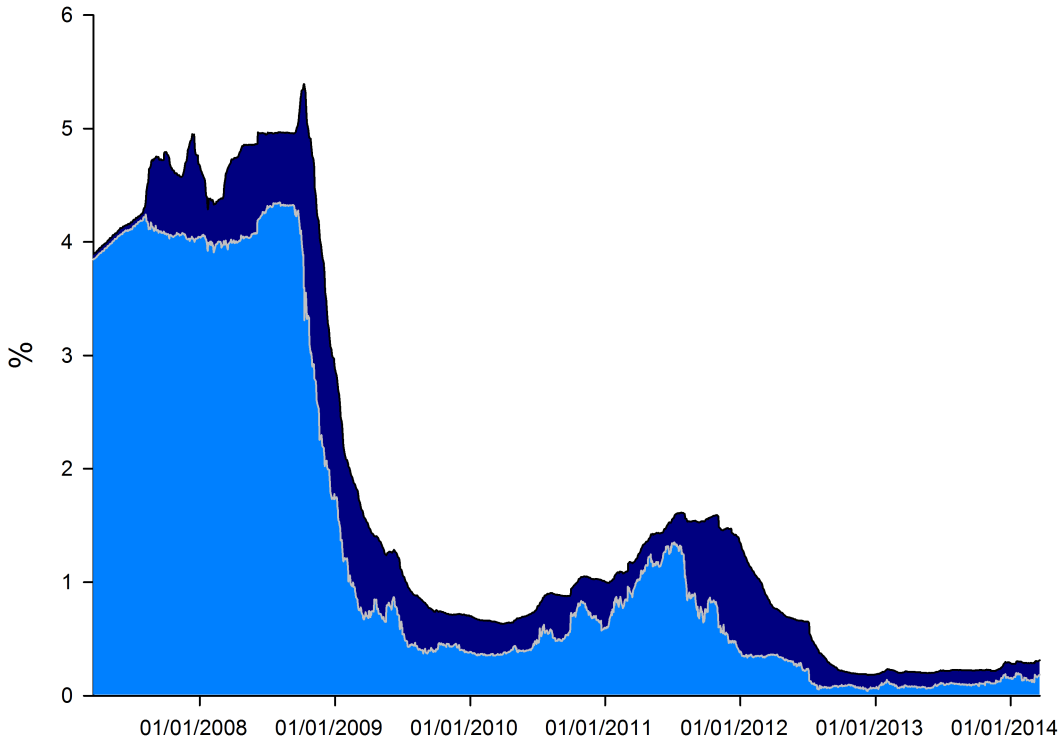


4.4.2 Counterparty Risk

In order to account for the fact a counterparty at some point may fail to meet its obligations in case of a credit event, three proxies are employed in the analysis: (A) the Euribor-EONIA spread (equivalent to LIBOR-OIS for Europe) as stated by Fontana (2010), is an indicator of both funding liquidity and counterparty risk in the context of inter banking lending[12]. Therefore, increasing spread is associated with lender's belief that the risk of default on interbank loans is higher. Figure 4 presents the evolution of the Euribor - EONIA spread:

[12]banks are among the major CDS dealers

Figure 4 Euribor 3 Month - EONIA Spread



Beginning in the second half of 2007, Euribor-EONIA spread became rather unstable with large fluctuations, particularly with Lehman Brothers collapse in September 2008, where the spread increased to nearly 200 basis points in 10 trading days. Then in 2009, markets and consequently credit conditions began to stabilize until the fear of a Greek sovereign default in 2011 led again to a gap widening, reaching the 100 basis points.

(B) The second proxy for counterparty risk follows the approach presented in Morkoetter, Pleus and Westerfeld (2012) where first is constructed

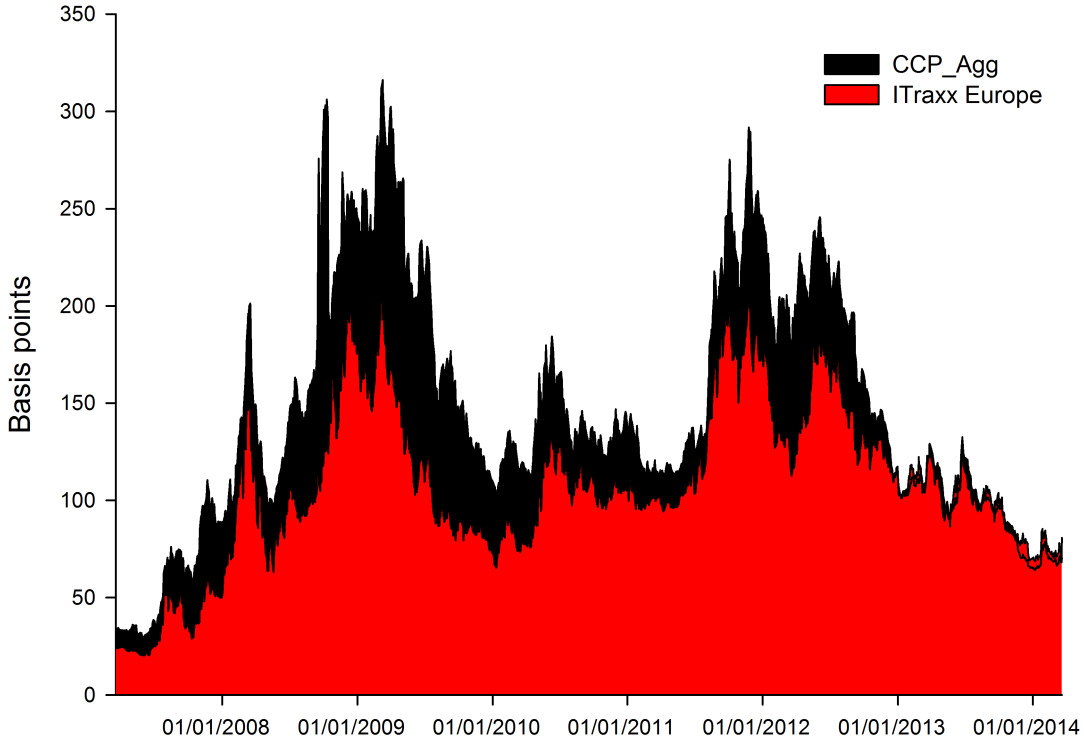
an equally weighted index constituted by the primary dealers in the CDS market. The introduction of central clearing counterparties (CCP) in meant to standardize the market and reduce counterparty risk to minimal levels as CCP is responsible for every contracts settlement. Therefore, ICE Clear Europe member's can be considered to reflect the major dealers in the market.[13] Although imperfect, this assumption is believed to represent the most active and competitive counterparties in the market. The proxy attempts to measure aggregate counterparty risk through a comparison between the overall creditworthiness of the primary dealers and ITraxx Europe index, the overall CDS market credit risk. Intuitively, a widening gap indicates increasing counterparty risk as it represents higher probability of major dealers default comparing with the overall European CDS market. Formally:

$$CCP\_Agg\_t = \frac{Barclays_t + BNP_t + HSBC_t + ...}{n} - ITraxx\_Europe_t \quad (5)$$

