An Analysis of Euro Area Sovereign CDS and their Relation with Government Bonds

Alessandro Fontana[1] and Martin Scheicher [2]

November 2014

We compare the market pricing of euro area sovereign CDS and the corresponding bonds issued by the same sovereign. In particular, we analyse the "basis" between the CDS Premium and the credit spread on the underlying cash bond. Our sample covers the period from 2007 to 2012 and contains several episodes of market distress. Overall, we observe a complex relationship between the derivatives market and the underlying cash market charactarised by sizable deviations from the no-arbitrage relationship. First, both CDS and bond spreads correlate positively with a market-wide risk premium, but CDS exhibit a stronger correlation with country-specific fundamental drivers of credit risk. Second, the basis repeatedly deviates from the no-arbitrage condition (i.e. zero). We show that short-selling frictions can explain positive basis deviations while funding frictions can explain negative basis deviations which are observed for countries with weak public finances. Moreover, the "flight-to-quality" phenomenon in bond markets is a key driver of the large positive basis of more credit-worthy countries. Third, we document that trading activity across the CDS and the bond market is consistent with arbitrage activities.

JEL classification: G00, G01;

Keywords: CDS, Government Bond, Short-selling Frictions, Funding Liquidity, Financial Crisis, Arbitrage;

---

[1] **Joint Research Center, European Commission,** Financial and Economic Analysis Unit (IPSC). E-Mail alessandro.fontana@jrc.ec.eu. This research was carried when Alessandro Fontana was a Postdoctoral Researcher at the Geneva Research Finance Institute (University of Geneva). Bd du Pont d'Arve 40, 1211 Geneva Switzerland. Financial support has been provided by the National Centre of Competence in Research \Financial Valuation and Risk Management" (NCCR FINRISK) is gratefully acknowledged. IP C1 "Credit Risk and Non-Standard Sources of Risk in Finance", Rajna Gibson. Research topic: AP, FE. First draft of the paper: October 2010.

[2] **European Central Bank**; Kaiserstrasse 29, D – 60311, Frankfurt am Main, Germany. Email: martin.scheicher@ecb.int. The opinions in this paper do not necessarily reflect those of the ECB or the Eurosystem.

We are very grateful to Rajna Gibson Brandon, Stefano Corradin, Loriana Pelizzon and Stephen Schaefer for many helpful comments and discussions. We also thank participants in the ECB DG-Research seminar, the CREDIT 2010 Greta conference in Venice and the EFMA 2011 conference for helpful comments.

1. Introduction

Since August 2007, financial markets have gone through an unprecedented and wide-ranging re-pricing of credit risk. This “credit crisis” started in US mortgage markets and subsequently led to a dramatic reassessment of bank credit risk. The turbulence reached a peak in the wake of the collapse of Lehman Brothers in September 2008. At that time, many major banks on both sides of the Atlantic were in distress and massive state interventions were required in order to reduce systemic distress. Widespread bank bail outs as well as stimulus measures to the broader economy quickly increased public sector deficits to levels last seen after World War II[3]. In the euro area, sovereign debt markets in several countries came under unprecedented stress[4] in the first half of 2010. European public authorities introduced a number of policy measures to reduce market tensions, such as the European Financial Stability Facility (EFSF), the European Stability Mechanism (ESM) or the ECB’s long-term refinancing operations (LTRO). [5]

Before the credit crisis, valuation of government debt issued by developed countries has typically treated a default as a very low probability event. In fact, modelling (e.g. in term structure analysis) was typically oriented towards interest rate risk or liquidity risk, rather than default risk. The lack of defaults among developed country governments has underpinned the widely used assumption that government bonds provide a good proxy for the long-horizon (default-) risk-free rate; a core feature of asset pricing. The dramatic experience of the 1997/1998 crisis in emerging market sovereigns has been the focus of key papers on sovereign Credit Default Swaps (CDS) such as Pan and Singleton (2008) or Longstaff, Pan, Pedersen and Singleton (2008).[6]

This paper studies euro area sovereign CDS Premia and their relation with the spreads on the underlying government bonds. We have three main objectives. First we want to understand whether the crisis has affected the pricing of CDS Premia and bond yield spreads in different ways. For this purpose, we perform a comparative analysis of the determinants of CDS Premia and bond spreads. A commonly used theoretical framework in the credit risk literature is the structural model of Merton (1974), which is oriented towards the analysis of corporate credit

[3] For example, in the UK the fiscal burden of bank support measures is estimated at 44% of UK GDP (Panetta et al. (2009)).

[4] Massive sell-offs occurred for instance in Greek government bonds, with CDS spreads on Greek bonds jumping above 1,000 basis points. These tensions peaked in a “flight to safety” episode in early May 2010, when investors started large scale sell-offs of many categories of risky assets.

[5] See e.g. Blundell-Wignall (2013) or IMF (2013 a, b) for a discussion of the crisis in the euro area.

[6] Pan and Singleton (2008) study Korea, Turkey and Mexico. Longstaff, Pan, Pedersen and Singleton (2008) analyse 26 countries where the only EU countries are Bulgaria, Hungary, Poland, Romania and Slovakia.

risk. Gapen et al. (2005) extend this structural modelling approach towards sovereign credit risk, thereby providing a contingent-claim based valuation of default risky government bonds. Specifically, Gapen et al. (2005) argue that the key drivers of the risk of sovereign default are the volatility of sovereign assets and a country's leverage. As it is common in this area of the literature, we assume that key theoretical results for corporate credit risk are also applicable to sovereign credit risk.

Our second objective is to analyse sovereign debt market functioning under unprecedented stress conditions. Several metrics can be used for this purpose. We focus on one such measure – the CDS-bond "basis", defined as the CDS premium minus the spread over a risk-free benchmark of a fixed-coupon government bond of similar maturity. Sovereign CDS and the underlying government bonds offer investors a similar exposure to the risk and return of sovereign debt and therefore their relative pricing is linked by a no-arbitrage relation[7]. Differences between market prices of CDS and bonds can provide information on the existence and size of arbitrage opportunities which should typically be very small or disappear quickly if credit markets are functioning normally. For instance, for the non-crisis period of 2002/03, Blanco, Brennan and Marsh (2005) show that the theoretical arbitrage relationship linking corporate credit spreads to CDS holds reasonably well. More recently, several studies have documented large and persistent negative basis deviations in the corporate sector during the US subprime crisis and in particular after the Lehmann collapse in 2008. As discussed by Duffie (2010) special capital impediments to capital formation have caused asset price distortions. Furthermore, Garleanu and Pederen (2011) argue that funding problems have had significant asset pricing effects. One example is the violation of the law of one price in the case of CDS and bond yield spreads, against the background that "securities with nearly identical cash flows, but different margins, traded at a different price, giving rise to price gaps (basis)". Mitchell and Pulvino (2011) see capital shortages at major dealers during the financial crisis as the most plausible explanation of the negative CDS-Bond basis. Bai and Collin-Dufresne (2011) point to drivers related to funding risk, counterparty risk and "collateral quality". Fontana (2012) highlights the role of "trading risk" and "convergence-trading-activity" in driving the basis negative during the crisis. In this paper, we also explore the idea that sovereign basis deviations are generated by "frictions" which affect trading activity differently across the derivative and the cash market for sovereign credit risk.

[7] This no-arbitrage relationship is discussed in detail in Section 2. The strategies an arbitrageur has to implement to profit from positive or negative deviations, from the no-arbitrage condition, are discussed in Section 3.

In this context, we also investigate the reaction of the CDS-bond basis to the government bond purchases by the ECB. From 2010 on, the government bond markets of some euro area countries faced significant stress and shrinking liquidity. To address these problems and contribute to restoring an appropriate monetary policy transmission mechanism, the ECB has conducted interventions in dysfunctional euro area market segments since 10 May 2010, using the Securities Markets Programme (SMP). The impact of these actions cannot be assessed merely on the basis of declines in government bond yields, nor on that of any narrowing of spreads, as neither gives an exact picture of market impairments. Indeed, government bond yield spreads are affected by a multitude of factors beyond the ECB's interventions: by market perceptions about the sustainability of public debt, by investors' risk aversion as well as by other European measures such as the actions and prospects of the European Financial Stability Facility (EFSF). We focus on the impact of the SMP on the basis; the overall impact of the SMP on bond yields has been studied e.g. by Eser and Schwaab (2013). In relation to ECB interventions, Corradin and Maddaloni (2013) find the cost of shorting Italian government bonds via reverse-repo (i.e. "specialness"), is linked to "short-selling pressures" and that ECB outright purchases have exacerbated the repo market squeeze. Pelizzon, Subrhamanyam, Tomio and Uno (2013) document that, prior to the ECB's LTRO in December 2011, credit risk was exacerbating the illiquidity of the Italian sovereign bond market, while subsequently, the causality reversed, as the improvement in the bond market liquidity helped reducing credit risk.

Our third objective is to analyse the role of the CDS market in the context of the euro area sovereign debt crisis. The CDS market allows investors to conduct the following three activities: speculating, hedging the credit risk of underlying bonds and arbitraging price discrepancies between a CDS contract and its underlying bond. Using position data on CDS for US corporates, Oehmke and Zawadowski (2013) provide evidence that the CDS market acts as "an alternative trading venue" for corporates with illiquid bonds; moreover, that CDSs are used for hedging, speculation and arbitrage motives.

Our empirical analysis provides four main results. First, we find that some variables, which previous research has identified as drivers of credit spreads (cf. Collin-Dufresne et al., 2001, Campbell and Taksler, 2003, Raunig and Scheicher, 2009, Ericsson et al., 2009 or Ang and Longstaff, 2011), also affect CDS Premia and bond spreads during the credit crisis. In particular, in the cross-section, country-specific covariates have a good explanatory power and the signs of the coefficients, which are significant, correspond to our hypotheses. In the time-series, CDS are exposed both to country-specific fundamentals and to proxies for risk premium while bond spreads mainly to proxies for risk premium. Interestingly, CDS seem more sensitive to fundamental drivers of credit risk.

Second, we document that since the onset of the US subprime crisis and even more so during the euro area sovereign debt crisis, each country's CDS-bond basis has deviated from zero persistently. The bases of "core" countries (AT, BE, DE, FR and NL) became large and persistently positive. In contrast, the bases of "peripheral" countries (GR, IE, IT, PT and SP) became temporarily negative in the first part of our sample and persistently negative from 2011 on. Hence, in the euro area, the movement of the basis substantially differs from results on corporate credit in the studies discussed above.

Third, we find that drivers of the common variation in the basis differ from those which we observe for spreads. In particular, market frictions play a large role. A Principal Component (PC) analysis on the basis shows that the cross-country co-movement of CDS is slightly weaker than of bond spreads, but the first two PCs of bonds and CDS respectively have a similar economic interpretation. This exploratory analysis indicates that the CDS-bond basis is not explained by the fundamental and global variables which explain credit spreads, but it exhibits a strong degree of co-movement across countries and it is linked to conditions in the sovereign credit market.

Fourth, we show that the sign of the basis is an important factor in understanding its determinants. A positive basis (i.e. CDS Premium exceeds bond spread) is related to short-selling frictions and flight to liquidity effects. For arbitrageurs to profit from this positive deviation they have to be able to take short positions without major frictions. We explore the role of "frictions" both in the cross-section and in the time series. We find that bonds with stronger "short selling frictions" tend to have larger positive bases. Moreover, the basis correlates significantly with "short-selling frictions" and pricing deviations lag the emergence of these frictions. Two additional results of positive basis deviations are worth noting. First, throughout the sample, "core" countries have larger positive bases. Because of the "flight-to-quality" bond trading activity has shifted from "peripheral" countries to "core" countries, especially to the German bund driving its yield to a historically unprecedented low. As higher bond liquidity reduces the bond yield spread, it should also be reflected in a larger CDS-bond basis. Against this background, we show that bonds with higher (lower) credit risk and lower (higher) liquidity tend to have smaller (larger) positive bases. Second, the ECB's SMP purchases temporarily increased the basis. We find that SMP buying were generally associated with declines in CDS Premia and bond spreads except during May 2010 and August 2011 when it was associated with increasing bond spreads. The SMP has been active to the largest extent when credit spreads were increasing sharply and the bond markets were extremely illiquid. Since, in May 2010 and August

2011, the impact on the basis is positive, our interpretation is that the buying pressure generated by the SMP was reflected in relatively stable (but still increasing) bond yields and in a temporary improvement of bond liquidity, as measured e.g. by bid-ask spreads.

As regards the negative bases of countries with weaker public finances, we observe the significant role of sharp increases in haircuts applied on government bonds in repo transaction and a corresponding deterioration of bond liquidity. This supports the view that “funding frictions” made it difficult for arbitrageurs to finance the purchase of bonds (via repo) for profiting from “negative basis trades”.

We also investigate arbitrage activity across the cash and the derivative market. We start from the idea that basis deviations from the no-arbitrage parity should generate predictions for CDS and bond trading activity. Consistent with our prior, we document CDS selling activity and bond short-selling activity in situations in which the basis is positive. Moreover, we document CDS buying activity and bond purchasing activity when the basis is negative.

The rest of this paper is organized as follows. In Section 2, we provide some background on sovereign CDS. In Section 3, we discuss the relation between CDS and bond yield spreads, we introduce the concept of the CDS-bond basis and develop the main hypotheses we test in the empirical analysis. In Section 4 we describe the data. In Section 5 we present the results of the econometric analysis. Section 6 we offer the final remarks.

2. **Background on Sovereign CDS**

A CDS transfers the risk that a certain individual entity defaults from the “protection buyer” to the “protection seller” in exchange for the payment of a regular fee. In case of default, the buyer is fully compensated by receiving the difference between the notional amount of the loan (made to the defaulted entity) and its recovery value from the protection seller[8]. The CDS premium, typically expressed in basis points per annum as a fraction of the underlying notional is the cost for protection against default. As in the case of an interest rate swap the premium is set such that the CDS has a value of zero at the time of origination[9]. In a standard CDS contract two parties enter into an agreement terminating either at the stated maturity or earlier when a

[8] After a credit event the protection seller compensates the protection buyer for the incurred loss by either paying the face value of the bond in exchange for the defaulted bond (physical settlement) or by paying the difference between the post-default market value of the bond and the par value (cash settlement). The post-default value of the bond is fixed by an auction procedure. In the context of sovereign risk, the first such auction procedure was held for Ecuador in January 2009.

[9] Since May 2009, CDS trading has undergone a “big bang” with prices now consisting of an upfront payment and a regular premium fixed at either 100 bps or 500 bps (depending on credit quality). Putting the two components together leads to the CDS premium which is comparable to the previous contracts. http://www.markit.com/cds/announcements/resource/cds-big-bang.pdf

previously specified "credit event" occurs and the protection component is triggered. Three important credit events defined by the International Swaps and Derivatives Association are: (1) Failure to pay principal or coupon when they are due: Hence, already the failure to pay a coupon can represent a credit event, albeit most likely one with a high recovery (i.e. "technical default"). (2) Restructuring: The range of admissible events depends on the currency and the precise terms which materialise. (3) Repudiation / moratorium.

