EUROPEAN CENTRAL BANK

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NO 1085 / AUGUST 2009

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by Ioana Alexopoulou[2], Magnus Andersson[2] and Oana Maria Georgescu[3]

In 2009 all ECB publications feature a motif taken from the €200 banknote.

This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=1456878.

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2 *European Central Bank, Postfach 160319, D-60066 Frankfurt am Main, Germany; e-mail: ioana.alexopoulou@ecb.europa.eu; Tel.: +49-69-1344-6357 and magnus.andersson@ecb.europa.eu; Tel.: +49-69-1344-7410*

3 *Authors e-mail address: oanamariageorgescu@gmail.com*

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Website
http://www.ecb.europa.eu

Fax
+49 69 1344 6000

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Abstract

Applied to the European markets, this paper analyzes the price of credit risk on the Credit Default Swap (CDS) and corporate bond markets by comparing the sensitivity of the credit spreads on each market to systematic, idiosyncratic risk factors and liquidity. Our analysis confirms the existence of a long-run relationship between the two markets, and the tendency for CDS markets to lead corporate bond markets in terms of price discovery. We find that the outbreak of the financial turmoil in the summer of 2007 induced a substantial increase in risk aversion and a shift in the pricing of credit risk, with CDS markets becoming more sensitive to systematic risk while cash bond markets priced in more information about liquidity and idiosyncratic risk. Moreover, the financial turbulence also brought about a systematic disconnection between the two markets caused by the significant change in the lead-lag relationship, with CDS markets always leading the cash bond markets.

Keywords: Credit Default Swap Spreads, Corporate Bond Spreads, Liquidity

JEL Classification: G12, G14, G15

Non Technical Summary

The purpose of this paper is to analyse the pricing dynamics in the two credit markets. Using weekly data, the analysis is applied to European financial and non-financial firms over the period January 2004 to October 2008. Two avenues are examined in more detail. First, we study to what extent credit spread movements are influenced by firm-specific, common factors and liquidity. To this end we also examine if a long-term equilibrium relationship between prices on the two markets exists. Second, we analyse potential explanations as to why the pricing in the two markets can temporarily change over time. Particular emphasis is put on the developments since August 2007, when there was a clear shift in the pricing of credit risk on both the CDS and corporate bond markets. Using the methodology developed by Berndt et al. (2004) and Amato (2005) we break down the credit spread into the "amount of risk" (approximated by expected default frequencies) and the "price of risk" (including default risk premia and liquidity risk). The paper's four main findings are as follows. First, in terms of relative importance, common systematic factors seem to play a relatively larger role in explaining movements in Euro area entities' CDS spreads compared to the influence common factors exert on the same entities' corporate bond spreads. Instead, corporate bond spread fluctuations appear to be more sensitive to movements in firm-specific and liquidity factors. Second, we find, in line with theory, that a long-run equilibrium relationship between the spread movements in the two credit markets can be established for most entities and that the outbreak of the financial market turmoil in the summer months of 2007 contributed to a weakening of the long-run co-movements between the two asset classes. Third, the results show that CDS markets tend to lead corporate bond markets in terms of price discovery, and that this lead-lag relationship strengthened following the sub-prime related turmoil. Fourth, we examine credit risk pricing during the turmoil further by breaking down movements in credit spreads into actual default rates and the corresponding default risk premia/liquidity risk. We find evidence that the general increases in credit spreads on both markets during the turmoil period have been driven mainly by default risk compensation demanded by investors. This feature is particularly pronounced for the CDS markets. The paper adds to the existing literature in two main ways. First, it is the first, to our knowledge, that models the joint movements in corporate bond spreads during favourable market conditions and periods of financial stress. Second, our approach of linking the decomposition of default risk premia and expected losses on credit markets with the structural modelling approach is also novel.

1 Introduction

From 2004 to mid-2007, the credit markets in most major economies were characterised by low volatility and narrow credit spreads. This favourable financial market environment came to an abrupt end in the summer of 2007 when concerns about the health of the US real estate sector began to mount. As a result, credit spreads surged rapidly in most economies. There are, in principle, many factors that can trigger fluctuations in credit spreads. For instance, higher credit spreads can emanate from an expected slowdown in overall economic activity, resulting in lower firm profitability and a higher default risk. However, higher credit spreads can also occur in an environment marked by low financial market liquidity. During such periods, investors tend to demand a higher premium for investment in risky credit-related instruments. In order to draw accurate policy conclusions, it is crucial that central banks and governments identify the underlying forces which are driving credit spread fluctuations.

The standard way of evaluating changes in markets' perceived credit outlook for firms is by monitoring movements in corporate bond spreads. Corporate bond spreads are usually measured as the difference between the yields offered on firms' corporate debt instruments and the risk-free interest rates, the latter is normally approximated by government bond yields (or swap yields). Corporate bond spreads can be defined as the risk premium corporations pay investors to compensate them for a number of risks associated with corporate debt.[1]

Recent financial innovations, in the form of credit derivatives, have provided analysts and policy makers with further measures to gauge firms' perceived credit risk. Credit Default Swaps (CDS) are of particular interest as they, similarly to corporate bond spreads, capture credit risk. In a CDS agreement the buyer of protection against default makes a periodic or upfront payment to the seller of the default swap. The seller of protection promises to make a payment in the event of a default on a reference obligation - which is usually a bond or a loan. The default swap premium is often referred to as the default swap spread.

The purpose of this paper is to analyse the pricing dynamics in the two credit markets. Using weekly data, the analysis is applied to European financial and non-financial firms over the period January 2004 to October 2008. Two avenues are examined in more detail. First, we study to what extent credit spread movements are influenced by firm-specific, common factors and liquidity. To this end we also examine if a long-term equilibrium relationship between prices on the two markets exists. Second, we analyse potential explanations as to why the pricing in the two markets can temporarily change over time. Particular emphasis is put on the developments since August 2007, when there was a clear shift in the pricing of credit risk on both the CDS and corporate bond

[1] These risks include default risk (when issuers are unable to make interest and principal payments on time), liquidity risk (when unwinding a position could result in adverse price changes as some corporate debt instruments are thinly traded) and prepayment risk (when issuers have an option that allows them to buy back all or part of the issue prior to maturity)

markets. Using the methodology developed by Berndt et al. (2004) and Amato (2005) we break down the credit spread into the "amount of risk" (approximated by expected default frequencies) and the "price of risk" (including default risk premia and liquidity risk).

The paper's main findings are as follows. First, in terms of relative importance, common systematic factors seem to play a relatively larger role in explaining movements in euro area entities' CDS spreads compared to the influence common factors exert on the same entities' corporate bond spreads. Instead, corporate bond spread fluctuations appear to be more sensitive to movements in firm-specific and liquidity factors. Second, we find, in line with theory, that a long-run equilibrium relationship between the spread movements in the two credit markets can be established for most entities and that the outbreak of the financial market turmoil in the summer months of 2007 contributed to a weakening of the long-run co-movements between the two asset classes. Third, the results show that CDS markets tend to lead corporate bond markets in terms of price discovery, and that this lead-lag relationship strengthened following the sub-prime related turmoil. Fourth, we examine credit risk pricing during the turmoil further by breaking down movements in credit spreads into actual default rates and the corresponding default risk premia/liquidity risk. We find evidence that the general increases in credit spreads on both markets during the turmoil period have been driven mainly by default risk compensation demanded by investors. This feature is particularly pronounced for the CDS markets.

The paper adds to the existing literature in two main ways. First, to our knowledge, it is the first paper that models the joint movements in corporate bond spreads during favourable market conditions and periods of financial stress. Second, our approach of linking the decomposition of default risk premia and expected losses on credit markets with insights from structured models is also novel.