Figure 4 documents the spread between between this variable:

[13]With exception to Lehman Brothers, major dealers in the CDS market on the subprime crisis were the same as the ones included in ICE Clear Europe(Vause 2010)

Figure 5 Evolution of Aggregate Counterparty Market Risk



The figure points out that widening gaps can be observed during subprime crisis and European debt crisis, reaching inclusively once a maximum 130 basis points.Surprisingly during the past year, the spread observed was negative, indicating a low risk of counterparty default as overall market is perceived as riskier. A possible interpretation could relate to clearing house implementation effects on the CDS market.(Duffie and Zhu 2011)

(C) Following Augustin (2012) and Bai-Dufresne (2011) approach, counterparty exposure can also be measured through an estimated beta between a firm and the index constituted by CDS spreads of primary dealers

(market).[14] Unlike the previous proxy that focus on the risk related to the overall CDS market, the betas mean to represent the firm specific credit risk compared to the index constituted by the major dealers. The interpretation behind this variable is rather simple: a higher $\beta_{i,cp}$ increases the probability of counterparty default and less valuable is expected to be the protection relative to the purchase of a CDS contract. The proxy is computed in the following way:

$$\beta_{i,cp} = \frac{cov(CDS_i, CDS_{index})}{var(CDS_{index})} \quad (6)$$

Then, betas are estimated recursively with a rolling window of 250 days, usually the number of annual trading days to capture the firm counterparty risk during the covered period. The drawback behind this approach is the loss of the first 249 days in the sample. Nevertheless the analysis is not severely affected since analysis is performed on 1500 observation dates for each one of the 74 firms included in the sample.

After ensuring that every variable is first difference stationary, the following regression was applied for the 74 firms under analysis:

$$\Delta(CDS\_Bond\_Basis)_t = \beta_1\Delta(EUEO)_t + \beta_2\Delta\left(BAS^{CDS}\right)_t + \beta_3\Delta\left(BAS^{Bonds}\right)_t + \beta_4\Delta(CCP\_Agg)_t + \beta_5\Delta(Beta)_t + \beta_6\Delta(VSTOXX)_t + \varepsilon_t \quad (7)$$

[14] The same assumptions applied in the previous proxy are also applied here

5 Analysis of the Results

5.1 Long-Run Movement

This section presents the results for the presence of a unit root and cointegration relationship between CDS and bond spreads, comparing break with no break condition.

Regarding stationarity testing that accounts for a structural break while performing Zivot and Andrews (1992), 7 out of 74 revealed to be stationary with breaks. It is worth mentioning that in those firms that followed a stationary process, structural breaks were detected either during the Euro sovereign crisis period for financial companies or during the first semester of 2009, for the industry sector (with the exception of Compagnie Cie), shortly after the subprime crisis and when main reforms were implemented in the CDS market (Bing Bang protocol)

Considering cointegration analysis, Engle and Granger test concludes that in 55% of the cases CDS and bond spreads move together in the long-run. In the financial sector, where 9 out of 13 firms were cointegrated. Nevertheless, while accounting for the presence of a break in the cointegration relationship, the null hypothesis is rejected for 70% of the cases, with special emphasis on the financial sector where this occurred for 10 out of 13. This results points that often we could be misled to believe that financial data follow a unit root process, while in fact they are stationary and only a large shock has deviated them temporarily from constant mean and variance. Increased percentage corroborate this statement.

5.2 CDS-Bond Basis Structural Breaks

Table 10 reports the structural breaks detected in the time series using Bai and Perron (1998, 2003) method. A total number of 141 unknown changes in the basis were detected for 69 firms.[15]. In 11 of those cases, break dates can be explained by subprime crisis events, namely Bear Sterns acquisition and Lehman Brothers collapse in March and September 2008 respectively. 20% of the structural changes occurred in 2009 when credit condition began to stabilize and reforms were implemented in the CDS market. Financial support for Ireland, Greece and Portugal on April, May 2010 and May 2011 respectively explain 45 out of 148 structural breaks. In total the European Sovereign Debt crisis is responsible for 66% of the breaks. Besides, 14 breaks were detected around the period in which Greece could not meet their obligations (March 2012).

5.3 Multivariate Regressions

Table 11 presents the CDS-Bond basis regression results for the financial firms. Results show that the proxy's chosen better explain the variation in the CDS-Bond basis in the after break period. Besides, it is fair to mention firm specific counterparty beta effect on the basis increases substantially also after the breaks.

Regarding CDS liquidity proxy, it proved significant only for 30% of the total firms with a negative effect in the basis as expected. Bonds bid ask spread have little significance in explaining basis dynamics particularly for the financial sector. On the other hand, market option implied volatility proxy VSTOXX, was highly significant in most of the cases and had an aver-

[15]for Deutsche Bank, Siena, Casino, Swedish and Unilever no structural change could be found

age positive effect of 100 basis points on the basis. Since higher volatility is related to an increase of an entity default risk, this shows that CDS spreads are more sensitive to VSTOXX changes than bond yield spreads. The Euribor-EONIA spread proved significant in half of the sample with an overall large effect on the CDS-Bond basis. In some cases, a one percent increase in funding risk leads to an increase of nearly 4% in the basis. Surprisingly, for some firms a negative sign was observed, possibly indicating that for those, counterparty risk is significantly priced in the basis. Since the sampling period comprises two financial turmoil events, there is the risk that both markets were not pricing efficiently credit risk which could bias the analysis. Market wide counterparty risk measured by the spread between the primary dealers and ITraxx Europe index is statistically relevant for 86% of the firms. While the risk of a counterparty default presents a negative sign, its effect can be considered rather small since the coefficient is close to zero. On the other hand, when considering firm specific counterparty betas, significance is found in 48 out of 74 companies with mix results of impact in the basis. Only in 30% of the financial sector results were statistically significant, where a higher beta by one standard deviation increases the CDS-Bond basis on average in 150 basis points. The only exception was BNP Paribas which presented a decrease of 330 basis points.

6 Conclusion and Future Research

This study focused on assessing whether the no arbitrage condition between CDS and bond markets held during the period covered. Apart from liquidity issues related to the choice of risk less benchmark, this par-

ity relation holds during normal times. Nevertheless, when markets suffer from financial instability a negative impact arises around the basis. Results report that market conditions deteriorated more for non financial firms during Lehman Brothers collapse while the reverse was observed in the European sovereign debt crisis period. Counterparty risk effect on basis dynamics after the break detected increased substantially, possibly confirming that before this type of risk was not correctly priced.

Cointegration tests performed on the basis suggest an increasing percentage of long run movement between CDS and bond spreads in the firms included in the sample, when considering structural change in the time series. Engle and Granger test documented cointegration in 55% of the firms, contrasting with 50 out of 74 companies found in Gregory and Hansen (1996) test.