For corporate as well as sovereign CDSs, the premium can be interpreted as a credit spread on a bond issued by the underlying name. Based on a no-arbitrage argument (Duffie, 1999) the CDS premium should be equal to the yield spread over a risk-free benchmark on a par floating-rate bond. According to this pricing analysis, the risk-reward profile of a protection seller, who is "long" credit risk, is equivalent to a trading strategy which combines a bond, by the same name, with a short position in a default-risk-free bond. While, the protection buyer's exposure is equivalent to a strategy which combines a long default risk-free bond and a short position on the bond. Based on this theoretical equivalence, traders arbitrage price differences between a defaultable bond, a risk-free bond and the CDS.

CDS are typically used for trading credit risk and for arbitraging price discrepancies between the CDS and the underlying bond rather than pure default-insurance instruments. Sovereign CDSs, compared to CDSs on corporations, can be used for two additional purposes. First, investors can hedge macro risk of portfolios composed by credits to corporations in foreign emerging countries. Second, investors can hedge counterparty risk in interest-rate derivative transactions in the case of bank exposure to governmental bodies, as many of these do not provide collateral.

Even if CDSs are generally considered the best proxy for credit risk a number of additional factors may influence their pricing. First, CDS on euro area governments can be denominated both in Euro and in USD (Barclays, 2010 a). In the case of a credit event, a severe depreciation of the bond's currency is likely. As euro area countries CDSs denominated in USD provide a hedge to "depreciation risk" they tend to be traded with a premium with respect to those quoted in Euro. Second, CDS contracts have several restructuring clauses which affect their pricing. Cumulative Restructuring (CR) is the most common for European sovereigns. This clause includes "restructuring" as a default event and allows the protection buyer to deliver bonds of any maturity after restructuring of debt[10]. Third, as the value of protection depends on sellers'

[10] CR was the standard contract term in the 1999 ISDA definition. The modified- restructuring (MR) clause, which has become common practice in US from 2001 on, limits deliverable obligations to bonds with a maturity of 30 months or less after a restructuring. The modified- modified-restructuring (MM) clause has been introduced in 2003. Under this rule, which is more

creditworthiness, an additional element which affects the pricing of CDSs is counterparty risk. CDSs on major countries may not always provide genuinely robust insurance against a large-scale default given the close linkages between sovereigns and the financial sector. As discussed by Aroroa et al. (2012) market participants typically collateralize these transactions, hence the impact of counterparty risk should be negligible. Also, sellers of protection are exposed to counterparty risk too since they face “mark-to-market" losses in the event of the failure of the protection buyer. Therefore counterparty risk is “two-sided” and it is non-trivial to assess its pricing impact on the CDS premium.

3. The Relation between CDSs and Bonds and the Main Hypothesis

In this section we focus on the following three broad issues on CDSs and bonds, in the euro area context, and formulate, accordingly, the hypotheses which we then test in Section 5.

First, we investigate the pricing of credit spreads. In principle, CDS and bonds offer investors a similar exposure to the risk and return of debt issued by governments, hence, their pricing is expected to be determined by the same set of risk factors[11]. Whether the crisis has affected the market pricing of sovereign credit risk differently across the derivatives and the cash market is ultimately an empirical question.

Hypothesis 1. CDS and bond spreads are driven by the same risk factors.

Second, we analyse the functioning of the euro sovereign debt market under stress conditions. The CDS-bond basis, defined as the difference between the CDS premium and the yield spread (over a risk-free benchmark) on a fixed-rate bond of similar maturity should be approximately zero due to the no-arbitrage principle. To exploit a negative basis an arbitrageur has to finance the purchase of the underlying bond, via a repo transaction, and buy protection (CDS), so that a bond’s default risk is fully hedged. To exploit a positive basis an arbitrageur has to short-sell, via a reverse-repo transaction, the underlying bond and sell protection. In a basis trade the investor “locks-in” an annuity which stops at the maturity of the bond or at default, whichever comes first. Deviations of the basis from zero provide information on the existence and size of arbitrage opportunities which should typically be very small and disappear quickly if credit markets were functioning normally. Our analysis is based on the idea that basis deviations are generated by

common for corporations in Europe, deliverable obligations can be maturing in up to 60 months after a restructuring. The no-restructuring (XR) clause excludes all restructuring events under the CDS contract as “trigger events".

[11] As Longstaff, et. al. (2008) show fundamental information about default risk as well as variation in global risk factors are key drivers of sovereign credit spreads. We discuss this issue in more detail in Section 4.

"frictions" which affect trading activity differently across the derivative and the cash market for credit risk.

Hypothesis. 2 "Short-selling frictions" impairing arbitrage explain persistent positive basis deviations.

"Short-selling frictions" represent the difficulty or high the cost, for market participants, to short-sell bonds. These bonds are often not available or the rates at which these can be obtained in reverse-repo transactions are lower than the rates on other types of collateral (i.e. the bond is "special")*;* lending cash, in a reverse-repo, for a lower rate is an opportunity cost. We investigate whether a positive basis persists because "short-selling frictions" prevent arbitrageurs to short-sell the bond (in a "positive basis trade"), to profit from the relative mis-pricing.

Hypothesis 3. More creditworthy countries with more liquid government bonds (i.e. Flight-to-quality") have larger CDS-bond bases.

With the "Flight-to-quality" bond trading activity has shifted from "peripheral" countries to "core" countries, especially to the German bund driving its yield to historically very low levels. We expect bond liquidity to be reflected in a price premium, hence in a relatively lower bond yield spread and a larger CDS-bond basis.

Hypothesis 4. ECB bond purchases increase the basis.

The ECB's SMP, which targeted bonds of peripheral countries, was aimed at lowering the illiquidity yield premium required by investors due to the absence of trading activity in situations of high credit risk. The SMP's sizable purchases should increase bond prices and are expected to temporarily increase the basis. As described by Corradin and Maddaloni (2012) the SMP portfolio is oriented towards the long term and the bonds are not repo-ed out again. Therefore, the ECB activity is also likely to have made the purchased bonds "special", i.e. costly to short-sell, further fostering the persistence of a positive basis.

Hypothesis 5. "Funding frictions" which impair arbitrage explain persistent negative basis deviations.

"Funding frictions" represent the difficulty or high cost to fund the purchase of bonds. Difficulties in access to sufficient funding (e.g. lending from prime brokers) are due to the presence of "haircuts" (i.e. margins) in repo transactions which fund bond purchases. Analogously to the positive basis and "short-selling frictions", a negative basis[12] persists because

[12]Two examples can illustrate the mechanics behind a basis deviation. As a first example, large bond sales, which might be driven by an increase in the cost of funding bond holdings or by the need of financial intermediaries to reduce credit risk exposure (i.e. de-leveraging motivations), are likely to generate strong downward pressure on bond prices, hence to increase yield

“funding frictions” make it difficult for arbitrageurs to finance the purchase of the bond (via repo transaction) for implementing a “negative basis trade”[13].

Third we investigate arbitrage activity across the cash and the derivative market for credit risk.

Hypothesis 6. Basis deviations from the parity predict CDS and bond trading activity.

When the basis is positive, we expect that arbitrageurs enter into “positive basis trades” selling CDS and short-selling the underlying bond. When the basis is negative, we expect that arbitrageurs enter into “negative basis trades” purchasing the CDS and its underlying bonds.

4. Data and Descriptive Statistics

4.1 CDS Premia and Bond Spreads

Our sample comprises the following ten euro area countries: Austria (AT), Belgium (BE), France (FR), Germany (DE), Greece (GR), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT) and Spain (SP) and covers the period from 1 January 2007 to 31 December 2012. We collect ten- year benchmark bond yields from Datastream and CDS Premia[14] with a ten year maturity from Markit. Figure 1 shows the time-series of CDS Premia and bond spreads for the ten countries.

(Insert Figure 1 Here)

During our sample period credit spreads followed an increasing trend, diverging substantially across “core” and “peripheral” countries, and have reached their peaks in the period from September 2011 to August 2012[15]. For “peripheral” countries CDS Premia and bond spreads were substantially higher than for “core countries”. Table I, Chart A provides the descriptive statistics of CDS Premia and bond yield spreads (calculated over the German Bund) weekly changes.

spreads substantially with respect to the CDS Premium, generating a negative basis. As a second example, a negative basis deviation might be due to a sharp decline in credit risk, which is reflected into a larger reduction of CDS Premia than bond yield spreads. This second example is less likely to generate basis deviations which persist in time, as in regimes of low credit risk “haircuts” would be low.

[13] The “negative basis trade” involves buying the bond financing its purchase via repo transaction and buying CDS protection.

[14] For the purpose of the empirical analysis, daily data are transformed into weekly, taking the last observation of the week. We focus both on CDS quoted in Euro and in USD, the former are available only for a subsample period and the latter are more liquid for the reasons discussed in Section 2. Moreover, we select the Cumulative Restructuring (CR) clause as this is most common for European sovereign CDS.

[15] We censor the series for Greece in June 2011 as credit spreads reached very high levels and trading activities reduced dramatically. For Germany the bond yield spread over the bund is by definition zero.

(Insert Table I Here)

"Peripheral" (GR, IE, IT, PT and SP) countries' credit spreads increased more and exhibited a larger variability. Throughout the sample, the average CDS change (standard deviation), expressed in basis points, was 0.45 (9.74) for "core" countries (AT, BE, FR, DE, NL) and 2.27 (35.72) for "peripheral" countries. Similarly, the bond spread average change (standard deviation), was 0.16 (8.37) for "core" countries and 0.97 (39.5) for "peripheral" countries. The average correlation across countries between CDS and bond spreads changes respectively was 0.60 and 0.67, hence significantly different from one as would be expected in the case of a "perfect" no-arbitrage relation.

4.2 The CDS-Bond Basis

We define the "unadjusted" CDS-bond basis as the difference between a country's CDS premium and the corresponding government bond yield spread for the same maturity. Furthermore, the "adjusted" basis is defined as the difference between the CDS-bond basis of a country relative to that of a benchmark country.

Figure 2 plots the time series of the unadjusted CDS-bond basis for ten euro area countries.

(Insert Figure 2 Here)

Chart a) shows that after the Lehmann collapse, the bases for "core" countries exhibited strong co-movement, largely and persistently exceeding zero. According to Charts b) and c), the bases for "peripheral" countries followed substantially different dynamics. To shed further light on this issue, Chart d) compares the CDS-bond basis for three countries which are representative of the three main "patterns" that we earlier identified by means of visual inspection: France, Italy and Portugal. The basis for Portugal (as well as for Greece and Ireland) temporarily declined below zero in several periods (i.e. April-May 2009 and May-June 2010) and became persistently negative from 2011 onwards. In contrast, the basis for Italy (as well as for Spain) started a declining trend from the beginning of 2011, fell below zero in summer 2011 and became persistently negative from the summer of 2012 on.

Next, we focus on country-specific aspects by means of the "adjusted" CDS-bond basis, where we take Germany, which has the most liquid and well-functioning government bond market in the euro area, as the benchmark country. This "adjusted" CDS-bond basis is also equal to the difference between the respective country's risk Premium over Germany, as priced in the CDS market and in the government bond market. If a country has a negative "adjusted" CDS-bond basis, it means that its bond yield spread over the Germany bund is larger than its CDS differential vis-à-vis Germany. Figure 3 plots the time series of the "adjusted" CDS-bond basis for the ten countries in our sample.

(Insert Figure 3 Here)

Visual inspection indicates three groups: Chart a) shows Austria, Belgium, France, Germany and the Netherland, Chart b) shows Italy and Spain and Chart c) shows Greece, Ireland and Portugal. The "adjusted" bases were negative across all countries in the first part of the sample during the Subprime crisis and the Lehmann collapse. From the start of the euro area sovereign crisis they diverged significantly. "Adjusted" bases for the "core countries" were negligible. In contrast, the "adjusted" bases for Greece, Ireland and Portugal became negative from May 2010 on. The "adjusted" bases for Italy and Spain hovered around zero till 2011 and turned significantly negative in the second quarter of 2011. Figure 3, Chat d) compares the basis and the "adjusted" basis for Italy. Even if the two series differ in their levels they co-move strongly; the correlation coefficient calculated on weekly changes is 0.93 and is significant. Table I, chart B, reports the descriptive statistics of the basis and the "adjusted" basis weekly changes. The behaviour of the two different measures is similar, but "core" and "peripheral" countries have a different characterization: the average change, expressed in basis points, of the basis is positive for "core" countries (0.17) and negative for "peripheral" countries (-0.10), consistently with what observed in Figure 2. The average change of the "adjusted" basis is approximately zero for "core" countries (-0.05) and negative for "peripheral" countries (-0.26). Also, the volatility is larger for "peripheral" countries (22.39 vs. 7.40) and the correlation between basis and "adjusted" basis weekly changes is larger for "peripheral" countries (0.95 vs. 0.73).

4.3 The set of explanatory Variables

4.3.1 The Fundamental Determinants of CDS Premia and Bond Spreads

Table II shows the definitions of the covariates we use in the regression analysis and their data sources. Chart A. plots those variables which previous research has shown are "fundamental determinants" of credit spreads (see Collin-Dufresne et al., 2001).

(Insert Table II Here)

Risk-free rate (Rf). -- In the Merton (1974) model the level of the risk-free rate is negatively related to credit spreads. A higher risk-free rate implies a higher expected growth rate of the firm value. In turn, this implies a lower price of the put option on the firm value and a lower the credit spread. As a euro-wide homogeneous proxy for the risk-free rate we use the three-month Euribor rate.

Slope of the term structure (Slope). -- In the Longstaff and Schwarz (1995) structural credit risk model the interest rate is stochastic. In the long run, the short rate is expected to converge to the long rate. Hence, an increasing slope of the term structure should lead to an increase in the expected future spot rate. This in turn, will decrease credit spreads through its effect on the drift of the asset value process. We proxy for the slope of the term structure taking the difference between the ten-year Euro Swap-rate and the three-month Euribor rate.

Idiosyncratic equity returns (EqRet) -- Collin-Dufresne et al. (2001) use stock returns as a proxy for the overall state of a country's economy. For the purpose of a clearer identification, we use a country's idiosyncratic stock returns rather than its total returns, which we define as the difference between the national equity-index return and the market-wide index return as represented by the Datastream euro area equity index. Our hypothesis is that the country-specific equity return is negatively related to a country's credit spreads.

The credit risk literature typically uses the theoretical framework of Merton (1974), which is oriented towards corporate credit risk. Gapen et al. (2005) extend this structural modelling approach towards sovereign credit risk, thereby providing a contingent-claim based valuation of default risky government bonds. Specifically, Gapen et al. (2005) argue that the key drivers of the risk of sovereign default are the volatility of sovereign assets and a country's leverage, which we discuss below. Along these lines, many of the theoretical results for corporate credit risk are indeed also applicable to sovereign credit risk.

Idiosyncratic equity volatility (EqVol). -- Campbell and Taksler (2003) document that variation in US corporate spreads is more strongly linked to idiosyncratic stock price volatility than to aggregate stock price volatility. Following this result, we use the idiosyncratic volatility which we calculate as the annualised GARCH (1, 1) volatility of idiosyncratic stock returns (defined as a country's stock returns minus Datastream euro are equity index). We expect idiosyncratic equity volatility and credit spreads to be positively related.

Country leverage (Debt/Leverage). This variable is the ratio between a country's public debt, i.e. outstanding bonds[16], and its GDP. This risk factor is expected to be positively related with credit risk and is also acknowledged in a fiscal policy perspective as the EU's Stability and Growth Pact aims to cap a country's total debt at 60 % of its GDP.