The remainder of this paper is organised as follows. Section 2 conducts a case study on recent price dynamics in the two markets. Section 3 discusses related literature. Section 4 outlines the structural model employed, while sections 5 and 6 discuss the data used and the results. Section 7 concludes.

2 Decoupling Movements between corporate Bond Spreads and CDS Spreads during the 2007-2008 turmoil - a case study

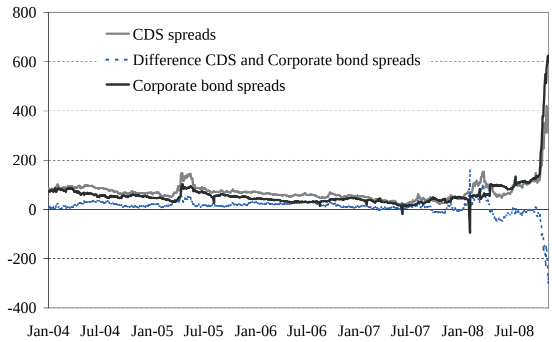
Financial market theory suggests that CDS spreads and corporate bond spreads for the same entities are bound by no-arbitrage conditions. By ignoring differences in liquidity and assuming the maturity of the corporate debt equals that of the CDS, an investor who acquires a corporate bond and buys protection for the same reference entity in the CDS market should be hedged against the default of this particular firm. The implied no-arbitrage assumption between the two markets suggests that the price of buying such a protection against default in the CDS markets should equal the observed corporate bond yield spread.

Despite the above mentioned arbitrage conditions, recent developments in financial markets have shown that substantial deviations between CDS spreads and corporate bond spreads can occur over a prolonged period of time. To provide a telling example, Figure 1a below depicts 5-year CDS senior loan spreads and aggregate corporate bond spreads over swaps (and the difference between the two) for the Daimler entity. The sample period is January 2004 to October 2008. Figure 1b shows the same series but focuses on the developments since September 2008.

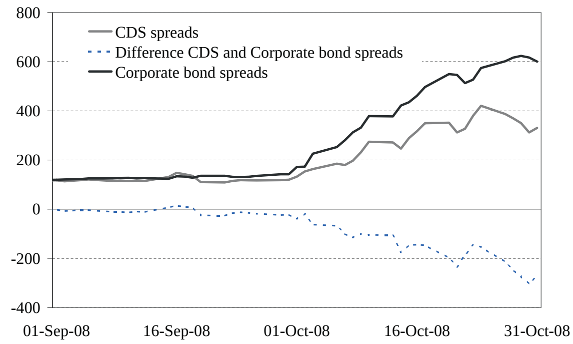
Three notable features emerge from the two figures (which can be deemed as typical behaviour for euro area firms over this time period). First, up until mid January 2008, the CDS spreads for the Daimler entity moved broadly in tandem with Daimler's corporate bond spreads. This provides some evidence that investors viewed and priced the two asset classes broadly in line with the theory. Second, although the differences are quite small in magnitude, CDS spreads for Daimler have on average hovered at slightly higher levels than its corporate bond spreads between January 2004 and January 2008 (15 basis points on average). Third, in September and October 2008, corporate bonds spreads increased much more than comparable CDS spreads, see Figure 1b. By end-October 2008, the CDS spreads for Daimler stood at around 330 basis points whereas corporate bond spreads had surged to a level of 600 basis points.

Figure 1
Decoupling Movements Daimler AG

(a)



(b)



(a) Daimler CDS spreads and Daimler corporate bond spreads (over swaps) and the spread difference (January 2004 - October 2008, daily data)
(b) Daimler CDS spreads and Daimler corporate bond spreads (over swaps) and the spread difference (September 2008 - October 2008, daily data)

There are two main explanations for the, on average, slightly higher CDS spreads. First, it is relatively easier to short credit by buying credit protection in the CDS markets (which pushes CDS spreads higher, everything else held equal). Shorting credit in the corporate bond markets is, however, difficult as the liquidity is not optimal for these types of transactions. Second, investors usually hold a number of various assets and use them as collateral for funding purposes. In this sense, corporate bonds are the preferred instrument, rather than CDS contracts. This feature tends to push corporate bond spreads down relative to CDS spreads.

The general pattern of close co-movements between the two markets were broken in the autumn of 2008 when corporate bond spreads witnessed some sharp increases while the widening of CDS spreads was far less pronounced. Market intelligence suggests that, particularly after the bankruptcy of Lehman Brothers, investors' flight-to-safety portfolio shifts and a preference for holding cash over risky assets (such as corporate bonds) can explain most of the decoupling between the two asset classes in September and October 2008. In addition, it is reasonable to assume that lending institutes became more prudent during these months and increased their collateral requirement, which probably also induced some investors to reduce their corporate bond exposure.[2]

Clearly, the turmoil period (that began in August 2007) seems to have generated some unusual pricing pattern in the two markets. The basis (defined as the difference between CDS spreads and corporate bond spreads) became highly volatile for many entities. Before examining the driving forces underlying the developments in the two credit markets, the next section reviews the related literature.

3 Related Literature

Literature on credit risk modelling has resulted in two approaches - structural and reduced-form approaches. Structural models perceive default risk as an endogenous process, partially accounted for by the structural factors, while the reduced form approach assumes that firms' default is not predictable and driven by an exogenous default intensity process, see Duffie and Singleton (1999) for an overview. The reduced-form approach has been criticised on the grounds of the weak economic rationale for the occurrence of a default event, which is why the structural model is widely preferred by practitioners in the field of credit risk.

Structural models build on the classic Black and Scholes (1973) option pricing model, formalised by Merton (1974). According to the basic Merton model, a bond defaults when the firm value falls below the debt value at the time of the maturity of the bond.

[2]See the Lex column "Bond appeal" in the November 20 issue of Financial Times and the November 14, research note "Global Speculations, a very negative basis" by Tim Bond at Barclays Capital.

Our specification builds on the economic intuition of a structural model. To this end, we test the relevance of key variables used in structural models (asset returns, asset volatility) for explaining the market price of credit risk. That is, we assume that default is endogenously driven by the firm's financial structure. In contrast, a reduced form model assumes that default is exogenously determined and driven by default intensity, see Arora et al. (2005).

Another important difference between structural and the reduced- form models concerns the information assumptions. The structural model assumes complete information about firm's asset value. This restriction is not imposed in reduced-form models. Again, our specification includes firm specific information of the type used in structural models (asset returns and asset volatility).

Apart from the above mentioned firm-specific factors such as asset returns and asset volatility, expected recovery rates also affect credit spreads. Given that firms' recovery rates are closely intertwined with the economy's macro conditions, this suggest that variables capturing systematic risk are also potential explanatory factors behind changes in investors' perceived credit risk. Athanassakos and Carayannopoulos (2001) find empirical evidence that corporate bond yield spreads and the business cycle are closely intertwined (while controlling for variations in default risk, bond optionalities, tax effects and liquidity). For similar findings, see Altman and Kishore (1996) and Helwege and Kleiman (1997). Structural models that include macro variables are also widely used among practitioners. For example, Goldman Sachs models the spread of low-grade US corporate bond yields over Treasuries as a function of both economic and financial variables using quarterly data over the past forty years (the so-called GS-SPREAD model).