Structural break detection revealed the existence of several changes in the basis, where a total of 148 break dates were found falling particularly on the 2011/2012 crisis but also on the subprime crisis period.

Further analysis of the basis could focus on assessing the lead-lag relationship between CDS and Bond markets in the presence of a structural break, through a rolling Granger Causality test. Both unit root and cointegration testing across this study account for the possibility of only one break in the time series. So, future research could extend the analysis to multiple changes, such as the methodology presented in Westerlund (2005). Besides, it could relate the implementation of a clearing counterparty effects on the CDS-Bond basis and its implications relative to counterparty risk.

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Table 3 Dataset Description

Financial Sector	Ticker	Country	Rating	Clearing Date	Entity	Ticker	Country	Rating	Clearing Date
Allianz SE	ALV	Germany	A	10/05/2010	Commerzbank	CBK	Germany	A	-
Axa	CS	France	A	10/05/2010	Deutsche Bank	DB	Germany	A	-
Barclays	BARC	UK	BBB	-	Generali	ASSGEN	Italy	A	10/05/2010
Banca Monte Dei Paschi Di Siena S.P.A	BMPS	Italy	-	10/05/2010	HSBC	HSBA	UK	BBB	-
Muenchener Rueckversicherungs	MUV2	Germany	BBB	03/05/2011	Intesa Sanpaolo	ISP	Italy	AA	10/05/2010
Banco Santander, S.A	SAN	Spain	AA	10/05/2010	BNP Paribas	BNP	France	A	-
BBVA	BBVA	Spain	A	10/05/2010					
Energy Sector									
EDP - Energias de Portugal, S.A	EDP	Portugal	BB	11/01/2010	EnBW	EBK	Germany	A	11/01/2010
Electricite de France	EDF	France	A	11/01/2010	Enel	ENEL	Italy	BBB	14/12/2009
United Utilities PLC	UU	UK	BBB	11/01/2010	E.ON AG	EOAN	Germany	A	14/12/2009
Vattenfall Aktiebolag	VATT	Sweden	NR	11/01/2010	Centrica PLC	CNA	UK	A	14/12/2009
Veolia Environment	VIE	France	BBB	11/01/2010	ENI SPA	ENI	Italy	A	03/03/2014
Gas Natural SDG, S.A	GAS	Spain	BBB	11/01/2010	Fortum Oyj	FUM1V	Finland	A	11/01/2010
GDF Suez	GSZ	France	A	11/01/2010	Repsol YPF S.A	REP	Spain	BBB	08/03/2010
Iberdrola, S.A	IBE	Spain	BBB	11/01/2010	RWE	RWE	Germany	BBB	11/01/2010
National Grid PLC	NG	UK	A	11/01/2010					
Consumer									
LVMH Moet Hennesy Louis Vitton	MC	France	A	08/03/2010	Metro AG	MEO	Germany	BBB	29/03/2010
Casino Guichard-Perrachon	CO	France	BBB	29/03/2010	Pernod Ricard	RI	France	BBB	03/03/2014
Compass Group SA	CPG	UK	A	29/03/2010	Sodexo	SW	France	A	29/03/2010
Imperial Tobacco Group PLC	IMT	UK	BBB	11/04/2011	Airbus	AIR	France	A	-
Experian Finance PLC	EXPN	UK	A	29/03/2010	Tesco PLC	TSCO	UK	BBB	29/03/2010
Groupe Auchan	AUCHAN	France	A	29/03/2010	Unilever N.V	ULVR	UK	A	11/01/2010
Kingfisher PLC	KGF	UK	BBB	11/04/2011	Carrefour	CA	France	BBB	29/03/2010
Swedish Match AB	SWMA	Sweden	BBB	11/04/2011	Diageo PLC	DGE	UK	A	08/03/2010
Danone	BN	France	A	08/03/2010					
Auto&Industrials									
Adecco SA	ADEN	Switzerland	BBB	15/02/2010	Deutsche Post AG	DPW	Germany	-	15/02/2010
AKZO Nobel N.V	AKZO	Netherlands	BBB	19/04/2010	Koninklijke DSM NV	DSM	Netherlands	A	19/04/2010
BASF SE	BAS	Germany	A	19/04/2010	Holcim Ltd	HOLN	Switzerland	BBB	15/02/2010
BMW	BMW	Germany	A	08/03/2010	PostNL NV	PNL	Netherlands	BBB	12/12/2011
Bouygues	EN	France	BBB	11/04/2011	Siemens	SIE	Germany	A	15/02/2010
Compagnie De Saint-Gobain	SGO	France	BBB	15/02/2010	Sanofi-Aventis	SAN	France	AA	10/05/2010
Daimler AG	DAI	Germany	A	08/03/2010	Volkswagen	VOW	Germany	A	08/03/2010
TMT									
British Telecommunications	BT/A	UK	BBB	01/02/2010	Telecom Italia SPA	TIT	Italia	BB	01/02/2010
Deutsche Telekom AG	DTE	Germany	BBB	01/02/2010	Telefonica SA	TEF	Spain	BBB	01/02/2010
Koninklijke KPN N.V	KPN	Netherlands	BBB	01/02/2010	Telenor Asa	TEL	Norway	A	01/02/2010
Orange	ORA	France	BBB	01/02/2010					
Portugal Telecom	PTC	Portugal	-	01/02/2010	Vivendi	VIV	France	BBB	01/02/2010
Publicis Groupe SA	PUB	France	BBB	29/03/2010	Vodafone PLC	VOD	UK	A	01/02/2010
TeliaSonera Aktiebolag	TLSN	Sweden	A	01/02/2010	Wolters Kluwer NV	WKL	Netherlands	BBB	29/03/2010

Table 4 Primary Dealers List

Entity
Barclays
Bank of America Merrill Lynch
BNP Paribas
Citigroup
Credit Suisse
Deutsche Bank
Goldman Sachs
HSBC
JPMorgan
Morgan Stanley
Nomura
UBS