As previous research has shown, fundamentals as well as changes in global risk factors are among the underlying drivers of sovereign credit spreads (see Ang and Longstaff, 2011). Table II Chart B. contains variables, which proxy for "global risk factors".

---

[16] We focus only on long-term bonds, hence this variable is lower than the usual debt-to-GDP ratio. The amount of bonds outstanding is available in Bloomberg with a monthly frequency. We use linear interpolation to obtain weekly observations.

Risk Premium (RP). -- Credit spreads not only compensate investors for pure expected losses. Spreads vary due to changes in investors' risk aversion even if the underlying fundamentals (i.e. the pricing under the "statistical measure") are unchanged. We use the VSTOXX, which is the index of implied volatility (European VIX) based on the EuroStoxx50. In order to obtain a proxy for the risk premium, we deduct a GARCH-based estimate of volatility from the VSTOXX index. This represents the risk premium which investors in equity options require in order to compensate them for equity market risk in Europe. We expect the "risk-premium" and credit spreads to be positively related.

Euro/USD *exchange rate uncertainty (EVZ)*. -- Higher uncertainty about the future path of the exchange rate should make protection quoted in USD more expensive [17] than in Euro. As a proxy for the exchange rate uncertainty, we use the 30-day implied exchange rate volatility index (EVZ), provided by CBOE, which follows the methodology of the VIX index. We expect this variable to correlate positively with CDS Premia.

Figure 4 shows time-series dynamics of the discussed determinants of the credit spreads.

(Insert Figure 4 Here)

Notice that *EqRet*, *EqVol* and *Debt/Leverage* are country - specific variables, whereas *Rf*, *Slope*, *RP* and *EVZ* function as common determinants of all the ten euro area countries' credit spreads.

4.3.2 Measures of CDS Trading Activity

Table II Chart C. shows the variables we use to proxy for CDS trading activity. This information is taken from the Depository Trust & Clearing Corporation (DTCC)[18].

CDS *net notional*[19] *outstanding amount (CDS_net_not)*. **--** This quantity is the equivalent of the protection sold, on a given name/country, by the net sellers[20] (i.e. the main CDS dealers). Table III A. shows that, for Italy, Germany, France and Spain, the *net notional outstanding*

[17] The Euro is expected to devaluate in case of a Member country default, hence protection in USD is more costly because it provides a currency hedge.

[18] Since October 2008, the DTCC publishes weekly reports on CDS trading activity on single name CDS which are traded frequently. This data can be found at http://www.dtcc.com/products/derivserv/data/index.php and covers almost entirely the trading reported by major dealers. For a detailed discussion of these data and a comparative analysis of this and other sources of information on CDS positions see Oehmke and Zawadowski (2013).

[19] The "gross notional outstanding amount" is the sum of all notional CDS contracts on a given credit name. Notice that this value increases also when a trade offsets an existing trade and thus reduces the level of credit risk in the system. The "notional" is the par value of the debt on which credit protection is exchanged, expressed in billion euros.

[20] Therefore, this amount multiplied by the one minus the recovery rate (on the defaulted bond) is also the payment that dealers have to make in case of the default of the underlying credit name.

amount of *CDS*, throughout the sample, is on average, respectively EUR 16.8, 11.3, 11.2 and 10.82 billion, which is more than twice the values for to the other euro area countries. Germany and France have seen the biggest increase throughout the sample, with a value of around 10 billion euros. In contrasts, for the rest of the countries the dynamics are quite flat. As a relative measure of "CDS market size", we scale *CDS net notional amount outstanding* by the value of *total bonds outstanding*. Table III B. shows that, for Greece, the maximum level, throughout the sample, is 2.5% and for Portugal and Ireland respectively 6%[21] and 6.2%. Notice that the financial sector exposure to the risk of paying out on CDS protection, in case of a credit event, is relatively small compared to the risk the financial sector is facing by holding the government bonds, hence insurable interest is far larger than the quantity covered by CDS protection.

(Insert Table III Here)

CDS *weekly trading volumes (CDS_trd_*vol). **--** This measure represents the number of contracts traded, by name, in a given week. Trades which do not transfer risk, such as for example portfolio compression trades are not included; hence this measure is directly comparable to bond volume. Table III C. shows that, for Spain, Italy and France, the CDS trading volumes expressed in *N. of contracts traded per week*, is on average, respectively 299, 278 and 244, namely more than twice with respect to the remaining countries. We also standardize trading volumes by the size of the net notional CDS (expressed in N. of contracts, not in Billions) to obtain a measure of "CDS % turnover." Table III D. shows that Spain and Italy have the highest "CDS % turnover" respectively 26.7 and 22.5%. Notice that the average "CDS % turnover" for "peripheral" countries is approximately 20% while for "core" countries only approximately 13%.

4.3.3 Measures of Bond Trading Activity and "Frictions"

Table II Chart D. shows the variables we use to capture various aspects of bond trading activity.

Government bond volume and bid-ask spread (bond_volume & bid_asks). -- We use transaction data from the MTS Group. We do not focus only on the 10-year benchmark bonds, instead we consider government bonds with all maturities. We use daily *trading volumes*, which we sum to obtain weekly data. *Bid-ask spreads* are weekly averages of the daily observations.

Quantity on Loan (bond_q_loan). – This variable, taken from Data Explorer, is the quantity of bonds on loan/borrowed, a measure for the amount of "short-selling activity" taking place. This information is specific to the benchmark bond of each country in the sample.

[21] This magnitude is in contrast to other markets, such as the Bund future, where the derivatives market exceeds the cash market.

Available Quantity (or quantity on loan). – This variable, taken from Data Explorer, is the amount of securities in lending programmes and is a proxy for "institutional ownership". The inventories which owners make available to a bond's borrowers will tend increase or decrease in line with their purchases and sales across their portfolios.

Active Utilisation (bond_actv). – This variable, also taken from Data Explorer, is the share (%) of securities in lending programs which are currently out on loan. Our assumption is that when this value is high there is a lack of bonds available to short in the market. In this sense it is a measure of "short-selling frictions".

DCBS. – This variable, again taken from Data Explorer, is expressed in steps from 1 to 5 and is an indicative fee of the borrowing cost of the bond to short-sell. Hence, it is a direct measure of the cost of "short-selling".

SMP purchases (SMP). -- These data refer to the book value, expressed in billion euros, of the total cumulative purchases, as of Friday of each given week. The ECB activated this program on May 10, 2010 to intervene for buying Greek, Portuguese and Irish government bonds and re-activated it on August, 7 2011 for buying Italian and Spanish bonds (Corradin and Maddaloni, 2012) [22]. Figure 5 shows the book value of the cumulative SMP purchases and, on the right-hand side axis, the weekly purchases.

(Insert Figure 5 Here)

Bond specialness (bond_spec). – This variable measures the cost of obtaining a bond to short in a repo transaction (we only have this variable available for Italy). As documented by Corradin and Maddaloni (2012), tension in the unsecured inter-banking market, due to increase of counterparty risk, have shifted a substantial amount of the financial intermediaries' financing activity to the secured repo market. In a repo agreement a security is sold in exchange with the commitment to deliver it at a given date. The party buying the security is providing collateralized financing to the other party which has entered a reverse repo. This type of operation is typically conduced to short-sell a security. The bond "specialness", which is defined as the difference between the general repo rate and the rate on a specific bond any given day is a measure of the cost of "short-selling" the bond. When the rate to obtain a specific security is very low "short-selling" becomes costly. For the purpose of our analysis, this cost directly affects the risk/return profile of a "positive basis trade" (in which one needs to short-sell the bond). Figure 6 shows its time-series dynamics.

[22] Interventions focused on bond from 2 to 10 year maturity. The ECB initially did not disclose the target and the amount of these operations, but has provided, on February 21, 2013, securities holdings at the country level. Out of 218 billion euros of total purchases, 103 refer to Italian bonds, 44 to Spanish bonds, 34 to Greek bonds, 32 to Portuguese bonds and 14 to Irish bonds.

(Insert Figure 6 Here)

Haircuts on government bonds (Haircuts). – We have this variable available only for Italy. Data on haircuts are obtained from "Cassa di Compensazione e Garanzia". Figure 7 shows that from the 9th of November 2011 on margins on the 10Y Italian bond increase to almost 12% (This had already happened for Greece in May 2010, Ireland in November 2010 and Portugal in April 2011). Garleanu and Pedersen (2011) show that during the crisis, funding problems have had significant asset pricing effects. One example is the violation of the law of one price in the case of CDS and bond yield spreads: "securities with nearly identical cash flows, but different margins, traded at a different price, giving rise to price gaps (basis)". Along these lines of reasoning, we expect negative basis deviations for "peripheral" countries, during periods of high market stress, to be related to large increases in haircuts on bonds.

(Insert Figure 7 Here)

Government Bonds outstanding (bond_outst). -- We standardize a country's total outstanding bonds by calculating the relative ratio over its GDP. Both these variables are taken from Bloomberg. As discussed in Subsection 4.3.1 this covariate proxies for a country debt level (or leverage), but it might have other two interpretations. For bonds, in a market with elastic demand this variable also reflects bond market liquidity because a larger bond market generally contributes to lower transaction costs. However, if new issuance exceeds existing demand, then there could also be an adverse impact on bond market liquidity. For these reasons, we expect this variable to capture also illiquidity conditions in the bond market, not only the level of credit risk.

5. Empirical Analysis

5.1 The Determinants of Credit Spreads

In this section we investigate how our set of determinants affects the variation of CDS Premia and bond spreads during the euro area sovereign debt crisis, as discussed in **Hypothesis 1.** Data are at the weekly level. We start with cross-sectional analysis. For this purpose, we estimate a panel regression, with time-fixed effects, of credit spreads on country specific *"fundamental"* variables:

$$Y_{it} = \alpha + \beta_1\, EqRet_{it} + \beta_2\, EqVol_{it} + \beta_3\, Debt_{it} + v_t + \varepsilon_{it} \quad (1)$$

with Y_{it} being a vector of dimension ten representing the CDS Premia or the bond spread of a country i at time t. Time fixed effects (FE) are captured by v_t. Table IV Panel A reports results from regressions in levels, while Panel B from regressions in changes. We find that most coefficients are significant and their signs correspond to the hypotheses which we outlined earlier. In the case of regressions in levels, *equity volatility* and *leverage* are positively related to credit spreads. For regressions in changes the significance of the results is weaker. *Equity returns* negatively affect credit spreads, but are significant only for CDS Premia. Overall, considering the significance of the coefficients and the explanatory power of the regressions, CDS Premia are more closely related to "country specific" fundamentals than bond yield spreads.

(Insert Table IV Here)

As a second step we implement a time-series analysis. The aim is to test whether other variables, beyond country-specific fundamentals, have explanatory power. These new factors cannot be added in equation (1) because of the lack of cross-sectional variation. For this purpose, we estimate the following model as a panel regression with country-fixed effects:

$$\Delta Y_{it} = \alpha + X^T_{it} \beta_1 + \beta_2 \Delta Rf_t + \beta_3 \Delta Slope_t + \beta_4 \Delta RP_t + \beta_5 \Delta EVZ_t + \rho_i + \varepsilon_{it} \qquad (2)$$

With Y_{it} being a vector of dimension ten representing the CDS Premia or the bond spread of a country i at time t. X_{it} is the vector of country specific covariates from model (1). Country fixed effects (FE) are captured by ρ_i. Table V reports results. We estimate this equation in changes only since for credit spreads and for the explanatory variables expressed in levels, the hypothesis of a unit-root is not rejected by the Augmented Dickey-Fuller test[23]. In the case of CDS Premia, we find that for most of the covariates, such as the "country specific fundamentals", the *risk-free rate (Slope)* and the *"proxies for risk premium"* the signs of the coefficients, which are significant, correspond to our hypotheses. In contrast, in the case of bond spreads, only proxies for "risk premium" are significant and with the expected sign. As discussed in Section 4.1, the CDS premium and the bond spread, within each country, do not correlate perfectly (average correlation across countries is 0.60) as would be expected in the case of a no-arbitrage relation. Note also that CDS Premia are more sensitive to "country specific" fundamentals than bond spreads.

(Insert Table V Here)

To better understand why pricing deviations take place, we proceed by analysing the degree of co-movements of credit spreads across countries by means of a principal component analysis. Table VI, Panel A, the first and second columns lists the percentage of explained variation by the first three components[24] of CDS Premia and bond spreads.

(Insert Table VI Here)

[23] Results are omitted for reasons of space and available from the authors.

[24] For reasons of brevity we present the loadings only for the first two PCs as these are those which explain most of the variation.

In the case of CDS Premia, the first PC explains 64%, the second PC the 12%, whereas the first three PCs explain 84% of the total variation. As shown in Panel B, the 1st PC places similar weights (eigenvectors), across all countries, i.e. the average weight within the two groups of "core" and "peripheral" countries is 0.34 vs. 0.30. The 1st PC can be defined as a "level factor", in the sense that when this factor increases, CDS Premia across countries all increase. For the 2nd PC the average weight within the two different groups of "core" and "peripheral" countries is -0.24 vs. 0.32. As this 2nd component differentiates well across countries it can be defined as a "core" vs. "periphery" factor. In the case of bond spreads, the 1st PC alone explains 50% of the variation, the second PC the 14%, whereas the first three PCs in total explain 75%. Note that the economic interpretation of the 1st and 2nd components is identical for CDSs and bonds spreads and that the degree of co-movement is very similar.

To compare these results with previous studies on sovereign CDS[25] we consider a proxy for domestic stock market performance, i.e. the returns on country-specific equity indexes. In our sample, we find that equity returns exhibit a degree of commonality similar to that of CDSs. In the case of the equity indexes, the 1st PC alone explains 70%, the 2nd PC 7%, whereas the first three PCs explain 82% of the variation. The 1st PC places similar weights (approximately 0.30), across all countries and can be interpreted again as a "level factor". In contrast, the 2nd PC does not appear to have a clear economic interpretation. Hence, elements of differentiation (i.e. the 2nd PC) across euro area countries mainly represent the dynamics in sovereign debt markets.

5.2 Commonality in the CDS-Bond Basis

Figure 2 shows that since the onset of the US subprime crisis and even more so during the euro area sovereign debt crisis, each country's CDS-bond basis and "adjusted" basis deviated from zero persistently and exhibited strong co-movements across countries.

To identify the drivers of the CDS-bond bases, we first quantify their co-movement across countries. For this purpose we conduct a principal component analysis. In Table VI, Panel A, the third and fourth columns lists the percentage of explained variation by the first three components[26] of the basis and the "adjusted" basis. For the CDS-bond bases (and "adjusted" bases) the 1st PC alone explains 45% (34%), the second PC the 13% (16%), whereas the first three PCs explain 67% (61%) of the total variation. As shown in Panel B, the 1st PC places

[25] Focusing on a global country-sample, and on a time-span which ends before the onset of the euro area sovereign debt crisis, Longstaff et al. (2011) find that the diversification benefits of sovereign credit portfolios (CDS) are lower than for international equity portfolios.