Over the past few years, credit risk trading has been complemented by complex financial innovations. The highly liquid credit default swaps (CDS) are of particular interest as they, similarly to corporate bond spreads, capture firms' default risk. There is substantial literature that builds on structural models to analyse movements in CDS spreads. Benkert (2004) shows that option implied volatility has the highest relevance for explaining CDS premia, among all other volatility measures. Zhang et al. (2006) set up a model of CDS spreads that includes the equity volatility and the jump risk of individual firms. Their results suggest that the volatility risk and the jump risk alone significantly improve the predictability of CDS spreads. Ericsson et al. (2004) show that the risk-free rate and firm-specific factors such as financial leverage and volatility all exert a significant impact on the level and changes of US firms' CDS spreads. Controlling for the expected loss and other firm-specific and market level variables, Raunig and Scheicher (2008) compares the risk premia embedded in CDS spreads for banks and corporations. They find that banks were perceived as less risky than corporations before the sub-prime related turmoil began in the summer of 2007. During the turmoil period, the two groups are priced broadly similar.

The empirical results from the CDS literature imply that CDS spreads are to be preferred over corporate bond spreads when measuring firm-specific credit risk. There are two main arguments for this assessment. First, although corporate bond spreads and CDS contracts share similar determinants, the CDS contracts are quoted directly in terms of spreads. Corporate bond spreads, on the other hand, have to be imputed from the yields on government bonds or swaps, which can potentially lead to measurement bias. Second, the CDS markets are very liquid and probably even more so in times of financial market stress, which favours the hypothesis that the price discovery takes place in the CDS markets. Moreover, bond prices are affected by interest rate risk and taxation issues, suggesting that CDS spreads might be a better measure of default risk.

This paper extends the existing literature on structural credit risk modelling by examining to what extent credit and CDS spreads are driven by the same factors and also analyses the impact financial market stress has on the implied parity relationship between the two markets. Our approach is similar to Blanco et al. (2005), who find a parity relation between the US corporate bond and CDS markets. By using a rather short sample (1.5 years) of daily data, they conclude that the price discovery is quicker in the CDS markets and that macro variables have a larger immediate impact on cash bond spreads than on CDS prices. A long term relationship between the two credit markets for European entities was also documented by Norden and Weber (2004), Zhu (2006) and De Wit (2006). Overall, most previous studies found the existence of a long-term (cointegrating) relationship between the two markets for the bulk of the entities examined.

The existence of a long-run relationship between the two markets does not, however, exclude short-run arbitrage opportunities. Levin et al. (2005) argue that market frictions are the main cause of non-zero CDS-bond spread basis. The authors argue that these market frictions are caused by systematic and idiosyncratic factors. Forte and Pena (2006) show that, in terms of price discovery, stock markets lead both bond and CDS markets. Concentrating on the CDS and bond markets, Doetz (2007) studies the price discovery in these two markets in a time-variant context. The results indicate that although the CDS market slightly dominates the price discovery process, its contribution fell significantly during the 2005 turbulence when General Motors and Ford were downgraded by the rating agencies from investment grade to "junk" grade.

The financial market crisis that began in the summer of 2007 challenges the explanatory power of the structural model approach. A simple linear model can hardly account for the jumps in corporate bond spreads and CDS spreads observed in 2008. In an attempt to answer what actually drives credit spread movements during difficult market conditions, we make use of the insights provided by Berndt et al. (2004) and Amato (2005). They show that the CDS can be broken down into two components; one that compensates investors for the expected loss and a second that compensates investors' aversion to default risk. Using data between 2002 and 2005, Amato (2005) stresses that default risk premia broadly follow the same pattern as perceived default risk but the movements tend to be more volatile.

4 The Model

Building on the previous literature on structural credit risk models, we assume in our modelling framework, that investors make use of a broad range of information and factors when they price credit risk. This information includes firm-specific, common and liquidity related factors. Below we discuss these three segments in some detail.

The relevance of firm specific factors for the pricing of credit risk is a direct implication of Merton's structural debt valuation model. In this framework, corporate liabilities are seen as contingent claims on the assets of a firm. Default is triggered whenever asset value falls below debt value (the analogue of the strike price in option pricing). Credit risk is measured by the probability that, at maturity, the asset value of a firm falls below the face value of this debt. The position of the bondholder is similar to that of the writer of a put option on the assets of the firm with a strike price equal to the face value of the debt. One intuitive interpretation of this approach is that the bondholder writes a put option to the equity holders at contract initiation. When default occurs, the equity holder will exercise his put option and sell the firm to the bondholder in exchange for the debt price. Thus, the default probability is a function of the financial structure of the firm, i.e. leverage, the volatility of the rate of return of the assets, time to maturity and the risk-free rate.

In line with Collin-Dufresne et al. (2001) and Blanco et al. (2005), we use i) *equity return* and ii) first differences in *implied equity volatility* as the *firm-specific factors* relevant for the size of the default premium.

(i) Equity return. To capture each firm's individual financial health we employ equity returns. Everything else held equal, a drop in stock prices increases leverage and generates uncertainty about a firm's debt repayment capacity. This should be reflected in a higher default probability and higher CDS and credit spreads. Thus, a negative sign is expected for equity returns.

(ii) Implied equity volatility. The basic economic reasoning for using changes in the implied volatility relies on the "leverage effect": equity return and volatility are negatively correlated because a decrease in the value of equity increases financial leverage, which in turn tends to make equity more volatile. Higher expected equity volatility signals deteriorating repayment capacity and therefore a higher default probability. A positive sign is thus expected for equity volatility.

Individual firms' credit risk is also influenced by common (or systematic) factors. Clearly, the probability of default is higher in a recessionary environment. The common factors considered in our analysis include *(i) ten-year government bonds yields* (depending on the issuer's country of origin), *(ii) market equity return* and *(iii) market implied equity volatility.*

(i) Government bond yields. Long-term government bond yields can be viewed as a reasonable proxy for the overall macroeconomic outlook. The expected sign is, however, not clear and must be determined empirically. A negative sign can be derived from the Fisher hypothesis which states that the yields offered on a government bond can be broken down into a real rate component

and a component which investors demand for the expected inflation to prevail over the maturity of the bonds (investors usually also require a term-premia whose size tends to be related to the expected uncertainty prevailing around future inflation expectations). The real rate component is positively related to the economic growth prospects. Thus, higher bond yields may signal optimistic expectations about future economic activity which should lower the perceived default risk for firms, leading to lower credit spreads (i.e. a negative sign).

A positive sign can be derived from the financing cost argument. An increase in government bond yields pushes up the cost of finance for the firms. Higher cost of finance means that fewer investment prospects will show a positive net present value and hence, lower aggregate investments in the economy. Lower investments could trigger an overall slowdown in economic growth, resulting in higher defaults and higher spreads. This argument would support a positive sign for government bond yields.

(ii) Market equity returns. Stock prices in an economy are determined by firms' current and expected dividends, discounted by the risk-free rate and the equity risk premium investors demand. Dividends are usually paid out as a fraction of firms' earnings. Firms' earnings prospects are, in turn, crucially determined by the overall economic growth prospects. Thus, movements in broad-based stock price indices can provide useful information for assessing market participants' expectations about economic activity in the economy as a whole. A negative sign is expected for market equity returns.

(iii) Market implied volatility. Option-implied volatility derived from broad-based stock market indices is a standard measure of overall macroeconomic uncertainty. Movements in stock market volatility tend to be a relatively good early indicator of recessions. For instance, in both the US and the Euro area, stock market volatility surged prior to or during all recessions that occurred since 1973, see Andersson and Hofmann (2008). A positive sign is expected for market implied volatility.

Apart from the firm specific, common factors we also include a proxy factor to for the time-varying global *liquidity risk*. In line with Levin et al. (2005), we use the difference between US on-the-run and off-the-run government bond yields. This is calculated as the difference between the yield offered on the most recently issued ("on-the-run") US nominal government bond and *"the yield obtained when pricing identical cash flows using a yield curve estimated using all other bonds and notes ("off-the-run")"*, see ECBa (2008). This difference is usually small (five to ten basis points) during tranquil periods in financial markets. On the other hand, during periods when financial market liquidity dries up, investors tend to seek protection in the most liquid "on-the-run" government bonds resulting in a widening between "off-the-run" and "on-the-run" bonds. A positive sign is expected for the "off-the-run" and "on-the-run" yield difference.