Source: https://www.theice.com/publicdocs/ICEU_CDS_Client_Clearing.pdf

Table 5 ZA Test: CDS Levels

Entity	t-stat	Conclusion	Break date	Entity	t-stat	Conclusion	Break date
Allianz SE	-4.424	Unit Root***	01/09/2011	British Telecommunications	-1.871	Unit Root*	14/05/2009
Axa	-4.690	Unit Root***	27/07/2011	Deutsche Telekom AG	-2.174	Unit Root***	04/11/2008
Barclays	-4.477	Unit Root***	02/08/2011	Koninklijke KPN N.V	-1.419	Unit Root***	08/07/2011
BBVA	-5.829	Stationary	20/03/2012	Portugal Telecom	-1.04	Unit Root*	07/06/2011
BNP Paribas	-6.376	Stationary	27/07/2011	Publicis Groupe SA	-1.255	Unit Root***	06/01/2009
Commerzbank	-5.259	Unit Root*	05/07/2011	Telecom Italia SPA	-2.215	Unit Root***	05/07/2011
Deutsche Bank	-5.311	Unit Root*	02/08/2011	Telefonica SA	-1.906	Unit Root***	05/07/2011
Generali	-5.431	Unit Root***	23/07/2011	Telenor Asa	-1.382	Unit Root***	07/03/2009
HSBC	-4.188	Unit Root***	02/08/2011	TeliaSonera Aktiebolag	-2.307	Unit Root***	07/03/2009
Intesa Sanpaolo	-5.463	Unit Root*	23/07/2011	Vivendi	-2.014	Unit Root***	06/01/2009
Muenchener Rueckversicherungs	-4.434	Unit Root***	08/02/2011	Vodafone PLC	-1.454	Unit Root**	09/12/2008
Banco Santander, S.A	-5.495	Unit Root*	20/03/2012	Orange	-2.618	Unit Root***	27/07/2011
Banca Siena	-3.79	Unit Root***	20/03/2012	Wolters Kluwer NV	-3.087	Unit Root***	06/01/2009
Centrica PLC	-5.163	Unit Root*	17/12/2008	Carrefour	-5.352	Unit Root*	02/08/2011
E.ON AG	-4.056	Unit Root***	27/07/2011	Compass Group SA	-4.18	Unit Root***	23/03/2011
EDP - Energias de Portugal, S.A	-5.325	Unit Root*	05/07/2011	Casino Guichard-Perrachon	-4.367	Unit Root***	06/01/2009
Electricite de France	-4.138	Unit Root***	23/07/2011	Danone	-4.642	Unit Root***	03/01/2009
EnBW	-4.7	Unit Root***	27/07/2011	Diageo PLC	-4.889	Unit Root***	13/09/2008
Enel	-3.59	Unit Root***	03/02/2009	Experian Finance PLC	-4.572	Unit Root***	15/04/2008
Fortum Oyj	-4.365	Unit Root***	06/01/2009	Groupe Auchan	-5.221	Unit Root*	02/08/2011
Gas Natural SDG, S.A	-3.598	Unit Root**	20/03/2012	Imperial Tobacco Group PLC	-5.759	Stationary	03/04/2009
GDF Suez	-4.926	Unit Root*	27/07/2011	Kingfisher PLC	-6.119	Stationary	06/01/2009
Iberdrola, S.A	-4.436	Unit Root***	20/03/2012	LVMH	-5.304	Unit Root*	02/04/2009
National Grid PLC	-4.835	Unit Root**	02/04/2009	Metro AG	-4.439	Unit Root***	02/04/2009
RWE	-4.23	Unit Root***	27/07/2011	Sodexo	-4.268	Unit Root***	11/03/2009
United Utilities PLC	-4.034	Unit Root***	11/01/2013	Pernod Ricard	-6.196	Stationary	28/03/2009
Vattenfall Aktiebolag	-3.727	Unit Root***	08/04/2009	Swedish Match AB	-4.736	Unit Root***	10/12/2008
Veolia Environment	-5.04	Unit Root**	29/07/2011	Tesco PLC	-4.581	Unit Root***	02/04/2009
ENI SPA	-4.881	Unit Root**	06/07/2011	Unilever N.V	-3.879	Unit Root***	06/01/2009
Repsol YPF S.A	-3.662	Unit Root***	22/02/2012	Airbus	-3.995	Unit Root***	03/01/2009
Adecco SA	-3.772	Unit Root***	03/08/2011	Deutsche Post AG	-3.272	Unit Root***	27/01/2009
AKZO Nobel N.V	-4.144	Unit Root***	03/04/2009	Koninklijke DSM NV	-4.762	Unit Root***	07/04/2009
BASF SE	-4.062	Unit Root***	19/03/2009	Holcim Ltd	-4.724	Unit Root***	03/01/2009
BMW	-5.603	Stationary	10/03/2009	Siemens	-5.217	Unit Root*	03/04/2009
Bouygues	-3.857	Unit Root***	06/01/2009	Sanofi-Aventis	-4.263	Unit Root***	01/04/2009
Compagnie De Saint-Gobain	-5.77	Stationary	23/07/2011	Volkswagen	-5.603	Stationary	01/04/2009
Daimler AG	-4.004	Unit Root*	11/01/2013	PostNL NV	-5.231	Unit Root***	10/03/2009

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively. Critical values: -5.57 at 1%, -5.08 at 5% and -4.82 at 10% level.

Table 6 ZA test: $\Delta(CDS)$

Entity	t-stat	Conclusion	Break date	Entity	t-stat	Conclusion	Break date
Allianz SE	-18.764	Stationary	10/03/2009	British Telecommunications	-17.776	Stationary	02/04/2009
Axa	-18.543	Stationary	26/11/2011	Deutsche Telekom AG	-16.891	Stationary	02/11/2008
Barclays	-22.061	Stationary	07/10/2008	Koninklijke KPN N.V	-24.751	Stationary	15/04/2008
BBVA	-25.367	Stationary	25/07/2012	Portugal Telecom	-15.213	Stationary	05/07/2012
BNP Paribas	-21.564	Stationary	24/11/2011	Publicis Groupe SA	-16.274	Stationary	17/12/2008
Commerzbank	-19.642	Stationary	30/11/2011	Telecom Italia SPA	-24.029	Stationary	25/07/2012
Deutsche Bank	-20.298	Stationary	27/11/2011	Telefonica SA	-17.699	Stationary	25/07/2012
Generali	-19.554	Stationary	24/07/2012	Telenor Asa	-16.995	Stationary	13/03/2009
HSBC	-18.312	Stationary	13/03/2009	TeliaSonera Aktiebolag	-16.797	Stationary	15/04/2008
Intesa Sanpaolo	-24.659	Stationary	26/11/2011	Vivendi	-17.319	Stationary	30/12/2008
Muenchener Rueckversicherungs	-25.084	Stationary	10/03/2009	Vodafone PLC	-18.965	Stationary	09/12/2008
Banco Santander, S.A	-23.598	Stationary	25/07/2012	Orange	-18.1	Stationary	15/04/2008
Banca Siena	-23.394	Stationary	21/04/2011	Wolters Kluwer NV	-16.501	Stationary	15/04/2008
Centrica PLC	-16.701	Stationary	12/12/2008	Carrefour	-19.573	Stationary	24/07/2012
E.ON AG	-16.434	Stationary	28/10/2008	Compass Group SA	-19.413	Stationary	07/12/2008
EDP - Energias de Portugal, S.A	-18.109	Stationary	19/06/2012	Casino Guichard-Perrachon	-17.457	Stationary	06/12/2008
Electricite de France	-19.022	Stationary	16/12/2008	Danone	-17.493	Stationary	08/12/2008
EnBW	-17.166	Stationary	07/10/2011	Diageo PLC	-17.286	Stationary	08/12/2008
Enel	-16.298	Stationary	14/12/2008	Experian Finance PLC	-19.008	Stationary	15/04/2008
Fortum Oyj	-17.955	Stationary	16/12/2008	Groupe Auchan	-18.735	Stationary	17/01/2012
Gas Natural SDG, S.A	-17.193	Stationary	07/04/2009	Imperial Tobacco Group PLC	-14.613	Stationary	30/10/2008
GDF Suez	-16.372	Stationary	17/12/2008	Kingfisher PLC	-21.963	Stationary	05/12/2008
Iberdrola, S.A	-19.769	Stationary	27/07/2012	LVMH	-18.571	Stationary	21/11/2008
National Grid PLC	-17.443	Stationary	19/12/2008	Metro AG	-15.648	Stationary	02/12/2008
RWE	-18.599	Stationary	24/11/2011	Sodexo	-22.116	Stationary	07/12/2009
United Utilities PLC	-17.426	Stationary	19/09/2012	Pernod Ricard	-16.592	Stationary	21/12/2008
Vattenfall Aktiebolag	-20.825	Stationary	16/12/2008	Swedish Match AB	-17.803	Stationary	26/10/2008
Veolia Environment	-16.442	Stationary	28/10/2008	Tesco PLC	-18.794	Stationary	06/12/2008
ENI SPA	-15.202	Stationary	16/12/2008	Unilever N.V	-22.637	Stationary	09/12/2008
Repsol YPF S.A	-19.204	Stationary	17/12/2008	Airbus	-15.748	Stationary	13/12/2008
Adecco SA	-16.996	Stationary	05/01/2013	Deutsche Post AG	-17.647	Stationary	28/10/2008
AKZO Nobel N.V	-16.812	Stationary	05/10/2011	Koninklijke DSM NV	-18.008	Stationary	16/12/2008
BASF SE	-26.016	Stationary	06/12/2008	Holcim Ltd	-21.173	Stationary	05/12/2008
BMW	-16.4	Stationary	14/12/2008	Siemens	-16.685	Stationary	09/12/2008
Bouygues	-18.186	Stationary	14/12/2008	Sanofi-Aventis	-17.001	Stationary	16/12/2008
Compagnie De Saint-Gobain	-18.274	Stationary	14/12/2008	Volkswagen	-17.21	Stationary	13/12/2008
Daimler AG	-16.167	Stationary	07/12/2008	PostNL NV	-15.838	Stationary	15/07/2008