[26] We present results only for the first three PCs as these are those which explain most of the variation.

similar weights, across all countries, in fact the average loading for the CDS-bond basis ("adjusted bases") within the two different groups of "core" and "peripheral" countries is of 0.36 vs. 0.26 (0.36 vs. 0.30). This can therefore be defined as a "level factor". The 2nd PC, instead, differentiates well, between countries, where the average loading within the two different groups of "core" and "peripheral" countries is of -0.20 vs. 0.32 (-0.20 vs. 0.39 for the "adjusted" basis). This 2nd PC can, therefore, be interpreted as a "core vs. periphery" factor. Interestingly, even if in the case of the basis (and similarly for the "adjusted" basis) the degree of co-movements across countries is weaker than for CDS Premia, bond spreads and equity index returns, the first two PCs appear to have the same economic interpretation than in the case of CDS and bond spreads. This is clear evidence that its dynamics is strongly linked to conditions in sovereign credit markets.

Table VII reports the correlation matrix of the first two PCs of CDS Premia, bond spreads, the basis and the "adjusted" basis. We first focus on the 1st PCs. The correlation between the 1st PC of CDSs and bond spreads[27] is 0.80, hence the degree of co-movement between euro area countries' credit spreads is similar across the derivative and the cash market. The correlation between CDS and the basis's 1st PC is 0.76, whereas the correlation between bond spreads and the basis is only 0.22. Results not reported for brevity show that for "peripheral countries" the correlation between the bond spread and the basis is not significant. Hence, for "peripheral countries", the increase (or decrease) in the basis is related to the CDS rather than to the bond dynamics. The correlation between 1st PCs of CDS and the "adjusted" basis is very low and only weakly significant, while between bond spreads and the "adjusted" basis it is negative, -0.37 and highly significant, implying that the "adjusted basis" captures bond markets dynamics.

(Insert Table VII Here)

We next analyse the 2nd PCs. The correlation between the 2nd PC of CDS Premia and bond spreads 2nd PC equals 0.60, meaning that CDSs and bond spreads diverge across the "core" and the "periphery" together. The correlation between CDSs and the basis ("adjusted" basis) 2nd PC is 0.49 (0.33), meaning that CDSs and the bases ("adjusted" bases) diverge across the "core" and the "periphery" together. However, the correlation between bond spreads and the basis ("adjusted" basis) 2nd PC is -0.22 (-0.31), which implies that divergence of bond spread across the "core" and the "periphery" coincides with convergence of the basis (and "adjusted" basis). Hence, when there are credit risk shocks and CDS Premia increase and the bases converge, the bond markets have their specific developments.

[27] As expected, the correlation between the 1st PC of CDSs and bond spreads with the 1st PC of equity returns is respectively -0.59 and -0.46, meaning that when euro area wide credit spreads increase equity returns are negative.

We next analyse links between the 1^{st} and the 2^{nd} PCs. The correlation between CDS and bond spread's 1^{nd} PCs with the "adjusted" basis' 2^{nd} PC is respectively 0.37 and 0.39, while with the basis is it is not significant. Hence, when euro area wide credit risk, as captured by both CDS Premia and bond spreads, increases the "adjusted" basis diverges across the "core" and the "periphery". This further confirms that the "adjusted" basis captures bond markets' specific developments.

We also investigate the role of variables which previous research has shown are the determinants of credit spreads in determining the basis. For this purpose we implement a cross-sectional and time-series analysis by estimating respectively model (1) and (2) as for CDS Premia and bond spreads. Table IV A and B and Table V, show that the basis and the "adjusted basis" are negatively related to *equity volatility* and *leverage* in the cross-section, implying that countries with worst (better) fundamentals tend to have a (higher) lower basis. An important result is also that basis changes in the cross-section and the basis time-series dynamics can not be well explained by the covariates in the regressions.

5.3 Short-Selling Frictions

The CDS-bond basis is not explained by the fundamental and global variables which explain credit spreads, at the same time it exhibits a strong degree of co-movement across countries. Hence, we next study what are the common determinants.

When the basis is positive (CDS premium exceeds bond spread), arbitrageurs can in principle profit from this deviation. A "positive basis trade" involves short-selling the "cheap" bond and selling the "expensive" CDS on the underlying bond. Here, we test **Hypothesis 2** that "short-selling frictions", preventing arbitrageurs to short-sell a bond and profit from a "positive basis trade" explain persistently positive basis deviations.

First, we explore the role of "frictions" in the cross-section. For this purpose, we estimate a panel regression, with time-fixed effects, of the basis on *active utilization*, our proxy for "short-selling frictions":

$$Basis_{it} = \alpha_0 + X^T_{it}\,\beta_1 + \gamma_1\,ActiveUtilisation_{\,it} + v_t + \varepsilon_{it} \quad (3)$$

X_{it} is the vector of country specific *"fundamental"* control variables from model (1). Time fixed effects (FE) are captured by v_t. Table VIII shows that bonds with "stronger" short selling frictions tend to have larger positive bases and "adjusted" bases (coeff. 0,378 and 0,379).

Second, for time-series implications we estimate the following panel regression with country-fixed effects:

$$\Delta\,Basis_{it} = \alpha_0 + \Delta X^T_{it}\,\beta_1 + \Delta Z_t\,\beta_2 + \gamma_1 \Delta\,ActiveUtilisation_{\,it} + \rho_i + \varepsilon_{it} \qquad (4)$$

Z_{it} is the vector of the global proxies for the risk premium from model (2). Country fixed effects (FE) are captured by ρ_i. Table IX shows that when *active utilisation* increases the basis increases as well (coefficients are 0,141 and 0,133). The coefficient is significant only with a lag of two. Hence pricing deviations take places with some delay with respect to the appearance of frictions. To further investigate the time-series link between "short-selling frictions" and the basis, we apply the Engle-Granger two-step approach. First, we estimate a specification of the model with the variables in levels. Our assumption is that the long run relationship between the basis and *active utilisation*, on a country by country level is:

$$Basis_{it} = \alpha_0 + \beta_{1i}\, ActiveUtilisation_{it} + \varepsilon_{it} \qquad (5)$$

If we reject the hypothesis of a unit root in the residuals there is a long run relationship between the variables, i.e. they are cointegrated. When residuals are unit-root stationary[28], we estimate the short-run regressions, using first differences of the variables and the lagged error, obtained in the long run equation (5), by means of the following Error Correction Model:

$$\Delta\, Basis_{it} = \alpha_0 + \lambda\, (\varepsilon_{it-1}) + \beta_{1i}\, \Delta ActiveUtilisation_{it} + \varepsilon_{it} \qquad (6)$$

As shown in Table IX Panel A the *basis* and *active utilisation* co-move positively in levels. This is the case for almost all the countries across the euro area, as the coefficient is positive and we reject the hypothesis of a unit-root of the residuals. As shown in Panel B the lagged error (estimated in the first step) explains future changes of the basis, implying that the basis tends to revert back to its equilibrium whenever it deviates from it. As expected, *active utilisation* tends to anticipate *basis* movements. We conclude that these results provide strong support in favour of hypothesis 2.

5.4 The Basis and the "Flight-to-Quality/liquidity" Phenomenon

In situations of economic distress investors tend to rebalance their portfolios towards less risky and more liquid securities. This phenomenon is usually referred to as a "flight-to-quality" or a "flight-to-liquidity". It is usually difficult to disentangle the two effects. In the context of the euro are sovereign crisis, if investors reduce their euro area government bond holdings and increase their German Bund holdings it is unclear whether they do so because of their concerns about credit risk or market liquidity risk as these two risks are strongly correlated. The Italian government bond market which is the largest and more liquid one in Europe provides an example. Compared to Bunds, the Italian government bond market is characterized by larger daily bond volumes (median 306 Billions vs. 24,5) and higher number of transactions per day

[28] We check for unit-root-stationarity of the residuals by mean of the Augmented Dickey Fuller Test. In this case the OLS estimator is super consistent and there are no spurious regression problems when we estimate the vector of parameters in (5).

(median 529 vs. 44) and similar bid-ask spreads (median 0,14 vs. 0,14 bps) [29]. But note that, as shown in Figure 8 A, in stress situations, Italian government bonds, which have higher credit risk, tend to become less liquid (larger bid-asks) with respect to the German Bund.

(Insert Figure 8 Here)

We test the hypothesis (**Hypothesis 3)** that more creditworthy countries with more liquid government bonds have larger CDS-bond bases. Most likely, the "flight-to-quality" effect has shifted bond trading activity from "peripheral" countries and we expect bond illiquidity to be reflected in a yield premium, hence in a relatively higher bond yield spread and a lower CDS-bond basis.

As discussed in section 5.1, in the cross-section equity volatility and leverage are negatively related to the basis and the "adjusted basis", in other words, less (more) creditworthy countries tend to have lower (larger) CDS-bond bases. Evidence of the "flight to quality/liquidity" phenomena is provided by the correlation between the 10Y benchmark bund changes and the 1PCs of the CDS, the bond spread and the basis, which are respectively -0.42, -0.41, -0.24 and strongly significant. Hence, in the time-series perspective, increasing credit spreads and bases tend to coincide with declining bunds. Further evidence of the "flight to quality/liquidity" effect is provided be the behaviour of *Imbalance trade*. This variable is generally positive for the bond market, especially when transactions are expressed in weekly averages. A high level indicates a large amount of purchasing activity, while a low level signals a lack of buying activity. As a country specific example, Figure 8 B shows that when in 2011 the German bund yield was declining *imbalance trade* for the Italian government bonds was declining as well.

To analyse the cross-sectional link between credit risk and liquidity we estimate a panel regression, with time-fixed effects, of various liquidity measures such as *bid-ask spreads*, *bond volumes* and *number of transactions* on the level of the *CDS Premium*:

$$Bond\ Liquidity_{it} = \alpha + \beta\, CDS_{it} + v_t + \varepsilon_{it} \quad (7)$$

Time fixed effects (FE) are captured by v_t. Table X A shows that bonds with higher credit risk tend to be characterized by lower liquidity, i.e. by higher bid-ask spreads and fewer transactions and volumes. Hence, the most credit risk bonds were also the most illiquid ones.

(Insert Table X Here)

To analyse the cross-sectional relation between the basis and credit risk and liquidity we estimate a panel regression, with time-fixed effects, of the basis on *bid-ask spreads*, *bond volumes* and *number of transactions* and on the *CDS Premium*:

[29] These are some figures on the aggregate transactions on government bonds across all maturities. When reading these numbers, consider that the bund is characterized also by a very liquid future market.

$$Basis_{it} = \alpha + \beta X_{it} + v_t + \varepsilon_{it} \quad (8)$$

X_{it} is the vector of the proxies for credit risk or liquidity. Time fixed effects (FE) are captured by v_t. Table X B shows that bonds with higher credit risk and lower liquidity tend to have lower positive bases.

These results altogether support the view that “core” countries’ larger positive bases, with respect to those of “peripheral countries”, are an implication of the “flight to quality/liquidity” phenomenon.

5.5 Effects of the ECBs’ bond purchases on the basis

Trading across the cash (bond) and the derivative (CDS) market for credit risk might explain temporary price deviations. As an example, in May 2010, to address government bond markets problems and to contribute to restoring an appropriate monetary policy transmission mechanism, the ECB has conducted interventions in dysfunctional euro area market segments, using the Securities Markets Programme (SMP). This measure, which has targeted bonds of peripheral countries, was aimed at lowering the liquidity premium required by investors mainly due to the absence of trading activity, in situations of high credit risk. The impact of these types of actions cannot be assessed merely on the basis of declines in government bond yields, nor on that of any narrowing of spreads, as neither gives an exact picture of market impairments.

We explore the hypothesis that **(Hypothesis 4.)** that ECB bonds purchases have had a positive effect on the basis, as these massive purchases might led to upward bond price pressure. To investigate this issue we regress the basis on the *SMP weekly purchases;* moreover we interact the *SMP variable* with two dummies. The first dummy is 1 for the month of May 2010, while the second dummy is 1 for the month of August 2011 otherwise they are zero. Results in Table XI (A) show that SMP purchases have had a positive effect on the basis for the countries for which the bond are purchased and in the specific “purchasing-periods”. The ECB activated the program on May 10, 2010 to intervene for buying Greek, Irish and Portuguese government bonds and re-activated it on August, 7 2011 for buying Italian and Spanish bonds. The significance of the coefficients is consistent with this.

(Insert Table XI Here)

We run the same regression separately for CDS and bond yield spreads. Results are reported in Table XI (B) and (C). For peripheral countries, throughout the sample, SMP purchases tend to decrease both CDS and bond spreads, as the coefficients are negative and generally significant. Instead, we find that *SMP* interacted with the *May2010* and *August2011* dummies tends to be associated to both increases in CDS Premia and bond spreads. The SMP programme has been implemented, to the largest extent, when credit spreads where increasing sharply and bond markets were extremely illiquid.

Our interpretation is that the buying pressure generated by the SMP had a stabilising effect on bond yields and was reflected in a temporary improvement of bond liquidity (i.e. reduction of the bid-ask spreads). This is supported by the fact that the bond purchases in May 2010 and August 2011 had a positive impact on the basis.

As described by Corradin and Maddaloni (2012) the SMP portfolio has a long term horizon and bonds are not repoed-out. For this reason, the ECB activity is also likely to make the purchased bonds "special", i.e. difficult to short-sell, favoring the persistence of a positive basis. The positive relation between the basis and "short-selling frictions" has been already documented and discussed in Section 5.3.

5.6 The role of "Funding Frictions"

The basis of countries with weaker public finances was negative in several situations as already documented in the Section 4. Here, we test the hypothesis (**Hypothesis 5**) that this was due to the appearance of "funding frictions" which made it difficult or costly for arbitrageurs to finance the purchase of the bond (via repo transaction) for implementing "negative basis" trades.

As we have obtained the complete data series of the haircut only for Italy, we discuss, as case study, developments in the Italian bond market. Figure 9 A shows that the basis was negative in reaction to sharp increases of the "haircut". We focus on haircuts of the Italian 10-year benchmark bond as the basis has a maturity of 10 years as well. More specifically, the basis became negative when the first haircut increase took place, from 3-4 to 5-6%, around mid-July 2011. It was again negative in the first two months of 2012, right after the haircut was increased from 7% to 11-12% in November 2011. Finally, it was persistently negative from mid-July 2012 on after the haircut was increased from 8 to 11-12%. Throughout this period of stress the basis was not only negative, it also fluctuated quite substantially. As discussed in Section 5.5, SMP purchases of Italian government bonds by the ECB were the main determinants of the sharp increase of the basis in the beginning of August 2011.The positive spikes in August-September 2011 and in the period from March to July 2012 exhibited persistency due to the appearance of "short-selling frictions" as highlighted in Figure 9 B and as extensively discussed in Section 5.3.

Figure 9 C shows that the increase of the haircut was also associated with massive bond sell-offs as captured by a reduction in institutional ownership (*available quantity*) from August 2011 on. As shown in figure 9 D, it was also associated with dramatic deterioration of bond liquidity as measured by a reduction of trading activity. For example, before July 2011 in the Italian bond market on average 627 daily transactions were taking place, while afterwards only 436. Moreover, the increase of the haircut and the reduction in trading activity were associated with temporary sharp increases of the bid-ask spread in July and November 2011.

(Insert Figure 9 Here)

5.7 Basis deviations and Arbitrage Activity

We now investigate arbitrage activity across the cash and the derivative market for credit risk. We present a case study of the developments in the Italian market.

We assume that basis deviations generate predictions for CDS and bond trading activity and test the **Hypothesis 6** discussed in Section 3. The "positive and negative basis trade" involves taking position both in the CDS and in the bond market.