5 Data Description

We use mid-CDS spreads provided by Datastream for 29 large European financial and non-financial firms (15 for the non-financial sector and 14 for the financial sector) included in the iTraxx index. The sample runs from 1 January 2004 to 31 October 2008. We limit the study to the 5-year maturity CDS, which is the most traded maturity segment. CDS are traded in notional amounts of 10 Million. This means if an entity is traded with 50 basis points, the total cost of annually obtaining insurance for this company is EUR 50,000.

Table 2 in the Appendix shows summary statistics for the CDS and corporate bond spread data as well as the explanatory factors. Three notable features can be inferred from the Table. First, the firm-specific factors (implied volatility and stock market returns) share similar characteristics across the two samples. Second, the large deviations between the minimum and maximum values suggest strong heterogeneity within the samples. Third, the mean differences between CDS spreads and credit spreads (i.e. the basis) are more marked for the financial firms when compared with the non-financial firms. To illustrate this, Table 3 provides a detailed description of the basis developments for all entities. The average basis for the bulk of the firms is less than 10 basis points but there are, at the same time, a number of firms for which relatively large differences can be observed. This reflects differences related to both fundamental and technical factors but also the difficulties to extract "clean" comparable measures of corporate debt data. Given the strong basis decoupling in October 2008 (as mentioned in the case study Section) the Table also shows the basis statistics for this particular month. As can be seen, in October the average basis became substantially more negative for both financial and non-financial firms.

Finding corporate bond data that matches the CDS data in terms of maturity and characteristics is not an easy task. In order to be as consistent as possible we take the following approach when extracting the corporate bonds. As a first screening we search for bonds expiring between 2006 and 2014. After filtering, the median corporate bond spread is calculated on a weekly basis. For a number of banks and firms, a second screening process was required. Such a process was needed for some firms with a very limited number of outstanding bonds trading in 2004 and 2005. For these cases we choose the bonds which most closely mimic the dynamics of the same entity's CDS spreads. As a reference, we choose to compute the spreads over 5-year swap spreads. The alternative would be to calculate the spread over government bonds, but as discussed in Blanco et al. (2005), government bonds are not an ideal proxy for the unobservable risk-free rate. Taxation, special agreements with repos and benchmark status can vary over time, thereby distorting this measure.

Corporate bond spreads over the swap curve are extracted from Datastream using datatype "SWSP". We use of Datastream to obtain firm specific at-the-money implied volatility (datatype "O1") and stock price information for each entity in our sample. For the common factors, we use ten-year government bond yields extracted from Datatstream. We use Datastream to extract implied volatility from options on the Dow Jones Eurostoxx 50 (datatype "VSTOXXI"), FTSE 100 (datatype "VFTSEIX") and the SMI index (datatype "VSMIIDX"). Market stock returns are also calculated from Datastream: for the Euro area (mnemonic "TOTMKEM"), for Switzerland (mnemonic "TOTMKSW") and for the United Kingdom (mnemonic "TOTMKUK"). The spread between the on-the-run and the off-the-run bonds was obtained from the website of the Federal Reserve Bank of Cleveland.[3]

6 Results

The following regressions are estimated:

$$\Delta CDS_{it}(\Delta CS_{it}) = \alpha + \beta_1 FIV_{it} + \beta_2 FSR_{it} + \beta_3 BOND_t + \beta_4 IV_t + \beta_5 SR_t + \beta_6 TR_t + \beta_7 EC_{i(t-1)} + \epsilon_{it} \quad (1)$$

Where CDS_{it} represents credit default swaps for firm i at time t, CS_{it} credit spreads, FIV_{it} firm-specific implied volatility, FSR_{it} firm-specific weekly stock returns, $BOND_t$ the yields offered on ten-year benchmark bonds, IV_t implied volatility, SR_t weekly stock returns, OTR_t the difference between on-the-run and off-the-run yields on US government bonds and EC_{it} represents the lagged errors from a (level) regression of CDS spreads on corporate bond spreads (see equation 2 below). Table 1 shows the estimation results for the financial and the non financial sample (for both CDS and credit spreads).

Columns (1), (2), (5) and (6) refer to individual regressions. Similar to the method used by Blanco et al. (2005), the p values are obtained from the cross-sectional regression of the coefficient estimates on a constant. Although this way of estimating the unit level regression method says little about the statistical properties of the individual regressions, it gives an indication on whether the homogeneity restriction imposed by the panel estimation is appropriate. Given that the bulk of the parameter estimates are significant the homogeneity assumption seems appropriate. Thus, columns (3), (4), (7) and (8) replicate the specifications from the individual regressions in a fixed effects panel framework.

In the benchmark setup (columns (1), (3), (5) and (7)) the CDS and corporate bond spreads are regressed on the above mentioned firm-specific and common factors. In the extended specification (columns (2), (4), (6) and (8)) the long-term relationship between the two markets is taken into account, where the EC coefficients represent the sensitivity to the lagged errors from a (level) regression of CDS spreads on corporate bond spreads:

$$CDS_{it} = \alpha + \beta CS_{it} + \epsilon_{it} \quad (2)$$

[3] See: hrefhttp://www.clevelandfed.org/research/data/tips/

6.1 Benchmark Specification

We consider the panel framework to be more informative and therefore discuss the outcome of these estimations in the current and next sub-sections. The results of the panel benchmark specification are shown in columns (3) and (7) in Table 1. Three main features are to be noted in terms of significance of the explanatory variables. First, common factor variables matter more for CDS spreads than for credit spreads, while firm-specific variables seem to be more relevant for the pricing of credit risk in the corporate bond markets.

Second, the coefficients for long-term government bonds are in general significant. The negative sign suggests that financial markets perceive higher government bond yields to signal improved economic growth prospects and lower perceived default risk on the side of the firms.

Third, global liquidity pressure (measured as the difference between the yields on US on-the-run and off-the-run government bonds) tends to significantly widen corporate bond spreads. Intuitively, during periods of financial stress and liquidity constrains, flight-to-quality portfolio shifts from risky credit assets such as corporate bonds to safer assets tend to drive corporate bond spreads higher. Interestingly, however, our liquidity proxy has a tightening effect on CDS spreads across all model specifications. Interpreting these results in term of the liquidity spill-over from the cash to the derivatives market is not straightforward. It is, however, reasonable to assume that during periods of financial stress short-selling in the cash bond markets becomes difficult (due to liquidity constraints). As a result, investors seeking credit exposure under these circumstances will shy away from the cash market and to a larger extent sell credit protection in the CDS market.

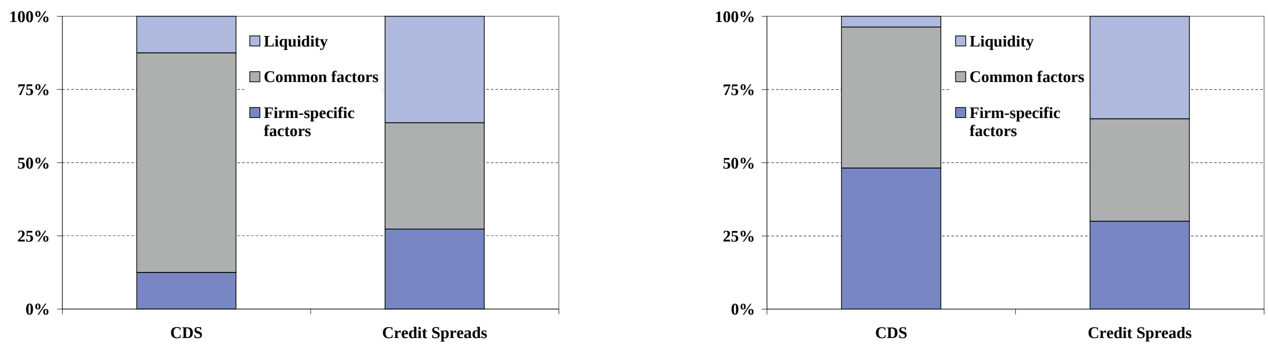
The results are in line with Buehler and Trapp (2008) who find that liquidity risk explains large part in the pricing of bond spreads, as opposed to CDS spreads, where credit risk receives the largest weight. Thus, consistent with our results, the authors also find that bond and CDS liquidity premia are negatively correlated.