Critical values: -5.57 at 1%, -5.08 at 5% and -4.82 at 10% level.

Table 7 ZA Test: Bond spreads

Entity	t-stat	Conclusion	Break date	Entity	t-stat	Conclusion	Break date
Allianz SE	-3.260	Unit Root***	12/07/2011	British Telecommunications	-5.838	Stationary	03/01/2009
Axa	-5.662	Stationary	21/04/2009	Deutsche Telekom AG	-4.668	Unit Root***	25/11/2008
Barclays	-5.289	Unit Root*	01/01/2009	Koninklijke KPN N.V	-5.539	Unit Root*	29/01/2009
BBVA	-3.63	Unit Root***	21/03/2012	Portugal Telecom	-4.804	Unit Root***	02/06/2011
BNP Paribas	-4.749	Unit Root***	04/08/2011	Publicis Groupe SA	-3.053	Unit Root***	11/02/2009
Commerzbank	-3.417	Unit Root***	10/02/2009	Telecom Italia SPA	-3.661	Unit Root***	04/04/2009
Deutsche Bank	-4.065	Unit Root***	12/05/2009	Telefonica SA	-3.893	Unit Root***	21/03/2012
Generali	-4.119	Unit Root***	08/07/2011	Telenor Asa	-6.877	Stationary	12/05/2009
HSBC	-5.795	Stationary	06/07/2011	TeliaSonera Aktiebolag	-4.916	Unit Root**	09/12/2008
Intesa Sanpaolo	-5.795	Stationary	06/07/2011	Vivendi	-5.356	Unit Root*	02/01/2009
Muenchener Rueckversicherungs	-4.956	Unit Root*	05/08/2011	Vodafone PLC	-6.099	Stationary	07/04/2009
Banco Santander, S.A	-6.474	Stationary	03/09/2011	Orange	-5.473	Unit Root*	13/12/2008
Banca Siena	-5.963	Stationary	08/07/2011	Wolters Kluwer NV	-4.815	Unit Root***	06/01/2009
Centrica PLC	-5.452	Unit Root***	02/12/2008	Carrefour	-3.605	Unit Root***	05/08/2011
E.ON AG	-4.759	Unit Root***	26/11/2008	Compass Group SA	-6.076	Stationary	05/05/2009
EDP - Energias de Portugal, S.A	-6.63	Stationary	06/07/2011	Casino Guichard-Perrachon	-4.333	Unit Root***	13/07/2011
Electricite de France	-3.58	Unit Root***	08/04/2009	Danone	-5.283	Unit Root*	27/11/2008
EnBW	-4.547	Unit Root***	18/04/2009	Diageo PLC	-4.619	Unit Root***	25/09/2008
Enel	-5.297	Unit Root*	05/07/2011	Experian Finance PLC	-7.196	Stationary	10/06/2009
Fortum Oyj	-5.246	Unit Root*	16/04/2009	Groupe Auchan	-4.57	Unit Root***	11/03/2009
Gas Natural SDG, S.A	-4.665	Unit Root***	29/03/2012	Imperial Tobacco Group PLC	-4.536	Unit Root***	04/04/2009
GDF Suez	-6.074	Stationary	09/01/2009	Kingfisher PLC	-7.152	Stationary	08/04/2009
Iberdrola, S.A	-3.448	Unit Root***	20/03/2012	LVMH	-4.623	Unit Root***	03/09/2008
National Grid PLC	-5.052	Unit Root**	07/12/2010	Metro AG	-5.026	Unit Root**	04/04/2009
RWE	-4.946	Unit Root***	11/12/2008	Sodexo	-5.806	Stationary	11/03/2009
United Utilities PLC	-7.926	Stationary	06/03/2009	Pernod Ricard	-5.562	Unit Root*	28/05/2009
Vattenfall Aktiebolag	-6.003	Stationary	17/03/2009	Swedish Match AB	-5.848	Stationary	16/01/2009
Veolia Environment	-4.253	Unit Root***	29/04/2009	Tesco PLC	-4.707	Unit Root***	06/12/2008
ENI SPA	-3.47	Unit Root***	12/07/2011	Unilever N.V	-4.036	Unit Root***	10/12/2008
Repsol YPF S.A	-5.996	Stationary	09/12/2011	Airbus	-4.726	Unit Root***	06/03/2009
Adecco SA	-4.949	Unit Root**	07/11/2008	Deutsche Post AG	-3.308	Unit Root***	05/06/2012
AKZO Nobel N.V	-5.079	Unit Root**	05/05/2009	Koninklijke DSM NV	-5.302	Unit Root*	10/03/2009
BASF SE	-4.607	Unit Root***	21/04/2009	Holcim Ltd	-5.313	Unit Root*	07/10/2008
BMW	-5.73	Stationary	25/03/2009	Siemens	-4.904	Unit Root**	10/06/2008
Bouygues	-3.772	Unit Root***	06/01/2009	Sanofi-Aventis	-5.916	Stationary	20/05/2009
Compagnie De Saint-Gobain	-4.755	Unit Root***	03/04/2009	Volkswagen	-6.151	Stationary	09/05/2009
Daimler AG	-5.402	Unit Root*	08/04/2009	PostNL NV	-3.282	Unit Root***	05/05/2009

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively. Critical values: -5.57 at 1%, -5.08 at 5% and -4.82 at 10% level.