In the derivative market, we measure CDS buying and/or selling activity by averaging the change in net notional outstanding amounts across the last four observations. When this quantity is found to be positive (negative) it means that on aggregate market participants are purchasing (selling) protection. As shown in Figure 10 A in the four situations where CDS selling activity is most evident (large negative values), namely in April 2010, December 2010, September-October 2011 and April 2012, the basis was largely positive. Instead when the basis was negative, namely in the end of July 2011, in January-February 2012 and from July 2012 on, the CDS market was characterized by purchasing activity as captured by increasing net notional outstanding amounts.

We finally focus on the bond market. As shown in Chart B. bond short-selling activity (as proxied by quantity on loan) tends to take place when the basis is positive: in December 2009 - February 2010, in December 2010, in August 2011 and in the period from March to June 2012. Also, as shown in Chart C bond purchasing activity tends to take place (trade imbalance is positive and spiking) when the basis is negative.

In summary, consistent with what is predicted by arbitrage trading, we document that when the basis is positive CDS selling activity and bond "short-selling activity" are prevailing, while when the basis is negative CDS and bond purchasing activity are prevailing. This trading appears to have a stabilizing effect of pricing deviations across the CDS and bond market, in the sense that even if large fluctuations take place, the basis tends then to revert back.

6. Conclusion

In principle, CDS and bonds offer investors a similar exposure to the risk and return of debt issued by governments, hence, their pricing is expected to be determined by the same set of risk factors. Instead, we find that both CDS and bond spreads correlate positively with measures of the “risk premium”, but CDS exhibit a stronger correlation with country specific fundamental drivers of credit risk.

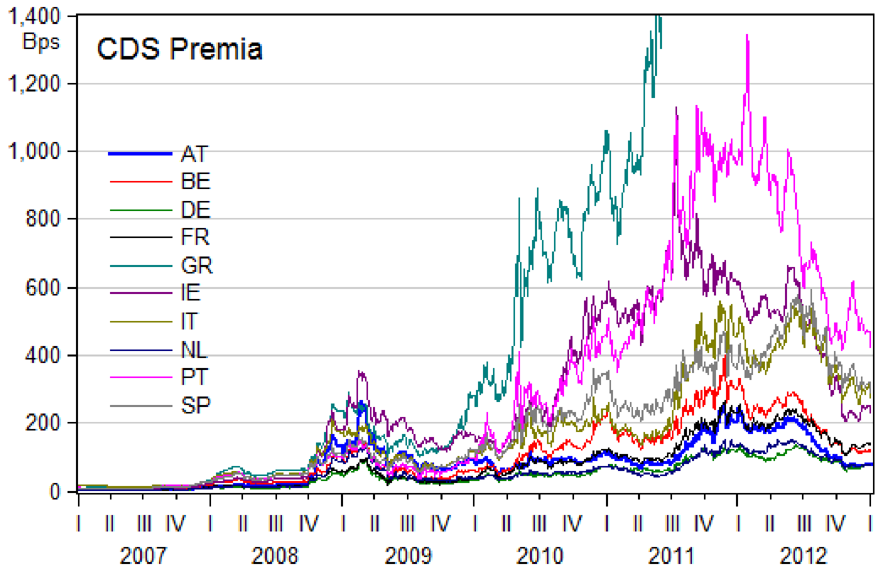
Pricing in the CDS and the government bond market may have drifted apart because of “flight to quality/liquidity” effects in the latter, but also because of increasing hurdles for those traders who were trying to exploit what seemed to be sizable arbitrage opportunities. The increase of sovereign credit risk exacerbated “short-selling frictions” in the government bond market and generated positive basis deviations. Also, the crisis has had an adverse impact on both “market” and “funding liquidity”, with the consequence that bonds issued “peripheral” governments where characterized by negative bases.

There is evidence that during times of market stress the number of market participants who acted as arbitrage traders declined sharply due to decreasing risk appetite and the exit of several major institutions (cf. Alloway, 2013). In any case, consistent with predictions of the theory of arbitrage trading, we document that when the basis is positive CDS selling activity and bond “short-selling activity” are prevailing, while when the basis is negative CDS and bond purchasing activity are prevailing. This trading appears to have a stabilizing effect of pricing deviations across the CDS and bond market, in the sense that even if large fluctuations take place, the basis tends then to revert back after a while.

All these phenomena are reflected in the pricing of sovereign CDS and their underlying government bonds, generating substantial and persistent deviations, which highlight the different nature of the market pricing in these two closely linked markets.

Figure 1: CDS Premia and Bond Yield Spreads – 10 Euro Area Sovereigns

This figure shows the time-series of the CDS Premium and the bond yield spread for the ten euro area countries considered in the analysis. CDS Premia, the national benchmark bonds and the risk-free benchmark (i.e. the German bund) used to calculate the bond spread have a 10-year maturity. The sample period is 1 January 2007 to 31 December 2012. The series for Greece is censored in June 2011. Observations are weekly.



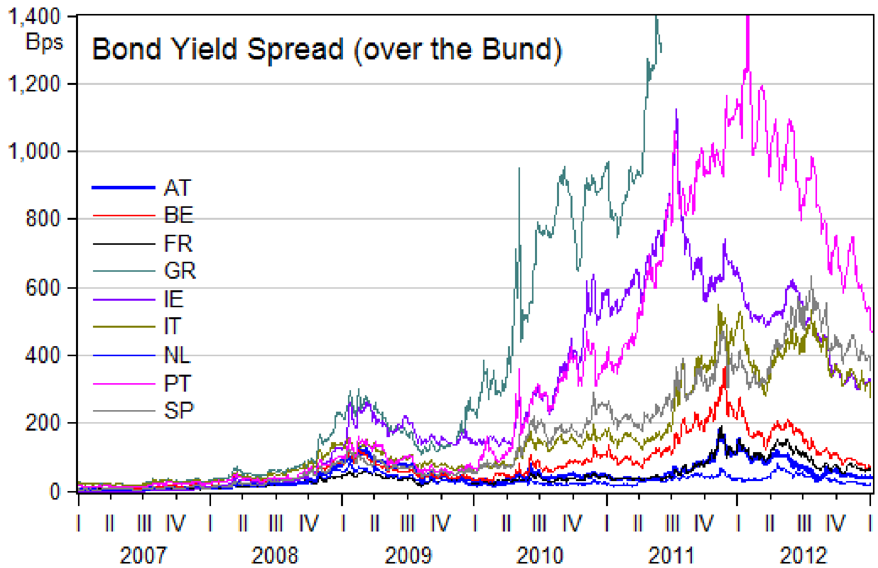


Figure 2: CDS-bond basis – 10 Euro Area Sovereigns

Chart a), b) and c) show the time-series dynamics of the CDS-bond basis for ten euro area countries. Chart d) reports a comparison of the CDS-bond basis for three selected countries: France, Italy and Portugal. CDS Premia, the national benchmark bonds and the risk-free benchmark (i.e. the German bund) used to calculate the basis have a 10-year maturity. The sample period is 1 January 2007 to 31 December 2012. Observations are weekly.

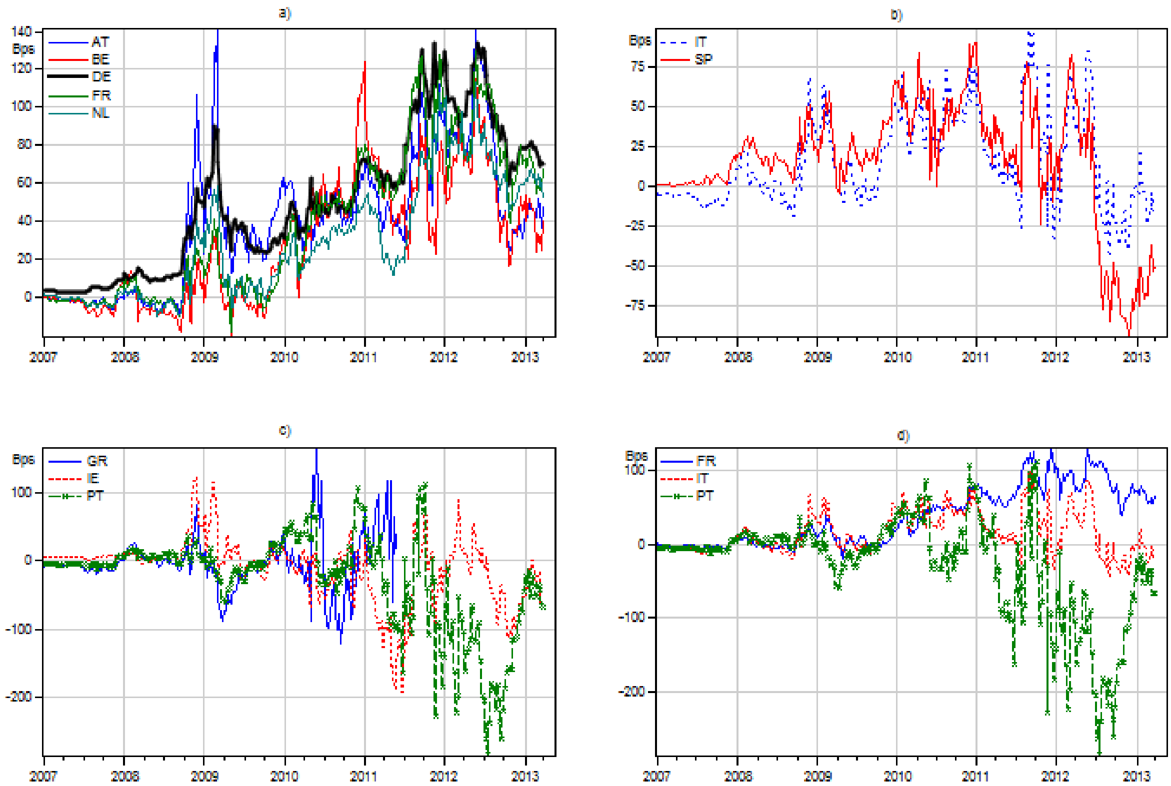


Figure 3: Adjusted CDS-bond basis – 10 Euro Area Sovereigns

Chart a), b) and c) shows the time-series dynamics of the "Adjusted" CDS-bond basis for ten euro area countries. Chart d) reports a comparison of the CDS-bond basis and "Adjusted" CDS-bond basis for one selected country: Italy. The CDS Premia, the national benchmark bonds and the risk-free benchmark (i.e. the German bund) used to calculate the basis have a 10-year maturity. The sample period is 1 January 2007 to 31 December 2012. Observations are weekly.

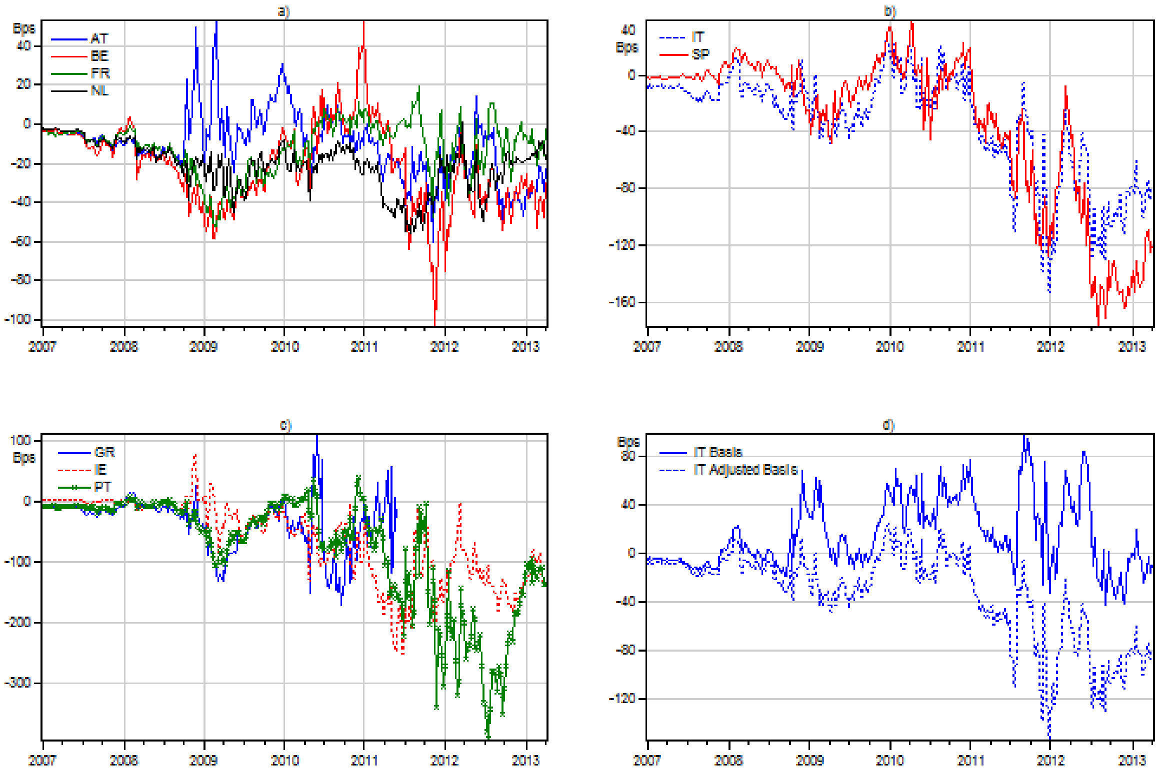


Figure 4: Set of Explanatory Variables

This figure shows time-series dynamics of the following determinants of the credit spreads: the risk-free rate, the slope of the term-structure, the EVZ and the cross-sectional average, across countries, of the idiosyncratic equity volatility and the debt level. Observations are weekly.