Any comparison of the liquidity on the CDS and bond market has to consider the structural differences between the two markets. The negative coefficient of the liquidity proxy in the CDS estimations may be caused by some special features in the CDS market that gained particular importance during the financial turmoil. For instance, most of the sellers of CDS protection are banks. During the turmoil, and following the collapse of Lehman Brothers in particular, the perceived counterparty risk for many European banks sharply increased while liquidity dried up across most asset classes. It is plausible to assume that the demand for protection decreased, and, as a result of the excess-supply, many banks had to sell protection in the CDS markets at a discount.

To see the relative importance of the firm-specific, common factors and liquidity factors for explaining movements in the two markets, Figures 2a and 2b decompose the respective share of the three blocks that contribute to the explanatory power (R-square). Again, common factors explain the largest share in the variation of financial and non-financial firms CDS spreads. In contrast, the three blocks have a rather similar impact on corporate bond spreads movements.

Figure 2
Determinants of CDS and corporate Bond Spreads

(a) Financial Sample (b) Non Financial Sample



Overall, CDS markets seem to be more influenced by systemic risk whereas the corporate bonds spreads are more affected by firm-specific, idiosyncratic default risk. These differences might impact the price discovery in the two markets. For instance, a sudden change in the broad macroeconomic environment (with firm's specific factors resilient to such changes) could potentially trigger some short or medium-term decoupling between the same entity's CDS spreads and corporate bond spreads. By examining the long-run relationship and the price discovery between the two markets a better understanding of this decoupling can be achieved. This approach is adopted in the next section.

Table 1

Estimation Results for the financial and non-financial Sample

Financial Sample									
	Expl/Dep Var	**CDS (1)**	**CDS (2)**	**CDS (3)**	**CDS (4)**	**CS (5)**	**CS (6)**	**CS (7)**	**CS (8)**
Firm Specific Factors	Delta Implied Volatility	0.02	-0.56	0.05	0.05	0.28	3.53	0.21	0.19
		(0.004)	(0.369)	(0.698)	(0.698)	(0.705)	(0.313)	**(0.001)**	**(0.003)**
	Stock Return	1.03	-0.87	0.39	0.36	0.14	0.22	-0.32	-0.25
		(0.464)	**(0.000)**	(0.1097)	(0.148)	**(0.005)**	(0.279)	**(0.015)**	**(0.052)**
Common Factors	Delta 10year Treasury	-14.5	-14.25	-14.1	-15.43	-12.24	-13.4	-16.26	-16.26
		(0.132)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.072)**	**(0.000)**	**(0.000)**
	Market Return	-0.64	-1.24	-0.01	-0.06	-0.86	-1.11	-0.17	-0.03
		(0.008)	**(0.021)**	(0.884)	(0.613)	**(0.059)**	**(0.021)**	(0.242)	(0.780)
	Delta Vola Market	-0.24	-0.19	0.54	0.56	0.31	-0.17	0.26	0.28
		(0.022)	(0.369)	**(0.000)**	**(0.000)**	**(0.003)**	**(0.031)**	(0.134)	(0.117)
Liquidity	Delta Liquidity	0.31	0.33	-0.6	-0.59	0.25	0.31	1.41	1.26
		(0.000)	**(0.007)**	**(0.001)**	**(0.002)**	**(0.008)**	**(0.007)**	**(0.000)**	**(0.000)**
Long run relation	EC		-0.05		-0.01		-0.05		0.03
			(0.000)		(0.239)		**(0.000)**		**(0.000)**
No of observations				2833	2554			2526	2526
R^2				11%	11%			9%	9%
Non Financial Sample									
	Expl/Dep Var	**CDS (1)**	**CDS (2)**	**CDS (3)**	**CDS (4)**	**CS (5)**	**CS (6)**	**CS (7)**	**CS (8)**
Firm Specific Factors	Delta Implied Volatility	0.09	0.07	0.07	0.07	0.37	0.29	0.36	0.36
		(0.257)	(0.735)	(0.399)	(0.402)	**(0.049)**	**(0.023)**	**(0.068)**	**(0.068)**
	Stock Return	0.05	0.06	-0.04	-0.04	-0.04	-0.05	0.01	0.01
		(0.452)	(0.43)	(0.348)	(0.312)	(0.658)	(0.545)	(0.803)	(0.694)
Common Factors	Delta 10year Treasury	-8.94	-7.88	-7.5	-7.56	-7.63	-9.82	-8.98	-8.89
		(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.061)**	**(0.021)**	**(0.000)**	**(0.000)**
	Market Return	-0.76	-0.87	-0.88	-0.92	-0.09	-0.08	-0.43	-0.33
		(0.006)	**(0.002)**	**(0.000)**	**(0.000)**	(0.51)	(0.520)	**(0.003)**	**(0.032)**
	Delta Vola Market	0.14	0.08	0.05	0.02	-0.32	-0.05	-0.26	-0.19
		(0.559)	(0.275)	(0.633)	(0.840)	**(0.027)**	(0.757)	**(0.087)**	(0.206)
Liquidity	Delta Liquidity	-0.37	-0.39	-0.32	-0.29	-0.32	-0.35	0.96	0.89
		(0.023)	**(0.014)**	**(0.003)**	**(0.004)**	**(0.027)**	**(0.015)**	**(0.000)**	**(0.000)**
Long run relation	EC		-0.06		-0.02		0.03		0.04
			(0.000)		(0.203)		**(0.008)**		**(0.000)**
No of obs				3305	3305			3282	3279
R^2				14%	14%			14%	15%

Note: Columns (1), (2), (5) and (6) report average coefficient estimates from the individual regressions. p values are obtained from the regression of the vector of coefficients on a constant. Columns (3), (4), (7) and (8) report the results from the fixed effects panel estimation. p values are reported in parenthesis.