Table 8 ZA test: $\Delta(Bondspread)$

Entity	t-stat	Conclusion	Break date	Entity	t-stat	Conclusion	Break date
Allianz SE	-16.167	Stationary	23/10/2008	British Telecommunications	-16.22	Stationary	29/12/2008
Axa	-21.882	Stationary	21/04/2009	Deutsche Telekom AG	-14.44	Stationary	19/10/2008
Barclays	-16.344	Stationary	03/01/2009	Koninklijke KPN N.V	-15.42	Stationary	28/10/2008
BBVA	-13.532	Stationary	16/11/2008	Portugal Telecom	-14.94	Stationary	01/02/2012
BNP Paribas	-18.53	Stationary	30/03/2012	Publicis Groupe SA	-16.17	Stationary	09/12/2008
Commerzbank	-19.02	Stationary	24/04/2009	Telecom Italia SPA	-15.59	Stationary	28/10/2008
Deutsche Bank	-18.542	Stationary	02/11/2011	Telefonica SA	-15.38	Stationary	26/07/2012
Generali	-16.958	Stationary	08/01/2009	Telenor Asa	-20.48	Stationary	31/12/2008
HSBC	-16.793	Stationary	13/03/2009	TeliaSonera Aktiebolag	-17.09	Stationary	07/11/2008
Intesa Sanpaolo	-18.665	Stationary	29/11/2011	Vivendi	-16.15	Stationary	29/10/2008
Muenchener Rueckversicherungs	-19.156	Stationary	20/02/2009	Vodafone PLC	-22.27	Stationary	15/01/2009
Banco Santander, S.A	-15.036	Stationary	05/11/2011	Orange	-17.99	Stationary	14/10/2008
Banca Siena	-15.912	Stationary	01/12/2011	Wolters Kluwer NV	-22.27	Stationary	15/01/2009
Centrica PLC	-26.793	Stationary	09/04/2008	Carrefour	-18.32	Stationary	26/11/2008
E.ON AG	-14.759	Stationary	20/10/2008	Compass Group SA	-14.98	Stationary	03/11/2008
EDP - Energias de Portugal, S.A	-14.996	Stationary	10/06/2012	Casino Guichard-Perrachon	-22.33	Stationary	28/11/2008
Electricite de France	-32.77	Stationary	15/12/2008	Danone	-12.47	Stationary	14/04/2008
EnBW	-18.616	Stationary	19/11/2008	Diageo PLC	-10.33	Stationary	06/11/2008
Enel	-18.619	Stationary	30/11/2011	Experian Finance PLC	-16.42	Stationary	06/01/2009
Fortum Oyj	-18.139	Stationary	06/01/2009	Groupe Auchan	-19.08	Stationary	29/10/2008
Gas Natural SDG, S.A	-17.727	Stationary	29/06/2012	Imperial Tobacco Group PLC	-16.17	Stationary	11/11/2008
GDF Suez	-17.009	Stationary	28/01/2009	Kingfisher PLC	-15.31	Stationary	28/12/2008
Iberdrola, S.A	-21.626	Stationary	26/07/2012	LVMH	-17.35	Stationary	24/04/2008
National Grid PLC	-20.298	Stationary	05/10/2008	Metro AG	-15.19	Stationary	02/11/2008
RWE	-17.394	Stationary	25/11/2008	Sodexo	-15.58	Stationary	07/02/2009
United Utilities PLC	-16.849	Stationary	05/12/2008	Pernod Ricard	-15.81	Stationary	05/11/2008
Vattenfall Aktiebolag	-21.981	Stationary	03/12/2008	Swedish Match AB	-15.54	Stationary	07/04/2009
Veolia Environment	-16.051	Stationary	01/11/2008	Tesco PLC	-20.78	Stationary	02/11/2008
ENI SPA	-16.213	Stationary	23/12/2008	Unilever N.V	-15.75	Stationary	19/10/2008
Repsol YPF S.A	-21.28	Stationary	29/06/2012	Airbus	-14.52	Stationary	19/12/2008
Adecco SA	-15.349	Stationary	21/11/2008	Deutsche Post AG	-16.85	Stationary	19/02/2009
AKZO Nobel N.V	-17.208	Stationary	25/11/2008	Koninklijke DSM NV	-16.15	Stationary	23/03/2009
BASF SE	-16.655	Stationary	25/01/2009	Holcim Ltd	-16.49	Stationary	22/10/2008
BMW	-13.325	Stationary	28/10/2008	Siemens	-16.18	Stationary	06/01/2009
Bouygues	-19.458	Stationary	14/12/2008	Sanofi-Aventis	-17.43	Stationary	19/10/2008
Compagnie De Saint-Gobain	-16.236	Stationary	25/11/2008	Volkswagen	-14.7	Stationary	28/10/2008
Daimler AG	-13.555	Stationary	26/10/2008	PostNL NV	-18.02	Stationary	02/11/2008

Critical values: -5.57 at 1%, -5.08 at 5% and -4.82 at 10% level.