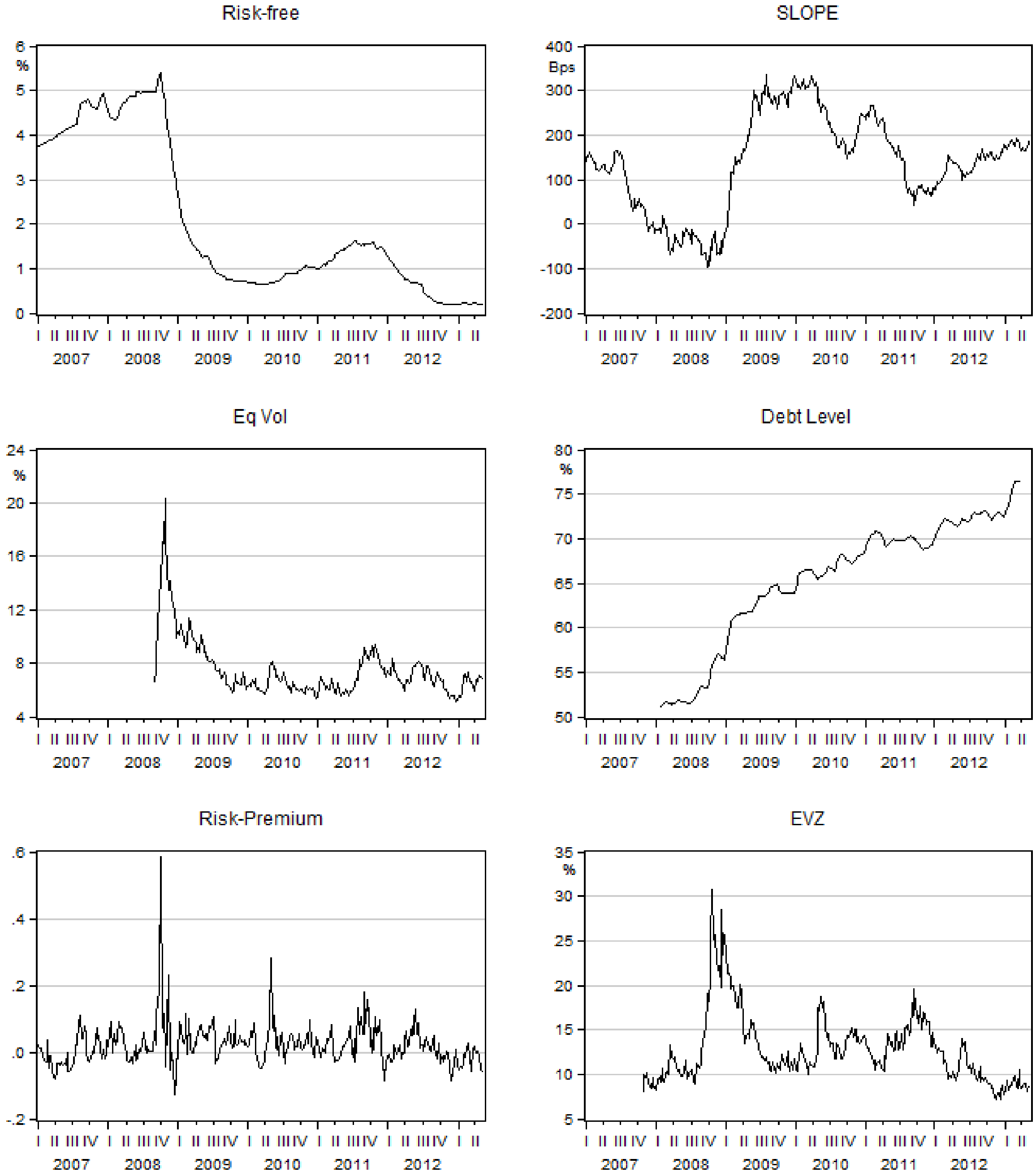


Figure 5: Total and weekly SMP Purchases Amounts

On the left-hand side axis this figure shows the book value of the cumulative SMP purchases, while on the right weekly purchases. Amounts are in billion euro as of Friday of each given week.

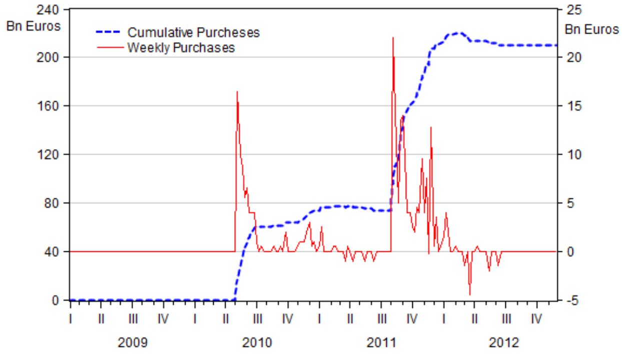


Figure 6: "Specialness" of 10Y Italian Government bonds

This figure shows the time-series dynamics of the "specialness" of the 10 years Italian benchmark bond.

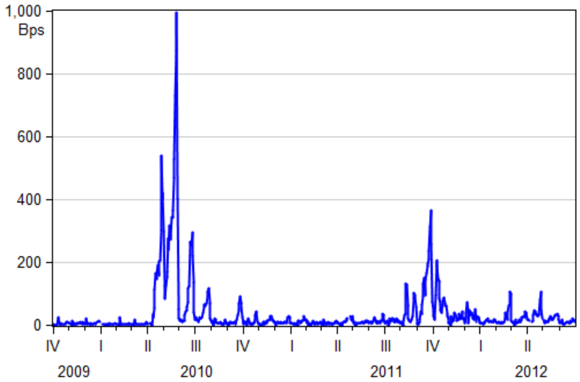


Figure 7: Margins for the 10Y Italian Government bond

On the right-hand side axis the figure shows the time-series dynamics of the Margins/Haircuts (expressed in % of the par notional) for Italian Government bonds with a maturity from 7 to 10 Years. On the left-hand side axis the figure shows the dynamics of the 10 years Italian benchmark bond yield spread.

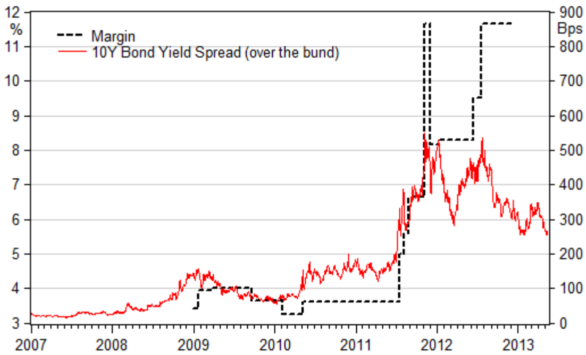
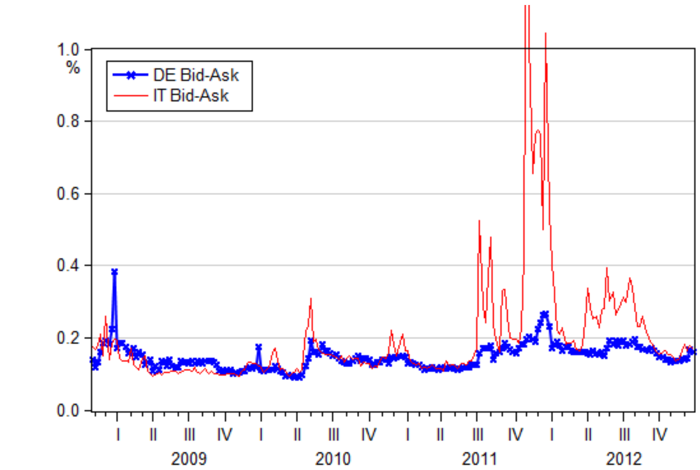


Figure 8: German Bund vs. Italian government Bond

Chart A shows the time-series dynamics of the bid-ask spread of the German bund and the Italian government bond. Chart B. shows the on the right-hand side axis the time-series dynamics of 10 years Bund benchmark bond yield, on the left hand side axis the dynamics of imbalance trades for the Italian government bond. Data on bid-asks and trade imbalances are weekly averages of daily observations, across bonds of all maturities.



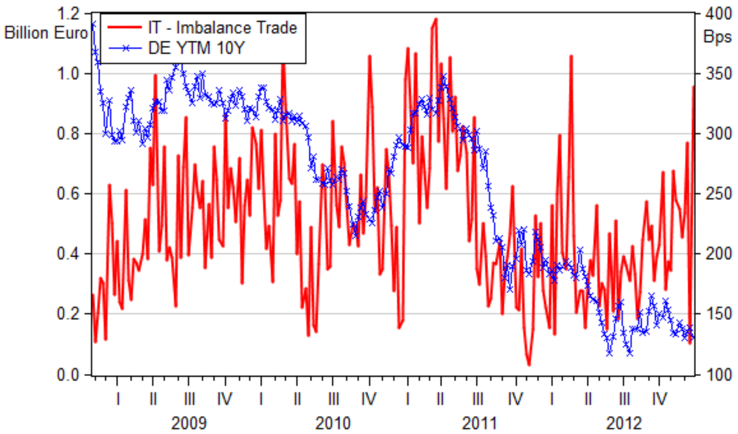


Figure 9: Haircuts, Short-selling frictions, Liquidity and the Basis. The Case of Italy.

Chart A. shows the time-series of the CDS-bond basis on the left-hand axis and of the haircut applied on the 10Y Italian government bond on the right-hand axis. Chart B. shows the CDS-bond basis on the left-hand axis and the dynamics of "active utilisation" (our proxy of short-selling frictions) of the Italian benchmark bond on the right-hand side axis. Chart C. shows the dynamics of the "available quantity" (proxy for institutional ownership) on the left-hand side axis and the dynamics of the haircut applied on the 10Y Italian government bond on the right-hand axis and. Chart D. shows the weekly average of daily number of transactions on the right-hand axis and the bid-ask spread on the left-hand side axis. Data are weekly observations.

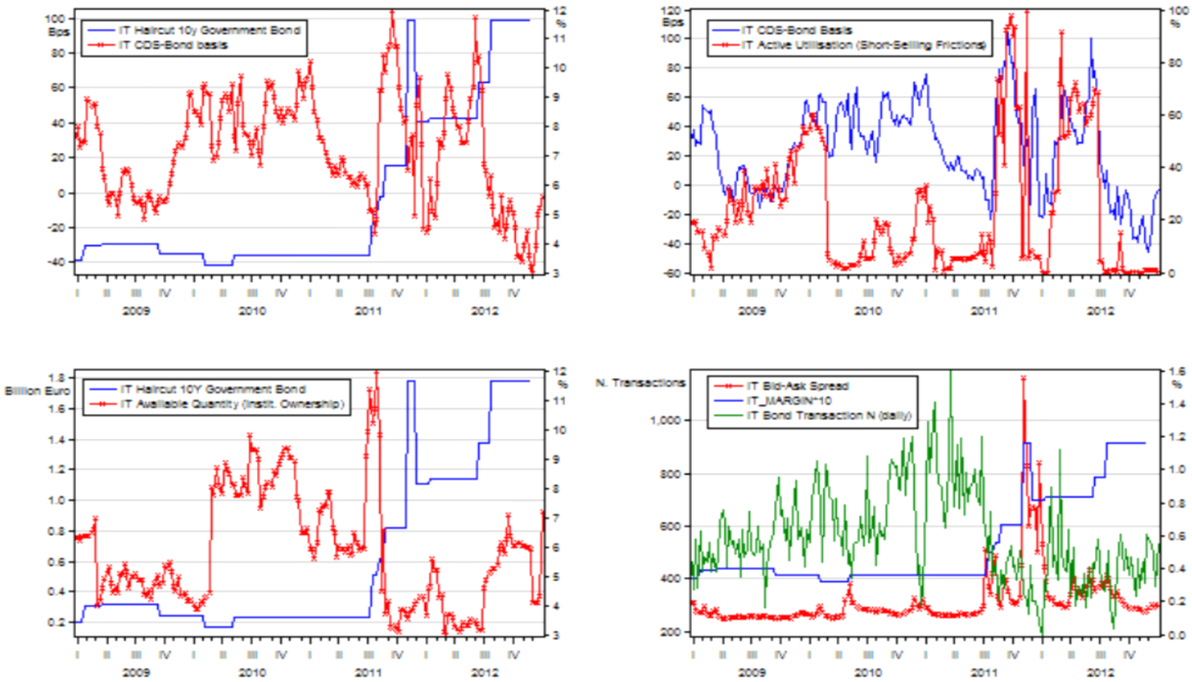


Figure 10: Arbitrage Activity. The Case of Italy

Chart A. shows the time-series dynamics of the CDS-bond basis on the left hand axis and of CDS net notional amount changes (averaged across the last 4 obs. so to measure purchases) on the right-hand side axis. Chart B. shows the time-series of "quantity on loan" a measure of short-selling activity on the right -hand side axis. Chart C shows the dynamics of "imbalance trade" in the bond market on the right hand side axis. Data are weekly observations.

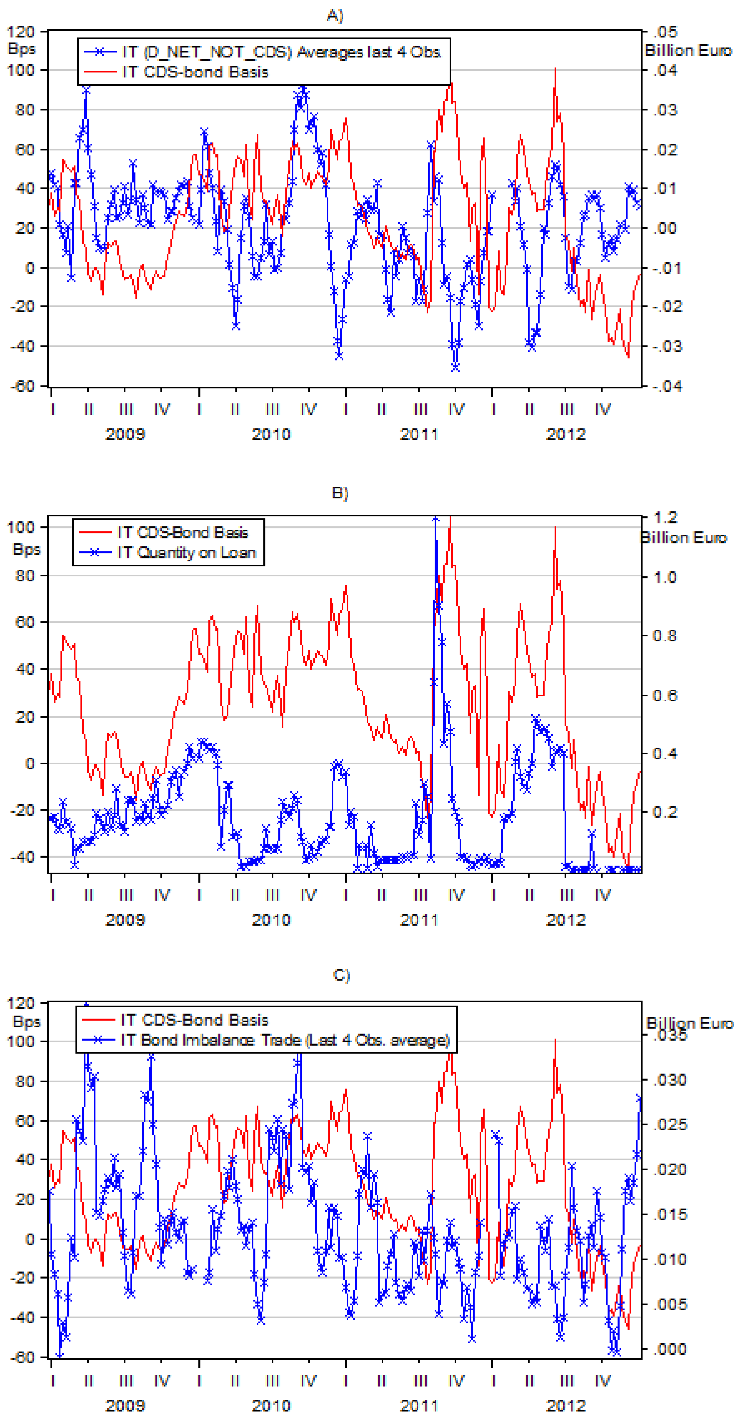


Table I. CDS Premia, Bond Spreads, Basis and "Adjusted" Basis – Descriptive Statistics

Panel A. reports descriptive statistics for weekly CDS Premia and bond yield spread (over the bund and with 10-year maturity) changes measured in basis points. Panel B. descriptive statistics for weekly CDS-bond basis and adjusted CDS-bond basis changes. The sample period is 1 January 2007 to Dec 2012.