6.2 Extended Specification

To gain some insight about the long-term relationship and price discovery in the two markets we extend the benchmark specifications by an error correction term (EC). We rely on the Engle-Granger two step approach. To this end, we start by checking the integration order of all entities' CDS and corporate bond spreads. The results of the ADF unit root test confirm that all entities CDS and corporate bond spreads are integrated of order one.[4] After establishing that the entities are integrated by the same order, we test if the residuals from a regression of CDS spreads on a constant and corporate bond spreads (see again equation (2)) are stationary (using ADF and Phillips-Perron tests). Table 4 in the Appendix reports the results. As indicated in the second column of the Table, the ADF tests reveal that for 8 out of 14 financial firms and for 10 out of 15 non-financial firms, the null hypothesis of non-stationarity of the residuals can be rejected (at the 10 percent level). Similar results are found when applying the Phillips-Perron test (see column 3). This is evidence for the existence of a co-integration relationship between the two markets. As a second step, the lagged residuals from the level equations are added to the benchmark specification. The results of the panel framework are shown in columns (4) and (8) in Table 1.
As discussed by Blanco et al. (2005), price discovery can be derived from the sign and significance of "the speed of adjustment coefficients" (the EC coefficients in Table 1). To ensure that any deviation from the long-term trend is corrected, a positive sign is expected for the CDS EC coefficients (column (4)) whereas a negative sign is expected for the corporate bond spread regressions (column (8)). A negative and statistically significant EC term in the CDS regression (column (4)) would signal that the corporate bond market is contributing to a large extent to the price of credit risk on the CDS market. Similarly, a positive and statistically significant EC coefficient for the CS regression (column (8)) would imply that that the CDS markets have a marked impact on the price discovery in the corporate bond markets.
Columns (4) and (8) show the EC coefficient is negative and statistically significant for the panel corporate bond spread regressions (for both financial and non financial firms), whereas the EC coefficients are not significant for the same panel CDS spread regressions. This indicates that the CDS markets contribute to price discovery on the bond market while the opposite is not the case. The same result follows from the sign and magnitude of the "Gonzalo and Granger measure" (GG), which is based on the manipulation of the relative magnitude of the two long-run coefficients: $GG = EC_{CS}/(EC_{CS} - EC_{CDS})$, where EC_{CDS} and EC_{CS} are the long-run coefficients from the CDS and the credit spreads equation respectively. If $GG \geq 0.5$, the CDS markets tend to lead the corporate bond market because of quicker credit spread adjustments to the level of CDS spreads compared to the way CDS spreads adjust to credit spread movements. $GG \geq 1 (GG \leq 0)$ could be

[4] One exception is the corporate bond spreads for Credit Agricole where the null-hypothesis of nonstationarity is rejected

interpreted as price discovery taking place only in the CDS market (corporate bond markets). As seen in Column (4) the EC coefficient for the CDS regressions are not significantly different from zero. This implies GG measures of 1 for both financial and non-financial firms, providing evidence that the CDS derivatives market leads the cash market in terms of price discovery.

6.3 Robustness Checks

The two step estimation approach outlined in the previous section is intuitive, relatively simple, while at the same time enabling a robust estimation. Furthermore, it enables a direct comparison with previous papers within this strand of the literature, for instance Blanco et al. (2005). An alternative estimation method would be to run the estimation in one step, see Davidson and G. (2004). One aspect which favours the one step approach is the fact that it potentially suffers less from serial correlation bias than the two step approach.

Thus, as a robustness test we first check the serial correlation of the errors for all the individual financial and non-financial firms. The results of the serial correlation tests are shown in Table 5 in the Appendix. The tests included up to 3 lags of the residuals. However, serial correlation test shows that the null hypothesis of no serial correlation fails to be rejected for the bulk of the units. To avoid serial correlation bias, the estimations shown in Section 6.1 and Section 6.2 include 3 lags of the dependent variable.

Second, as a cross-check, we re-estimate the error correction model using the one step approach and compare the error correction coefficients for the two approaches. As can bee seen in Table 6 in the Appendix, the magnitude and statistical significance of the error correction coefficients are broadly similar for the two approaches.

There seems to be no consensus in the literature as to which test is to be preferred. Concerning the robustness of the tests, a major caveat of both co-integration tests discussed here is that the results depend on the particular choice of the co-integration relation. That is, although the distribution of the t statistic is independent of the particular choice of the co-integrating variables, its value is not. Thus, the same test performed on the same data but different choices of the co-integrating variables can lead to different results. This problem is not overcome by the ECM test. As Davidson and G. (2004) show, as the number of possible co-integrating relationships increases, the probability density function of the t statistic moves steadily to the left, i.e. the critical values increase and the power of the test decreases.

However, the loss of power due to an increasing number of potential co-integration relationships is not an issue here, because we only postulate one possible co-integrating relationship. The restriction is justified, since the assumed long-run relationship is economically plausible and unchallenged in the related literature. Even is the results of the co-integrating tests might diverge to some extent in the literature, there is consensus over the specification of the co-integration relationship.

6.4 Credit risk pricing during the financial market turmoil period

A natural question that arises is to what extent the financial market turmoil that got underway in August 2007 influences the above-reported results in sections 6.1 and 6.2. This last sub-section examines this issue from three different angles. First, the extended specification is re-estimated and evaluated using the sample up to end-July 2007. Second, we analyze the time-varying explanatory power of firm-specific and common factors. Third, we decompose the CDS spread movements into an expected loss and a risk premium component. The latter approach can help in explaining if the sharp re-pricing of credit risk during turmoil period emanated from upward revision in actual default rates or if the higher credit spreads merely reflect changes in investors' risk preferences.

i) Impact of the financial market turmoil on price discovery

The results of the estimation using only the sample up to end-July 2007 are reported in Table 7 in the Appendix (the global liquidity variable is dropped from this estimation since we consider it to have little influence on CDS and corporate bond spreads during the overall tranquil period 2004 to mid-2007). The results show a different pattern compared with the results obtained when running the estimations over the entire sample. Most importantly, the results provide little support of a systematic disconnection between the CDS and the credit market before the outbreak of the financial turmoil; the error correction terms are significant with the expected sign for both financial and non-financial firms. This suggests that in the period January 2004 to end-July 2007, the prices in the two credit markets corrected deviations from their long-run relationship in a roughly equivalent manner. This differs from the whole sample analysis where the CDS markets always lead the price discovery process.

In the same vein, the derived GG measures show some marked differences in the price discovery process in the period up until end-July 2007 compared with price discovery found for the whole sample. More specifically, the GG ratio drops from 1 to 0.83 for the financial firms and from 1 to 0.66 for the non-financial corporations when computing the ratios over the period January 2004 to end-July 2007. Thus, it seems that the leading role of the CDS market in the price discovery process strengthened relative to the corporate bond markets during the financial crisis period. This observation is in line with Upper and Werner (2007) who examined price discovery in the German bond futures and cash markets in the aftermath of the financial market turbulence in 1998. They found the derivative market to remain relatively more liquid and that contribution of the cash market to price discovery dropped considerably.

ii) Time-varying impact of firm-specific and common factors

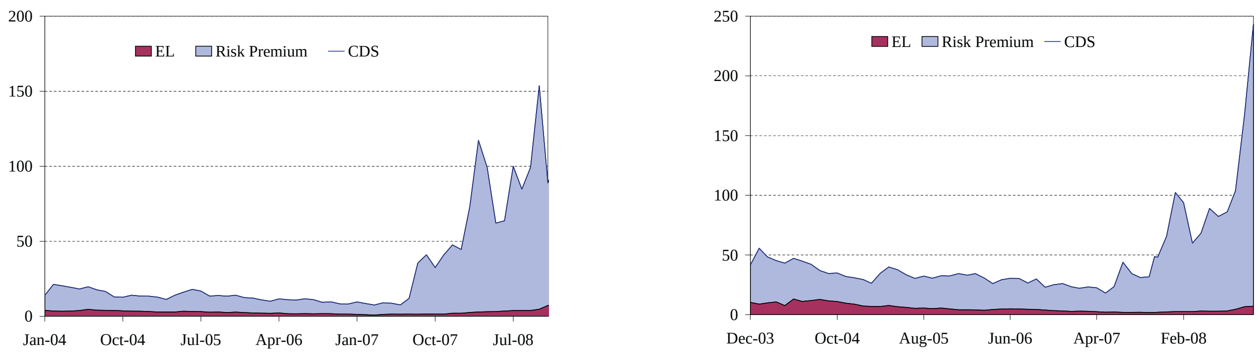
To evaluate if firm-specific and common factors' respective impacts on credit risk changed over the sample under consideration, we run a rolling one-year panel regression for both CDS and credit spreads. Figures 4a to 4d in the Appendix display the respective factors contribution to the explanatory power. Two features can be inferred from the figures. First, up until the outbreak of the turmoil in the summer of 2007, firm-specific and common factors contributed broadly equally (and rather marginally) to the explanatory power of CDS and corporate bond spread movements (across financial and non-financial firms). Second, the financial market turmoil seems to have brought about a closer correlation between firm-specific and common factors on the one hand, and firms' CDS and corporate bond spreads on the other. In the CDS markets the increasing relevance of systematic risk factors is particularly pronounced.

iii) Decomposing credit risk into expected losses and default risk premia

To further examine the pricing of credit risk changed after the turmoil, we decompose the observed credit spreads into the expected losses and the risk premium that market participants demand to invest in credit derivatives. Following the approach suggested by Berndt et al. (2004) and Amato (2005) we proxy the markets' perceived default risk by one-year-ahead expected default frequencies (EDF) provided by Moody's. By assuming a 40% recovery value (a standard assumption in literature) we derive the risk premium as the absolute difference between the observed level of CDS spreads and the expected loss. Figures 3a and 3b below show this decomposition for the financial and the non financial sample.