Table 9 Cointegration Results with Structural Break

Entity	t-stat	Conclusion	Break date	Entity	t-stat	Conclusion	Break date
Allianz SE	-5.97	Cointegrated***	18/05/2012	British Telecommunications	-5.76	Cointegrated***	25/10/2008
Axa	-6.25	Cointegrated***	29/05/2010	Deutsche Telekom AG	-5.76	Cointegrated***	25/10/2008
Barclays	-6.16	Cointegrated*	28/02/2009	Koninklijke KPN N.V	-4.18	Not Cointegrated	10/09/2011
BBVA	-5.43	Cointegrated**	20/11/2008	Portugal Telecom	-3.79	Not Cointegrated	21/02/2012
BNP Paribas	-5.34	Cointegrated**	25/04/2012	Publicis Groupe SA	-5.75	Cointegrated***	29/05/2012
Commerzbank	-3.44	Not Cointegrated	09/09/2010	Telecom Italia SPA	-4.59	Not Cointegrated	21/05/2010
Deutsche Bank	-4.98	Cointegrated**	26/06/2009	Telefonica SA	-4.62	Not Cointegrated	20/06/2011
Generali	-4.28	Not Cointegrated	22/02/2012	Telenor Asa	-5.61	Cointegrated***	28/01/2009
HSBC	-5.59	Cointegrated***	11/07/2010	TeliaSonera Aktiebolag	-5.16	Cointegrated**	02/01/2009
Intesa Sanpaolo	-6.46	Cointegrated***	22/11/2011	Vivendi	-5.5	Cointegrated***	18/07/2009
Muenchener	-5.43	Cointegrated*	15/09/2008	Vodafone PLC	-6.54	Cointegrated***	17/02/2010
Banco Santander, S.A	-4.73	Cointegrated**	20/04/2012	Orange	-4.59	Not Cointegrated	10/08/2011
Banca Siena	-5.770	Cointegrated***	23/07/2012	Wolters Kluwer NV	-4.18	Not Cointegrated	20/06/2012
Centrica PLC	-5.98	Cointegrated***	31/08/2010	Carrefour	-3.68	Not Cointegrated	28/04/2012
E.ON AG	-4.06	Not Cointegrated	07/08/2011	Compass Group SA	-6.1	Cointegrated***	24/09/2009
EDP	-5.27	Cointegrated**	29/11/2011	Casino Guichard-Perrachon	-7.94	Cointegrated***	30/12/2008
Electricite de France	-5.33	Cointegrated**	29/10/2011	Danone	-5.22	Cointegrated**	19/10/2009
EnBW	-5.62	Cointegrated***	22/01/2009	Diageo PLC	-5.54	Cointegrated***	21/08/2009
Enel	-5.41	Cointegrated**	13/04/2009	Experian Finance PLC	-4.11	Not Cointegrated	25/09/2009
Fortum Oyj	-4.89	Cointegrated*	12/08/2010	Groupe Auchan	-4.42	Not Cointegrated	06/04/2009
Gas Natural SDG, S.A	-5.62	Cointegrated***	14/06/2009	Imperial Tobacco Group PLC	-6.58	Cointegrated***	29/04/2012
GDF Suez	-5.62	Cointegrated***	14/06/2009	Kingfisher PLC	-5.61	Cointegrated***	27/11/2008
Iberdrola, S.A	-4.89	Cointegrated*	07/04/2009	LVMH	-5.66	Cointegrated***	06/08/2011
National Grid PLC	-5.39	Cointegrated***	23/05/2011	Metro AG	-4.47	Not Cointegrated	09/06/2011
RWE	-3.71	Not Cointegrated	24/05/2010	Sodexo	-6.18	Cointegrated***	26/01/2010
United Utilities PLC	-5.1	Cointegrated**	05/06/2009	Pernod Ricard	-8.31	Cointegrated***	19/05/2009
Vattenfall Aktiebolag	-4.560	Not Cointegrated	01/01/2010	Swedish Match AB	-5.28	Cointegrated**	16/11/2009
Veolia Environment	-4.96	Cointegrated**	06/04/2009	Tesco PLC	-6.34	Cointegrated***	11/12/2008
ENI SPA	-5.61	Cointegrated***	17/04/2012	Unilever N.V	-4.43	Not Cointegrated	10/12/2008
Repsol YPF S.A	-5.49	Cointegrated***	24/11/2011	Airbus	-6.76	Cointegrated***	10/10/2011
Adecco SA	-4.75	Cointegrated*	11/08/2011	Koninklijke DSM NV	-4.52	Not Cointegrated	29/04/2012
AKZO Nobel N.V	-6.42	Cointegrated***	11/08/2011	Holcim Ltd	-6.03	Cointegrated***	12/12/2008
BASF SE	-7.07	Cointegrated***	15/09/2011	Siemens	-4.63	Not Cointegrated	08/08/2011
BMW	-4.37	Not Cointegrated	22/10/2008	Sanofi-Aventis	-6.39	Cointegrated***	20/11/2011
Bouygues	-21.47	Cointegrated***	03/11/2008	Volkswagen	-6.08	Cointegrated***	21/05/2011
Compagnie De Saint-Gobain	-5.38	Cointegrated**	07/08/2011	PostNL NV	-3.75	Not Cointegrated	04/08/2010
Deutsche Post AG	-5.65	Cointegrated***	28/07/2012	Daimler AG	-5.87	Cointegrated***	01/03/2011

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively. Critical values: -5.47 at 1%, -4.95 at 5% and -4.68 at 10% level.

Table 10 Bai and Perron (2003) Detected Structural Breaks

Entity	Break Dates				Entity	Break Dates			
Allianz SE	30/04/2012				Deutsche Telekom AG	15/10/2010	17/04/2009		
Generali	02/03/2012	18/09/2008	14/01/2010		Portugal Telecom	09/03/2012	17/04/2008	26/05/2009	
Banco Santander, S.A	17/01/2013				Orange	31/08/2011	04/08/2010		
Axa	19/03/2010	07/07/2011			Publicis Groupe SA	15/05/2012	18/01/2011		
Barclays	19/04/2010	29/07/2011	17/12/2012	21/04/2010	Telecom Italia SPA	02/06/2010	15/05/2009	26/07/2010	
BNP Paribas	30/10/2012	16/06/2008	12/11/2010		Telefonica SA	12/06/2009	04/02/2013		
BBVA	01/02/2013				Telenor Asa	22/07/2009	30/10/2012		
Commerzbank	02/09/2010	11/03/2009			TeliaSonera Aktiebolag	04/08/2009	07/05/2012	22/02/2013	
Deutsche Bank	No Break				Vodafone PLC	11/01/2010	12/10/2011		
HSBC	27/07/2010	09/08/2012			Vivendi	08/07/2009	17/10/2011		
Intesa Sanpaolo	27/02/2012	17/06/2008			British Telecommunications	06/07/2012	07/02/2012	17/12/2010	10/11/2010
Banca Siena S.P.A	No Break				Koninklijke KPN N.V	03/04/2012			
Muenchener	16/09/2008				Wolters Kluwer NV	11/01/2010			
Centrica PLC	13/08/2010				Airbus	08/09/2011	11/12/2012		
E.ON AG	24/08/2011	13/05/2009	09/08/2010		Casino Guichard	No Break			
Electricite de France	28/07/2011	01/02/2010	13/01/2009		Danone	30/09/2009	25/02/2013		
Enel	26/11/2008				Diageo PLC	26/11/2009	12/10/2011		
Fortum Oyj	28/06/2010	12/07/2011	30/09/2010		Imperial Tobacco PLC	04/04/2012			
Iberdrola, S.A	16/04/2009	05/10/2010	25/02/2013		LVMH	29/09/2011	22/02/2013		
Gas Natural SDG, S.A	08/07/2009	20/03/2012			Pernod Ricard	27/05/2009	24/01/2012		
GDF Suez	08/06/2009	12/04/2011			Sodexo	24/02/2012			
National Grid PLC	02/12/2008				Swedish Match AB	No Break			
Repsol YPF S.A	08/12/2011	21/10/2008			Tesco PLC	08/06/2009	31/10/2011	28/10/2011	06/12/2012
United Utilities PLC	21/01/2010	18/09/2012			Carrefour	21/06/2011	13/08/2009		
Vattenfall Aktiebolag	30/09/2009	28/10/2011			Compass Group SA	01/09/2009	10/02/2012	07/09/2012	
ENI SPA	03/04/2012				Experian Finance PLC	03/02/2010	09/05/2008		
EnBW	17/08/2009	05/01/2010			Groupe Auchan	29/09/2009	31/10/2011		
RWE	15/07/2010	19/02/2013	22/02/2013		Kingfisher PLC	10/08/2009	29/07/2011		
Veolia Environment	11/04/2011	15/06/2009			Metro AG	21/09/2011	29/07/2011		
EDP, S.A	12/10/2011	04/08/2009			Unilever N.V	No Break			
Adecco SA	14/05/2012				Koninklijke DSM NV	08/08/2012	16/03/2009	08/08/2012	
AKZO Nobel N.V	05/03/2012	28/07/2008	04/04/2012	21/03/2011	Holcim Ltd	05/05/2009	02/09/2011	11/12/2012	
BASF SE	01/09/2011				Siemens	09/04/2008			
Bouygues	13/04/2012	16/02/2009	19/08/2010		Sanofi-Aventis	17/10/2011			
Compagnie De Saint-Gobain	17/04/2012	19/08/2010			Volkswagen	18/03/2011			
Daimler AG	11/03/2011				BMW	21/07/2009	01/09/2011		
Deutsche Post AG	15/01/2010				PostNL NV	11/04/2011	05/01/2010		