Panel A

	Δ(CDS)				Δ(Bond Spread)					Correlation
	Mean	Std. Dev.	Max.	Min.	Mean	Std. Dev.	Max.	Min.	N. Obs:	Δ(CDS) vs. Δ(Bon Spread)
AT	0,41	12,58	71,55	-59,75	0,13	8,01	47,70	-49,20	326	0,56
BE	0,60	15,69	74,13	119,09	0,23	13,72	78,40	-110,30	326	0,82
DE	0,32	5,25	24,41	-22,46	//	//	//	//	326	//
FR	0,58	8,86	28,42	-53,82	0,21	7,26	35,90	-40,10	326	0,60
GR	5,04	46,69	260,31	325,71	-0,08	84,71	347,17	1289,90	232	0,20
IE	1,36	38,11	227,37	279,83	1,03	30,92	157,70	-191,90	326	0,79
IT	1,40	21,93	86,80	-99,00	0,95	18,70	75,90	-100,60	326	0,77
NL	0,34	6,32	31,48	-34,67	0,05	4,50	18,00	-15,10	326	0,41
PT	1,99	50,31	310,15	248,66	1,70	42,22	210,30	-173,08	326	0,77
SP	1,53	21,58	71,52	101,49	1,26	21,22	71,30	-120,80	326	0,83
Core	0,45	9,74	46,00	-57,96	0,16	8,37	45,00	-53,68		0,60
Periphery	2,27	35,72	191,23	210,94	0,97	39,55	172,47	-375,26		0,67

Panel B

	Δ(CDS-Bond Basis)				Δ(Adjusted CDS-Bond Basis)					Correlation
	Mean	Std. Dev.	Max.	Min.	Mean	Std. Dev.	Max.	Min.	N. Obs:	Δ(Basis) vs. Δ(Adj basis)
AT	0,15	10,05	56,51	-55,94	-0,06	8,34	32,10	-38,44	326	0,85
BE	0,13	8,54	36,38	-33,68	-0,08	8,23	30,81	-30,47	326	0,80
DE	0,20	5,18	24,41	-22,46	//	//	//	//	326	//
FR	0,21	7,27	30,72	-26,79	0,00	6,12	19,86	-29,20	326	0,71
GR	0,03	30,30	117,52	177,32	0,05	29,87	128,02	-174,37	232	0,98
IE	-0,20	22,81	109,57	-97,80	-0,40	22,18	99,55	-100,41	326	0,97
IT	-0,01	14,54	101,86	-53,77	-0,21	13,05	96,29	-46,83	326	0,93
NL	0,16	5,97	26,84	-22,25	-0,05	5,20	13,85	-24,13	326	0,57
PT	-0,19	31,43	144,56	198,49	-0,39	30,32	152,45	-176,03	326	0,98
SP	-0,16	12,86	50,03	-55,81	-0,36	12,09	45,26	-51,47	326	0,91
Core	0,17	7,40	34,97	-32,22	-0,05	6,97	24,16	-30,56		0,73
Periphery	-0,10	22,39	104,71	116,64	-0,26	21,50	104,31	-109,82		0,95

Table II. Covariates - Variables definitions

This table shows variable definitions of the covariates used in the empirical analysis and their data sources. Panel A. contains the "fundamental" determinants of CDS and bond spreads, Panel B. the proxies for the risk premium, Panel C. the proxies for CDS trading activity and Panel D. the proxies for bond trading activity and "arbitrage frictions" in the credit markets.

PANEL A:	**The "Fundamentals" Determinants of Credit Spreads**	**Source**
Rf	Risk-free rate (Euribor 3m)	Bloomberg
Slope	10 Year Euro Swap rate minus 3 Month Euribor	Bloomberg
Eq Ret	A country's equity index returns minus euro area equity Index	Datastream
Eq Vol	Annualized GARCH (1,1) volatility of idiosyncratic equity returns	Datastream
Debt/Leverage	(Gov Bond outstanding amounts) / GDP	Bloomberg

PANEL B:	**Proxies for global risk factors**	
Risk Premium	VSTOXX (index of implied volatility of the EuroStoxx50) – annualized GARCH (1.1) realized volatility	Bloomberg
EVZ	Exchange rate Euro/USD Implied Volatility	Bloomberg

PANEL C:	**CDS Trading Activity**	_
CDS Net Not	CDS net notional outstanding amounts (Billion Euro)	DTCC
CDS Volume	CDS weekly trading volume (N. contracts)	DTCC

PANEL D:	**Bond Trading and "Frictions"**	_
Bond Volume	Weekly bond volume (Billion Euro) and transaction N. (average all maturities)	MTS
Bond Bid-Ask	Weekly bid-ask spread (average all maturities)	MTS
Bond Outst.	Government bond outstanding amounts/ GDP	Bloomberg
SMP Purchases	Weekly ECB euro area government bond purchases	ECB
Bond Haircut	Italian bond haircut (7-10 year maturity)	CCG
Quantity on Loan	Quantity of bonds on loan/borrowed and is a proxy for "short-selling activity"	Data Explorer
Active Utilisation	% of securities in lending programmes which are currently out on loan and gives an indication of the lack of bonds to short in the market.	Data Explorer
Available Quantity	Proxy for "institutional ownership".	Data Explorer
Bond Specialness	Repo on the bond – General Collateral Repo rate	ECB

Table III. Descriptive Statistics

This table reports descriptive statistics of CDS net notional outstanding amounts in Billion Euros, relative CDS market size, (where we scale CDS net notional outstanding amount by the value of total bonds outstanding), CDS volumes (N. contracts) and CDS Turnover, (where we scale CDS volume in Notional amount by CDS net notional outstanding amount. Observations are weekly.

	Sample: November 2008 May 2013									
A) CDS Net Notionals	AT	BE	DE	FR	GR	IE	IT	NL	PT	SP
Mean (Billion Euros)	4.9	4.0	11.3	11.2	4.8	3.1	16.8	2.2	4.8	10.8
Median	4.5	4.1	11.4	11.8	5.3	3.1	16.4	2.2	4.5	11.1
Maximum	7.0	5.3	18.2	19.2	6.7	4.4	21.7	3.4	7.0	13.5
Minimum	3.2	2.7	6.7	3.5	2.3	1.9	12.0	1.0	3.1	7.5
Std. Dev.	1.0	0.7	2.9	4.9	1.3	0.5	1.9	0.5	1.1	1.6
Obs:	226	226	226	226	177	226	226	226	226	226

B) Relative CDS Market Size	AT	BE	DE	FR	GR	IE	IT	NL	PT	SP
Mean (%)	2.7	1.2	0.8	0.8	1.7	3.7	1.1	0.7	3.9	1.9
Median	2.5	1.2	0.7	0.8	1.9	3.4	1.0	0.7	3.7	2.0
Maximum	4.1	1.6	1.1	1.3	2.5	6.2	1.4	1.0	6.0	3.1
Minimum	1.6	0.8	0.5	0.3	0.9	1.7	0.9	0.4	2.5	1.2
Std. Dev.	0.6	0.2	0.1	0.3	0.5	0.9	0.1	0.1	1.0	0.3
Obs:	226	226	226	226	177	226	226	226	226	226

	Sample: July 2010 May 2013									
C) CDS Volumes	AT	BE	DE	FR	GR	IE	IT	NL	PT	SP
Mean (N. Contracts)	40.0	68.8	127.0	244.9	82.9	71.7	278.6	26.1	91.1	299.7
Median	29.0	52.5	109.0	191.0	74.0	60.0	253.0	19.0	81.5	279.0
Maximum	249.0	281.0	553.0	1271.0	245.0	277.0	867.0	153.0	308.0	941.0
Minimum	2.0	4.0	2.0	7.0	4.0	1.0	13.0	1.0	3.0	8.0
Std. Dev.	34.4	56.5	99.6	205.2	46.6	48.4	161.2	25.1	51.0	161.7
Obs.	130	130	130	130	81	130	130	130	130	130

D) CDS Turnover	AT	BE	DE	FR	GR	IE	IT	NL	PT	SP
Mean (%)	11.1	15.1	13.3	18.1	15.5	19.0	22.5	10.8	16.8	26.7
Median	8.5	11.7	10.9	15.7	13.1	15.5	19.2	8.1	13.3	24.4
Maximum	53.4	57.4	64.4	73.3	54.8	67.9	77.2	50.5	67.3	69.2
Minimum	0.5	1.2	0.1	1.1	0.5	0.6	0.5	0.0	0.5	0.6
Std. Dev.	9.3	10.5	9.3	11.3	10.8	14.4	13.0	8.7	12.6	13.9
Obs.	130	130	130	130	81	130	130	130	130	130

Table IV. Credit Spreads and the Basis – Cross-Sectional Analysis

*This table reports results from a panel regression with time-fixed effects on credit spreads and the basis. The regression specification is given by $Y_{it} = \alpha + \beta_1 \, EqRet_{it} + \beta_2 \, EqVol_{it} + \beta_3 \, Debt_{it} + v_t + \varepsilon_{it}$ Reported coefficients are in basis points and p-values are (in parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5% and 10% are denoted by ***, ** and * respectively. Chart A reports results in levels, Chart B in changes. The sample period is November 2008 to Dec 2012. Weekly Observations.*

Panel A

Variable	CDS	Bond Spread	Basis	Adj Basis
C	-54,396	38,749	48,847	-31,66
	(0,002)***	(0,134)	(0,000)***	(0,000)***
EqRet	-0,142	0,017	-0,031	-0,028
	(0,275)	(0,920)	(0,406)	(0,456)
EqVol	0,243	0,093	-0,037	-0,033
	(0,000)***	(0,000)***	(0,000)***	(0,000)***
Debt	1,549	1,301	-0,277	-0,156
	(0,000)***	(0,000)***	(0,000)***	(0,000)***
Time FE	Yes	Yes	Yes	Yes
N	1948	1811	1811	1811
Adj. R-sq	0,453	0,121	0,125	0,214

Panel B

Variable	Δ (CDS)	Δ (Bond Spread)	Δ (Basis)	Δ (Adj Basis)
C	1,292	1,247	-0,216	-0,350
	(0,000)***	(0,847)	(0,020)**	(0,000)***
Δ EqRet	-0,039	-0,013	-0,005	-0,006
	(0,004)***	(0,727)	(0,520)	(0,474)
Δ EqVol	0,012	0,000	-0,011	-0,010
	(0,268)	(0,911)	(0,132)	(0,157)
Δ Debt	-1,085	-0,006	0,118	0,133
	(0,395)	(0,896)	(0,899)	(0,873)
Time FE	Yes	Yes	Yes	Yes
N	1948	1811	1811	1811
Adj. R-sq	0,347	0,128	0,256	0,194

Table V. Time-Series Analysis of Credit Spreads

This table reports results from a panel regression with country-fixed effects on credit spreads and the basis. The regression specification is given by $\Delta \, Y_{it} = \alpha + X^T_{it} \, \beta_1 + \beta_2 \, \Delta \, Rf_t + \beta_3 \, \Delta \, Slope_t + \beta_4 \, \Delta \, RA_t +$

*$\beta_5\Delta$ EVZ$_t$ +ρ_i+ ε_{it} The vectorΔXit represents the base case covariates of country-specific variables. Reported coefficients are in basis points and p-values are (in parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5% and 10% are denoted by ***, ** and * respectively. Results are in changes. The sample period is November 2008 to December 2012. Weekly Observations.*

	Δ (CDS)	Δ (Bond Spread)	Δ (Basis)	Δ (Adj Basis)
C	1,357	0,371	-0,121	-0,181
	(0,289)	(0,794)	(0,890)	(0,819)
Δ(Rf)	-0,214	-0,259	0,013	0,113
	(0,355)	(0,209)	(0,927)	(0,319)
Δ(SLOPE)	-0,157	-0,076	-0,042	-0,008
	(0,079)*	(0,404)	(0,455)	(0,869)
Δ(EqRet)	-0,046	0,006	-0,011	-0,008
	(0,001)***	(0,870)	(0,234)	(0,362)
Δ(EqVol)	0,018	0,004	-0,011	-0,015
	(0,088)*	(0,839)	(0,125)	(0,030)**
Δ(Debt)	-0,920	-0,757	0,277	0,265
	(0,520)	(0,397)	(0,771)	(0,764)
Δ(RP)	0,015	0,013	0,003	0,000
	(0,001)***	(0,003)***	(0,215)	(0,659)
Δ(EVZ)	0,026	0,028	0,000	-0,004
	(0,004)***	(0,000)***	(0,979)	(0,979)
Country FE	Yes	Yes	Yes	Yes
N	1948	1811	1811	1811
Adj R-sq	0,129	0,041	0,028	0,026

Table VI. CDS, Bond Spread and CDS-bond basis – Principal Component Analysis

This table reports results of a principal component analysis of weekly changes of CDS, Bond Spreads and national equity index returns, CDS-bond bases and "adjusted" CDS-bond bases changes. Panel A reports the percentage of explained variation by 1st, 2nd and 3rd PC and the cumulative percentage of *explained variation by the first three PCs. Panel B reports the eigenvectors (loadings) of PC1 and PC2 across the various countries. At the bottom of the averages of the loadings within the two groups of "core" and "peripheral" countries are reported. The sample period is 1 January 2007 to Dec 2012.*

Panel A

PC	Δ CDS %	Δ Bond Spread %	Equity Ret.	Δ Basis %	Δ Adj. Basis %
1	64%	50%	70%	45%	34%
2	12%	14%	7%	13%	16%
3	7%	11%	6%	10%	12%
Tot 3	84%	75%	82%	67%	61%

Loadings (Eigenvectors) Panel B

Country	PC 1	PC 2	PC 1	PC 2	PC 1	PC 2	PC 1	PC 2	PC 1	PC 2
AT	0,33	-0,32	0,37	-0,33	0,33	0,10	0,35	-0,28	0,32	-0,31
BE	0,36	-0,07	0,40	-0,18	0,32	-0,08	0,34	0,11	0,43	-0,07
DE	0,33	-0,28	//	//	0,34	-0,02	0,35	-0,29	//	//
FR	0,36	-0,20	0,39	-0,32	0,36	-0,02	0,37	-0,24	0,37	-0,34
GR	0,28	0,38	0,02	0,32	0,23	0,79	0,16	0,33	0,23	0,08
IE	0,27	0,43	0,30	0,46	0,29	-0,06	0,20	0,56	0,24	0,43
IT	0,36	0,06	0,39	0,13	0,35	0,05	0,34	0,11	0,36	0,25
NL	0,33	-0,31	0,32	-0,29	0,32	-0,35	0,36	-0,33	0,34	-0,45
PT	0,24	0,56	0,24	0,57	0,31	0,20	0,27	0,45	0,25	0,55
SP	0,35	0,15	0,36	0,15	0,29	-0,43	0,34	0,14	0,39	0,15

Average Loadings

Core	0,34	-0,24	0,37	-0,28	0,33	-0,08	0,36	-0,20	0,36	-0,29
Periph.	0,30	0,32	0,26	0,33	0,29	0,11	0,26	0,32	0,30	0,29

Table VII. PC – PCs Correlation Matrix

This table reports the correlation between the 1st and 2nd PCs extracted from weekly changes of CDS, Bond Spreads, CDS-bond bases and "adjusted" CDS-bond bases The sample period is 1 Jan 2007 to Dec 2012.