Figure 3
Risk Premia Decomposition

(a) CDS financial sample (b) CDS non financial sample



Two main features may be inferred from these decompositions. First, up until the turmoil got underway in the summer of 2007, both expected losses and the demanded risk premium hovered at relatively low levels (for both financial and non financial CDS spreads). Second, the bulk of the sharp upturn in perceived credit risk since August 2007 seems to reflect a higher compensation required by investors for accepting exposure to default risk rather than an actual increase in perceived default risk. This conclusion is in line with a similar exercise applied on euro area Large and Complex Banking Groups (LGCB): *"Whereas largest proportion of CDS spreads corresponded to the compensation for expected loss between 2005 and mid-2007, since the eruption of the turmoil, the expected-loss component has increased only moderate in comparison with the default risk premium"*, see ECBb (2008).

The time-varying results described above suggested an increasing relevance of systematic risk during the turmoil period for CDS spreads. Combining this observation with that shown in Figures 3a and 3b suggest that the sharp upturn in the default risk premia are primarily driven by higher systematic risk. This is also supported by the large increase in the cross-sectional correlation of residuals after August 2007 in the CDS regressions, pointing to an increasing relevance of an unobserved common factor in this market.[5].

7 Concluding Remarks

This paper is aimed at comparing the price of credit risk in the CDS and the corporate bond markets. For this purpose a structural credit risk model was estimated. Applied to the European markets, we find CDS spreads to be more sensitive to changes in systematic risk compared with the corporate bond spreads. Instead, the corporate bond markets seem to price in more information related to the firm-specific environment and the overall liquidity situation.

Given the no-arbitrage condition between the two markets, we tested for a long-run relationship based on an error-correction setup. We find evidence of a co-integration relationship between CDS spreads and corporate bond spreads, confirming the theoretical claim that arbitrage opportunities are traded away over the long term. Various measures for price discovery suggest that the European CDS markets absorb information faster than corporate bond markets, probably due to micro-structure differences between the two markets.

We find that the period of financial market turmoil induced a significant shift in the way market participants priced credit risk of which the following three are particularly notable. First, the leading role of the CDS market in the price discovery process strengthened following the financial crisis. Second, the financial market turmoil seems to have brought about a closer correlation between firm-specific and common factors on the one hand, and firms' CDS and corporate bond spreads on the other. Of note is that in the CDS markets the large increase in sensitivity to systematic factors is particularly pronounced. Third, to the extent that EDF does not underestimate the true expected

[5] The cross-sectional correlation of residuals increased significantly for the CDS and credit spreads regressions after July 2007 (for the extended specification) The importance of the unobserved common factor has also been emphasised by Collin-Dufresne et al. (2001)

loss, the bulk of the upturn in credit risk measures during the turmoil period seems to emanate from the higher premia investors demand for systematic risk rather than an actual increase in firms' expected losses.

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8 Appendix

Table 2
Summary Statistics

Financial Firms					
Variable	**Unit**	**Mean**	**Std. Dev.**	**Min**	**Max**
CDS Spreads	bp	29.467	35.011	3.700	273.539
Credit Spreads	bp	52.163	48.793	0.200	335.200
Implied Volatility	%	29.078	19.200	8.870	217.300
Return	%	-0.116	1.910	-26.300	13.400
Market Implied Volatility	%	19.232	9.462	9.239	87.510
Market Return	%	-0.049	2.150	-14.004	4.713
Treasury Yield	bp	3.904	0.719	1.793	5.512
Liquidity	bp	11.445	6.400	3.770	47.930
Non Financial Firms					
CDS Spreads	bp	43.2	36.5	5.5	591.0
Credit Spreads	bp	36.6	34.5	-14.2	335.0
Implied Volatility	%	26.5	11.5	7.0	140.7
Return	%	0.0	3.7	-31.3	26.6

Table 3
Basic Statistics

Financial Firms	Jan.2004-Oct.2008		Oct.2008	
	Average	Absolute average	Average	Absolute average
Banca Monte dei Paschi di Siena SpA	-22	32	-95	95
Banco Bilbao Vizcaya Argentaria SA	-26	42	-18	29
Banco Santander SA	-4	15	-45	45
Barclays Bank PLC	-6	20	-36	36
BNP Paribas	-20	24	-68	68
Commerzbank AG	8.66	16	-140	140
Credit Agricole SA	-66	106	-37	37
Credit Suisse Group AG	-24	32	-53	53
Deutsche Bank AG	-3	13	-49	49
Intesa Sanpaolo SpA	-9.3	17	-67	67
Societe Generale	-117	126	-58	58
Royal Bank of Scotland PLC/The	-4	21	-78	92
UBS AG	-37	43	-42	75
UniCredit SpA	-10	16	-55	55
Average Financials	**-24**	**37**	**-60**	**64**
Non-Financial Firms				
Gaz de France	7	9	16	20
France Telecom	20	22	-49	42
Deutsche Telecom AG	14	19	-72	68
Bayer AG	1.36	7	-47	48
Iberdrola SA	-11	35	73	73
Carrefour SA	12	14	-34	42
Daimler Chrysler	36	37	-20	31
Fortum Oyj	-1	9	-18	18
Koninklijke Aeronautic Defense	-16	16	-176	176
Deutsche Post Fin	7	10	-14	20
European Aeronautic Defense	10	12	43	53
Lafarge SA	-8	25	117	129
Akzo Nobel NV	15	18	11	35
Lufthansa AG	12	23	-11	31
Henkel AG	2	10	-6	15
Average Non-Financials	**7**	**18**	**-13**	**53**

Table 4
Engle-Granger Cointegration Tests

Financial Firms	**E-G Tests**	
	ADF	PP
Banca Monte dei Paschi di Siena SpA	-	-
Banco Bilbao Vizcaya Argentaria SA	-	-
Banco Santander SA	*	-
Barclays Bank PLC	***	***
BNP Paribas	**	*
Commerzbank AG	-	-
Credit Agricole SA	-	**
Credit Suisse Group AG	-	-
Deutsche Bank AG	***	***
Intesa Sanpaolo SpA	***	***
Societe Generale	-	-
Royal Bank of Scotland PLC/The	***	**
UBS AG	***	-
UniCredit SpA	**	**
Non-Financial Firms		
Gaz de France	**	**
France Telecom	*	*
Deutsche Telecom AG	-	**
Bayer AG	***	***
Iberdrola SA	-	-
Carrefour SA	**	**
Daimler Chrysler	***	***
Fortum Oyj	***	***
Koninklijke Aeronautic Defense	*	**
Deutsche Post Fin	*	**
European Aeronautic Defense	-	**
Lafarge SA	***	***
Akzo Nobel NV	-	-
Lufthansa AG	*	-
Henkel AG	-	*

Note: Column 2 shows the results of the ADF test that the residuals from the equation $CDS_t = \alpha_i + \beta_i CS_t + \epsilon_t$ have a unit root. Column 3 shows the results of the Philipp-Perron Unit Root Test. ***, ** and * indicate that the 0 hypothesis of non-stationarity can be rejected at the 1%, 5% and 10% level respectively.