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively. Critical values: -5.47 at 1%, -4.95 at 5% and -4.68 at 10% level.

Table 11 Time Series Determinants of CDS-Bond Basis: Multivariate Regressions - Financial Sector

Firm		Bas$\hat{c}$ds	Bas$\hat{b}$ond	ccp_agg	Betai	VSTOXX	EUEO	Adj R2
Deutsche Bank	No Break	0.02144	18.7538***	-0.0825	361,71***	0.9288***	3547.279***	0.09
Allianz	Before	-0.2092*	-3.6236	0.1407***	56.3534	-0.5534***	-2332.855***	0.0793
	After	0.24***	-0.14	0.5181***	2555.41***	-0.4***	-865.44	0.2054
Santander	Before	0.074	-0.24	0.019	62.43	0.91	-1085.25	0.02
	After	0.28**	1.62	-1.74***	-2645.23	1.56***	3581.499	0.41
BBVA	Before	0.01	0.4	-0.46***	32.66	0.66***	3727.025**	0.07
	After	0.24**	4.5	-1.55***	0	1.13***	-11.48	0.41
HSBC	Before	0.3	0.06	-0.14	99.74***	0.42***	2305.39**	0.04
	After	0.32	5.61	-0.31***	-427.07***	1.22	-1144.59	0.09
Intesa	Before	0.05	-0.45	-0.12***	-23.9	0.62**	1902.27	0.09
	After	0.11	-0.67	-1.36***	-1199.19	1.84***	-11015.03***	0.2
Siena	No Break							
Muenchener	Before	0	-36.37	-0.48***	17.1	-0.48	2027.39	0.31
	After	0.12	19.94**	-0.17***	-58.87	0.28**	127.69	0.33
AXA	Before	-0.66*	17.93	0.28**	-13.34	-0.26	-3254.184	0.07
	After	0.3848*	1.48	0.3365	-429.86	0.5767	-950.01	0.26
Barclays	Before	-0.19	19.25	0.19*	52.55	-0.15	-996.82	0.62
	After	0.14	-0.32	0.32**	-1409.34	0.33	124.17	0.76
Generali	Before	0.0432	-8.1***	-0.82***	17.03***	2.08***	1902.65***	0.2877
	After	-0.32**	-0.08	-0.32***	-0.31	0.83***	3231.59**	0.1392
Commerzbank	Before	0.3	0.06	-0.69**	99.74**	0.42***	2305.97***	0.04
	After	0.32***	5.61**	-0.31	-427.07***	1.22***	-1144.59	0.09
BNP	Before	0.26	1.06	-0.35***	-126.25*	0.57***	-1203.97	0.03
	After	-1.18	12.19	-2.57***	-5201.37	-0.02	-204.13	0.05

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively.

Table 12 Time Series Determinants of CDS-Bond Basis: Multivariate Regressions - Non Financial

Firm		Bas$\hat{c}$ds	Bas$\hat{b}$ond	ccp_agg	Betai	VSTOXX	EUEO	Adj R2
	Before	-0.14	-31.13***	-0.07	-0.92	0.92***	1412.48	0.07
Adecco	After	0.16***	-32.12	-0.13	-825.64***	0.84***	4162.95	0.25
	Before	0.22	14.16	-0.42***	-98.06*	0.13	2865.975	0.04
Akzo	After	0.09	-6.93	-0.16***	-381.22	0.61***	627.65	0.09
	Before	0.07	-3.26	-0.12***	-7.83	0.54***	1295.65**	0.09
Basf	After	0.09	-1.13	-0.08**	-131.02	0.75***	1793.81**	0.16
	Before	0.03	0.5	-0.11***	-58.79***	0.53***	1344.30**	0.09
Bouygues	After	0.20***	-0.96	-0.44***	-1669.37***	0.87***	1027.32	0.20
	Before	0.12	8.16	-0.26***	-11.04	0.92***	3832.15***	0.12
Cie	After	0.10*	-0.21	-0.45***	-5602.25***	0.95***	918.02	0.25
	Before	0.32**	7.86	-0.19***	-45.83	1.09***	-300.38	0.10
Daimler	After	0.12	-9.54	-0.28***	-381.08	1.00***	462.17	0.21
	Before	0.05	-22.69**	-0.19***	-64.58***	1.08***	-1070.241	0.08
Deutsche Post	After	0.19	12.86	-0.3***	9.02	1.07***	593.63	0.18
	Before	-0.01	-0.93	-0.08**	13.60	0.42***	856.41	0.03
DSM	After	0.37**	5.02		750.32	0.22**	2307.4	0.1
	Before	0.5***	-43.42	0.12	-346.67***	1.71***	-1297.63	0.26
Holcim	After	0.34***	7.36	-0.22***	-1854.73**	0.55***	1183.58	0.25
	Before	0.49	3184.71	-0.71***	-20.95	1.12***	2588.12	0.39
Siemens	After	-0.09	-5.18	-0.28***	-35.30	1.26***	3342.25***	0.17
	Before	0.13	-2.46	-0.03	34.60*	0.41***	635.19	0.06
Sanofi	After	0.09	3.19	-0.17***	-160.95	0.51***	-118.94	0.16
	Before	0.01	0.01*	-0.31***	-40.50	0.97***	605.45	0.11
VW	After	0.04	-4.68	-0.3***	-143.51	0.89***	505.30	0.17
	Before	0.04	-11.72	-0.00	-35.30	0.76**	-4921.23**	0.04
BMW	After	-0.01	-16.87***	-0.29***	-221.477	0.80***	954.51	0.22
	Before	-0.17***	-8.81**	-0.5**	-83.40***	0.50***	306.88	0.14
PostNL	After	0.23***	-0.86	-0.4***	153.13**	0.88***	425.83	0.17

***, **, * indicate that coefficients are significant at 1%, 5% and 10% respectively.