Correlation	**1st PC**					**2nd PC**				
(Prob.)	CDS	B Spread	Basis	AdjBasis	Equity	CDS	B Spread	Basis	AdjBasis	Equity
	1st PC									
CDS	1									
	-									
B Spread	0,80	1								
	(0,00)	-								
Basis	0,76	0,22	1							
	(0,00)	(0,00)	-							
Adj Basis	0,09	-0,37	0,58	1						
	(0,10)	(0,00)	(0,00)	-						
Equity	-0,59	-0,46	-0,44	-0,01	1					
	(0,00)	(0,00)	(0,00)	(0,87)	-					
	2nd PC									
CDS	0,00	0,15	-0,19	0,10	0,09	1				
	(0,94)	(0,01)	(0,00)	(0,08)	(0,09)	-				
B Spread	0,08	0,00	0,08	0,17	-0,07	0,60	1			
	(0,17)	(1,00)	(0,17)	(0,00)	(0,23)	(0,00)	-			
Basis	-0,04	0,00	-0,01	0,30	0,17	0,49	-0,22	1		
	(0,46)	(0,97)	(0,92)	(0,00)	(0,00)	(0,00)	(0,00)	-		
Adj Basis	(0,37)	0,39	0,22	-0,01	-0,10	0,33	-0,31	0,78	1	
	0,00	(0,00)	(0,00)	(0,92)	(0,07)	(0,00)	(0,00)	(0,00)	-	
Equity	-0,19	-0,13	-0,17	-0,09	-0,01	0,09	-0,05	0,07	-0,08	1
	(0,00)	(0,03)	(0,00)	(0,11)	(0,80)	(0,11)	(0,38)	(0,23)	(0,16)	-

Table VIII. The Basis and "Short-selling frictions" – Panel Regressions

This table reports results from a panel regression of the basis and "adjusted" basis on short-selling frictions. Chart A. reports results of regressions in levels with time fixed effect. Chart B. reports results in changes. P-values are (in parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5%

*and 10% are denoted by ***, ** and * respectively. The sample period is November 2008 to December 2012. Weekly observations.*

Chart A Cross-Section

Variable	Basis	Adj Basis
C	yes	yes
Active Utilisation	0.378 (0,004)***	0.379 (0,004)***
Country Specific Covariates as controls	yes	yes
Time FE	yes	yes
N	1811	1811
Adj. R-sq	0.125	0.233

Chart B Time-Series

	Δ (Basis)	Δ (Adj Basis)
C	yes	yes
Δ(Active Utilisation)	0.141 (0,076)*	0.133 (0,013)**
Δ(Country Specific Covariates)	yes	yes
Δ(Global Proxies Risk Premium)	yes	yes
Country FE	yes	yes
N	1811	1811
Adj. R-sq	0.022	0.023
ADF	2.020	2.000

Table IX. The Basis and "Short-selling frictions" – Cointegration Analysis

This table presents the results of the Engle-Granger two-step estimation. (Chart A) First, we estimate the model using the variables in levels. The long run relationship between the basis and active utilisation, is: $Basis_{it} = \alpha_0 + \beta_{1i}$ $ActiveUtilisation_{it} + \varepsilon_{it}$*. We check for unit-root stationarity of the residuals by mean of the Augmented Dickey Fuller Test. (Chart B) Second, we estimate the short run regressions, using first differences of the variables and the lagged* *error, obtained in the long run equation, by mean of the following Error Correction Model:* $\Delta\ Basis_{it} = \alpha_0 + \lambda(\varepsilon_{it-1}) + \beta \Delta ActiveUtilisation_{it} + u_{it}$. *Reported coefficients are in basis points and p-values are (in parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5% and 10% are denoted by ***, ** and * respectively. The sample period is November 2008 to Dec 2012. Observations are weekly.*

Chart A Long-Run Regression

	Δ (Basis)								
	AT	BE	DE	FR	NL	IE	IT	PT	SP
C	31,762	36,496	37,988	14,483	8,731	-13,298	8,690	-24,162	16,43
	(0,000)***	(0,000)***	(0,000)***	-0,129	-0,111	-0,137	(0,087)*	(0,040)**	(0,143)***
Active Utilis.	0,668	0,177	0,725	0,988	1,039	-0,173	0,707	-1,012	0,167
	(0,000)***	(0,415)	(0,000)***	(0,000)***	(0,000)***	(0,535)	(0,000)***	(0,013)***	(0,522)***
Adj. R-sq	0,167	0,003	0,143	0,283	0,355	0,001	0,279	0,097	0,004
Prob. Resid ADF	0,002	0,084	0,095	0,003	0,004	0,004	0,003	0,003	0,217

Chart B Short-Run Regression

	Δ (Basis)								
	AT	BE	DE	FR	NL	IE	IT	PT	SP
Long-Run Resid	-0,093	-0,054	-0,028	-0,037	-0,042	-0,12	-0,018	-0,132	-0,054
Lag 1	(0,012)**	(0,015)**	(0,072)*	(0,036)**	(0,032)**	(0,001)***	(0,010)*	(0,000)***	(0,052)*
Δ(Active Utilis.)	0,151	0,046	-0,047	0,109	0,143	-0,163	0,545	0,001	0,120
	(0,045)**	(0,552)	(0,223)	(0,067)**	(0,027)**	(0,191)	(0,002)***	(0,995)**	(0,242)**
Δ(Active Utilis.)	0,076	-0,038	0,001	0,011	0,004	-0,113	0,327	0,057	-0,114
lag 1	(0,370)	(0,766)	(0,805)	(0,893)	(0,370)	(0,422)	(0,028)**	(0,761)	(0,220)
Δ(Active Utilis.)	0,074	-0,048	0,041	-0,007	0,015	-0,051	0,097	0,430	-0,028
lag2	(0,343)	(0,647)	(0,288)	(0,904)	(0,343)	(0,584)	(0,494)	(0,169)	(0,773)
Adj. R-sq	0,051	0,014	0,021	0,011	0,021	0,050	0,138	0,068	0,019
ADF	2,051	1,924	2,121	2,004	2,106	1,906	2,091	2,002	2,051

Table X. The Basis and the "Flight-to-Quality/Liquidity"– Cross-Sectional Analysis

This table reports results from a panel regression with time-fixed effects on liquidity measures, CDS premia and the basis. Chart A shows the result of a panel regression, with time-fixed effects, of various liquidity measures such as bid-ask spreads, bond volumes and number of transactions on credit risk as proxied by the level of the CDS Premium: $Bond\ Liquidity_{it} = \alpha + \beta\ CDS_{it} + v_t + \varepsilon_{it}$ *(7). Chart B the results of a panel regression, with time-fixed effects, of the basis on various liquidity and credit risk measures:* $Basis_{it} = \alpha + \beta X_{it} + v_t + \varepsilon_{it}$ *(8)* X_{it} *is the vector of the proxies for liquidity and credit risk. Time fixed effects (FE) are captured by* v_t. *Reported coefficients are in basis points and p-values are (in* *parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5% and 10% are denoted by ***, ** and * respectively. The sample period is January 2007 to Dec 2012. Weekly observations.*

Chart A

Variable	Bid-ask	Bond Volume	Bond N. Trans.
C	-0.922	8.75E+08	131.152
	(0,000)***	(0,000)***	(0,000)***
CDS Premia	0.010	-822107.000	-0.083
	(0,000)***	(0,000)***	(0,000)***
Time FE	yes	yes	yes
N	2013	3050	3050

Chart B

Variable	CDS-bond basis			
C	49.912	23.434	16.267	17.203
	(0,000)***	(0,000)***	(0,000)***	(0,000)***
CDS Premia	-0.156			
	(0,000)***			
Bid-Ask Spread		-1.277		
		(0,012)**		
Bond Volume			2.45E-09	
			(0,000)***	
Bond N. Trans.				0,007
				(0,000)***
Time FE	yes	yes	yes	Yes
N	3050	2013	3050	3050

Table XI. The Basis, CDS and Bond Spreads and the SMP

*Table A. reports results regression for the basis, Table B. for the CDS Premia and Table C. for the bond spreads. P-values are (in parentheses) are adjusted for heteroskedasticity. Significance levels at 1%, 5% and 10% are denoted by ***, ** and * respectively. The sample period is January 2007 to Dec 2012. Weekly observations.*

Chart A	Δ (Basis)									
	AT	BE	DE	FR	GR	NL	IE	IT	PT	SP
C	0,086	0,213	0,877	0,534	0,296	0,236	-0,125	0,479	1,288	-0,311
	(0,907)	(0,793)	(0,062)**	(0,462)	(0,936)	(0,672)	(0,956)	(0,717)	(0,692)	(0,686)
SMP	0,000	0,000	-0,001	0,000	-0,005	0,000	-0,002	-0,002	-0,006	-0,001
	(0,924)	(0,664)	(0,400)	(0,714)	(0,138)	(0,747)	(0,016)**	(0,006)	(0,000)	(0,276)
SMP May 2010	0,000	0,001	0,000	0,001	0,011	0,000	0,004	0,001	0,006	0,001
	(0,987)	(0,348)	(0,875)	(0,603)	(0,002)***	(0,748)	(0,000)***	(0,243)	(0,000)***	(0,570)

SMP August 2011	0,001	0,001	0,001	0,001	//	0,001	0,002	0,003	0,006	0,001
	(0,473)	(0,235)	(0,355)	(0,429)	//	(0,463)	(0,001)***	(0,000)***	(0,000)***	(0,070)*
Adj. R-sq	0,027	0,011	0,045	0,006	0,191	0,002	0,012	0,109	0,756	0,034
D-W	1,931	1,951	1,952	1,989	2,216	1,970	2,031	1,916	2,000	2,038

Chart B	Δ (CDS)									
	AT	BE	DE	FR	GR	NL	IE	IT	PT	SP
C	0,306	0,974	0,419	0,592	9,264	0,384	1,869	1,530	2,525	1,860
	(0,831)	(0,499)	(0,771)	(0,680)	(0,008)	(0,789)	(0,194)	(0,288)	(0,079)	(0,196)
SMP	-0,001	-0,002	-0,001	-0,001	-0,004	-0,001	-0,003	-0,002	-0,003	-0,002
	(0,426)	(0,022)**	(0,596)	(0,446)	(0,387)	(0,514)	(0,002)***	(0,027)**	(0,018)**	(0,035)**
SMP May 2010	0,001	0,002	0,000	0,001	-0,005	0,364	0,002	0,001	-0,002	0,002
	(0,651)	(0,110)	(0,920)	(0,610)	(0,364)	(0,701)	(0,100)*	(0,464)	(0,253)	(0,307)
SMP August 2011	0,002	0,003	0,001	0,001	//	0,001	0,003	0,003	0,003	0,002
	(0,234)	(0,036)**	(0,561)	(0,374)	//	(0,445)	(0,019)**	(0,021)**	(0,013)**	(0,196)
Adj. R-sq	0,043	0,043	0,001	0,001	0,102	0,001	0,001	0,025	0,028	0,065
D-W	1,985	1,985	1,999	2,000	1,851	1,999	2,000	2,000	2,002	2,031

Chart C	Δ (Bond Spreads)									
	AT	BE	DE	FR	GR	NL	IE	IT	PT	SP
C	0,306	0,973	//	0,592	2,000	0,384	1,869	1,530	2,526	1,860
	(0,840)	(0,523)	//	(0,697)	(0,690)	(0,800)	(0,220)	(0,312)	(0,097)	(0,222)
SMP	-0,001	-0,002	//	-0,001	0,000	-0,001	-0,003	-0,002	-0,003	-0,002
	(0,452)	(0,030)**	//	(0,4719)	0,968	(0,538)	(0,003)***	(0,037)**	(0,025)**	(0,046)*
SMP May 2010	0,001	0,002	//	0,001	-0,015	0,001	0,002	0,001	-0,002	0,002
	(0,670)	(0,131)	//	(0,630)	(0,000)***	(0,716)	(0,127)	(0,489)	(0,280)	(0,334)
SMP August 2011	0,002	0,003	//	0,001	//	0,001	0,003	0,003	0,003	0,002
	(0,261)	(0,048)**	//	(0,401)	//	(0,471)	(0,027)**	(0,029)**	(0,019)**	(0,227)
Adj. R-sq	0,043	0,056	//	0,002	0,038	0,026	0,016	0,003	0,017	0,060
D-W	1,953	1,955	//	1,970	1,913	1,972	1,946	1,957	1,958	1,962

References

Alloway, T. (2013) Digging into dealer inventories. FT Alphaville comment.

Ang, A. and F. Longstaff (2011) "Systemic sovereign credit risk: Lessons from the U.S. and Europe", NBER Working Paper 16982.

Arora, N., P. Gandhi, F. A. Longstaff (2012) "Counterparty credit risk and the credit default swap market", Journal of Financial Economics, 280-293

Bai, J. and P. Collin-Dufresne (2011) "The determinants of the CDS-bond basis during the financial crisis of 2007-2009", working paper.

Barclays Capital (2010a) "Sovereign CDS trading", Credit Research.

Blanco R., S. Brennan and I.W. Marsh (2005) "An empirical analysis of the dynamic relationship between investment-grade bonds and credit default swaps". Journal of Finance 60, 2255 - 2281.

Blundell-Wignall, A. (2012) Solving the Financial and Sovereign Debt Crisis in Europe. OECD Financial Market Trends.

Campbell, J and G. Taksler (2003), "Equity Volatility and Corporate Bond Yields", Journal of Finance 58, 2321 – 2349.

Collin-Dufresne P., R. Goldstein and J. S. Martin (2001) "The Determinants of Credit Spread Changes", Journal of Finance 56, 2177-2207.

Corradin, S., Maddaloni, Angela (2012) "The Importance of Being Special: Repo Markets During the Crisis" Working Paper

Garleanu, N. and L. Pedersen (2011), "Margin-based asset pricing and the law of one price", Review of Financial Studies 24, pages 1980-2022.

Duffie, D. (2010) "Presidential Address: Asset Price Dynamics with Slow-Moving Capital", Journal of Finance 65, 1237–1267.

Duffie, D. (1999) "Credit Swap Valuation", Financial Analysts' Journal, 83, 635–665.

Ericsson J, .K. Jacobs, and R. Oviedo-Helfenberger (2009) The Determinants of Credit Default Swap Premia. Journal of Financial & Quantitative Analysis 44, 109–132.

Eser F., and B. Schwaab (2013) "Assessing asset purchases within the ECB's Securities Markets Programme", ECB Working paper 1587.

Fontana, A. (2012) "The persistent negative CDS-bond basis during the 2007/08 financial crisis", working paper.

IMF (2013a) "A Banking Union for the euro area", Staff Discussion Notes No. 13/1.

IMF (2013b) "Toward A Fiscal Union for Euro Area", Staff Discussion Notes No. 13/9.

Longstaff, F. A, J. Pan, L. Pedersen and K. Singleton (2011) "How sovereign is sovereign risk?" American Economic Journal: Macroeconomics, 3(2): 75-103.

Mitchell, M. and Todd Pulvino (2012) "Arbitrage crashes and the speed of capital," Journal of Financial Economics 104, Issue 3, Pages 469-490.

Oehmke, M. and A. Zawadowski, 2013 "The Anatomy of the CDS Market", working paper.

Pan, J. and K. Singleton (2008) "Default and Recovery Implicit in the Term Structure of Sovereign CDS Spreads". Journal of Finance 63, 2345-2384.

Panetta, F. et al (2011) "The Impact of Sovereign Credit Risk on Bank Funding Conditions." Committee on the Global Financial System, working paper.

Raunig, B. and M. Scheicher (2009), "Are Banks Different? Evidence from the CDS Market", OeNB Working paper 152.