Table 5
Serial Correlation Tests Residuals

	CDS		Credit Spreads	
Financials	**Chi2**	**P-value**	**Chi2**	**P-value**
Banca Monte dei Paschi di Siena SpA	2.402	0.121	1.491	0.221
Banco Bilbao Vizcaya Argentaria SA	1.11	0.292	1.185	0.276
Banco Santander SA	0.12	0.728	2.531	0.111
Barclays Bank PLC	1.61	0.21	0.603	0.437
BNP Paribas	0.28	0.59	4.91	0.000
Commerzbank AG	1.12	0.29	1.011	0.314
Credit Agricole SA	0.07	0.79	5.93	0.015
Credit Suisse Group AG	0.14	0.707	0.73	0.393
Deutsche Bank AG	2.2	0.138	1.72	0.192
Intesa Sanpaolo SpA	0.151	0.283	7.79	0.005
Societe Generale	1.67	0.195	0.91	0.342
Royal Bank of Scotland PLC/The	1.88	0.170	0.48	0.489
UBS AG	1.45	0.229	0.95	0.330
UniCredit SpA	2.06	0.152	11.26	0.001
Non-Financials				
Gaz de France	0.25	0.617	0.18	0.669
France Telecom	1.74	0.187	0.37	0.54
Deutsche Telecom AG	0.06	0.811	0.59	0.441
Bayer AG	1.22	0.269	0.59	0.439
Iberdrola SA	0.25	0.615	1.01	0.315
Carrefour SA	0.47	0.492	0.45	0.499
Daimler Chrysler	10.69	0.001	8.43	0.004
Fortum Oyj	0.18	0.676	3.62	0.057
Philips	0.42	0.516	8.48	0.004
Deutsche Post	0.11	0.735	12.98	0.000
European Aeronautic Defense	0.18	0.669	0.12	0.996
Lafarge SA	0.13	0.716	1.19	0.275
Akzo Nobel NV	1.34	0.245	12.521	0.000
Lufthansa AG	12.52	0.000	12.301	0.001
Henkel AG	1.2	0.272	0.01	0.907

Note: We tested for serial correlation of the residuals for each unit in the sample. We first estimated the specification in columns (4) and (8) in Table 5 for each unit. We used the Breusch-Godrey LM test for serial correlation on the residuals of those regressions. The maximum number of lags of the dependent variable required by the serial correlation tests in order to avoid serial correlation is the same number of lags of the dependent variable used to estimate the panel regressions in columns (3), (4), (7) and (8) in Table 1.

Table 6
Comparison between the one-step and two-step Cointegration Tests

	FIN		**NON FIN**	
One step approach	CDS	CS	CDS	CS
Error Correction Coefficient	-0.015	0.025	-0.01	0.03
t statistic	-1.18	3.56	-1.15	3.5
Engle-Granger Test				
Error Correction Coefficient	-0.01	0.03	-0.02	0.04
t statistic	-1.29	4.07	-1.34	3.91

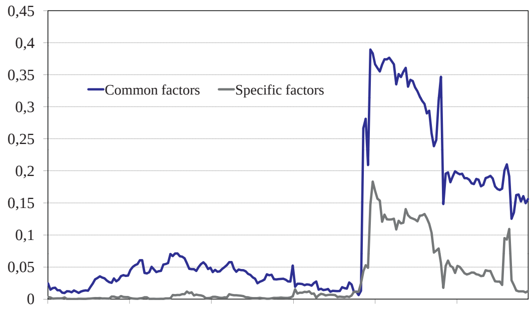
Table 7
Extended Specification up to end-July 2007

	FIN	NON FIN	FIN	NON FIN
Expl/Dep Var	**CDS** **(1)**	**CDS** **(2)**	**CS** **(3)**	**CS** **(4)**
Delta Implied Volatility	0.56	0.005	0.47	0.02
	(0.002)	(0.827)	**(0.024)**	(0.527)
Stock Return	-0.16	-0.05	0.08	-0.04
	(0.004)	**(0.049)**	(0.748)	(0.174)
Delta 10year Treasury	-2.66	-2.68	-4.07	-2.89
	(0.001)	**(0.004)**	**(0.414)**	**(0.027)**
Market Return	-0.02	-0.32	-0.1	-0.13
	(0.441)	**(0.000)**	(0.670)	(0.152)
Delta Vola Market	0.32	0.001	0.2	-0.2
	(0.000)	(0.987)	(0.549)	**(0.029)**
EC	-0.07	-0.03	0.35	0.06
	(0.003)	**(0.002)**	**(0.030)**	**(0.000)**
R^2	58%	4%	4%	4%
No of observations	1677	2368	1645	2340

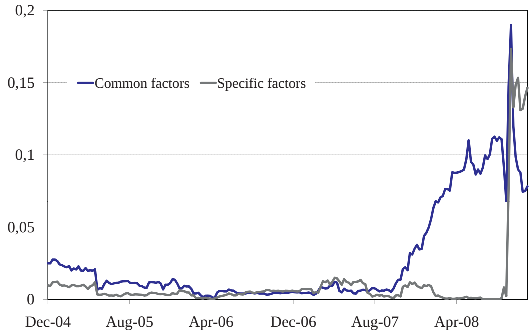
Note: Fixed effects panel estimation using only the sample up to August 2007. The first 2 columns show the estimation results for the CDS spreads, financial and the non financial sample, while the last 2 columns show the results for the credit spreads estimations.

Figure 4
Change in Explanatory Power over Time

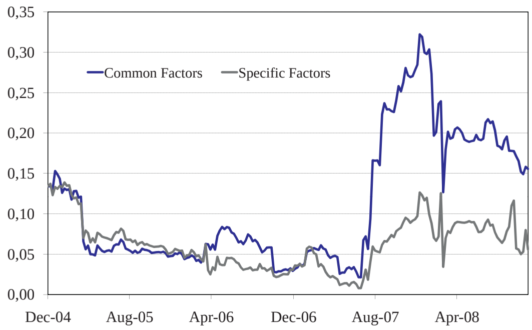
(a) CDS Non Financial Sample



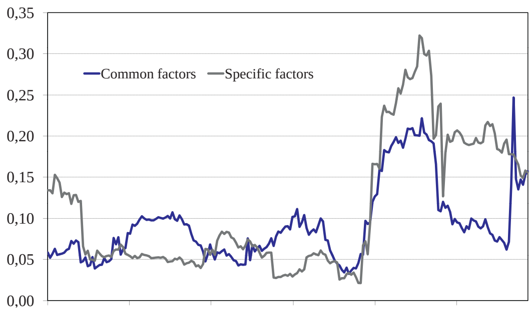
(b) Credit Spreads Non Financial Sample



(c) CDS Spreads Financial Sample



(d) Credit Spreads Financial Sample



Note: R^2 from 1 year moving window rolling regressions (fixed effects panel estimations) of CDS spreads and credit spreads on common factors and specific factors respectively. Firm-specific factors are: individual firms' weekly changes in implied volatility and weekly stock returns. Common factors are: weekly changes in ten-year government bonds, weekly changes in EURO STOXX 50 implied volatility and weekly returns on the Datastream Euro Area Stock Price Index.

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