The Economic Impact of Credit Default Swap on Credit Markets

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Abstract

This study conducts a comprehensive analysis of the economic benefits and costs of credit default swap (CDS) in credit markets since its inception. Consistent with its role of insuring credit risk, the introduction of CDS reduces illiquidity and liquidity risk more for speculative grade bonds with high credit risk than investment grade ones. More importantly, CDS significantly improves the price convergence between investment grade bonds and CDS spreads through a popular trading strategy—CDS-bond basis arbitrage in normal period. In the recent crisis, however, CDS fails to reduce the prolonged price divergence between the two markets plausibly due to the lack of arbitrage. Overall, the economic impact of CDS is dependent on the prevailing trading strategies in the credit markets.

JEL Classification: G10, G12

Keywords: Credit Default Swap, CDS-Bond Basis, Basis Arbitrage, Corporate Bond, Financial Crisis, Investment Grade, Speculative Grade, the Limits of Arbitrage, Price Convergence, Price Divergence.

"*There is a dearth of serious empirical studies on the social benefits and costs of credit default swaps and other derivatives—not just in the last two years, but in the last several decades.*"

— *Stulz, JEP, 2010, Pg. 18*

1. Introduction

Credit default swap (CDS) is one of the most prominent financial innovations in recent years. Since its introduction, market practices have been significantly changed in the investment, trading, and management of credit risk.[1] Traditional finance theory suggests that credit derivatives can increase economic welfare by facilitating credit-risk sharing among investors, improving price discovery, and making capital allocation more efficient (e.g., Stulz, 2010; Jarrow, 2010). On the other hand, recent empirical evidence reveals that the exposure created by CDS and the trading of the CDS can heighten the vulnerability of financial markets, which has been manifested in the recent financial crisis (e.g., Duffie, 2010; Mitchell and Pulvino, 2012). Nevertheless, the extant literature still lacks a comprehensive empirical analysis on the economic roles played by CDS in credit markets (Stulz, 2010). Our study intends to fill this void.

We examine the economic impact of CDS on corporate bond market and CDS market since its inception. Our first empirical exploration focuses on the insurance role provided by CDS for credit risk because CDS allows traditional buy-and-hold bond investors to pass their credit risk to others who want to bear it directly. If this insurance benefit is indeed provided by CDS for marginal bond investors, we shall expect that those bonds with high credit risk benefit more from the availability of CDS than other bonds. Our results confirm this conjecture: the illiquidity level of speculative grade bonds is about 27% lower than investment grade bonds after CDS became available. The illiquidity measures we use include the number of zero-trading days, the number of transactions, trading volume, turnover, the trade size, and the Amihud measure (2002). Moreover, we also find that the return compensation for liquidity risk is reduced by about 1% per year for speculative grade bonds compared to investment grade bonds. These results suggest that CDS facilitates a better trading for those bonds with higher credit risk than other bonds.

[1] See Rajan, McDermott, and Roy (2007) and D'Arcy, McNichols, and Zhao (2009) for a review of the credit derivatives markets.

Since CDS is introduced, it has also been widely used by investment banks, hedge funds and other speculators to "arbitrage" the mispricing of the credit risk of the same company in the cash and derivatives markets through the so-called CDS-Bond basis trade. The CDS-Bond basis (the basis hereafter) is defined as the difference between the CDS spread of a reference firm and the spread of the firm's cash corporate bond with similar maturity. Many studies have shown that CDS spread and credit spread follow a co-integrated process since they measure the credit risk of the same company.[2] Investors can arbitrage away non-zero basis if the two markets are expected to converge in the future. When the basis is negative (positive), one can long (short) the underlying corporate bond and buy (sell) CDS to bet on the narrowing of the basis. In practice, the negative basis arbitrage is more popular than the positive basis arbitrage because it is more difficult to short sell cash bonds. In theory, arbitrage helps to bring market prices of the securities closer to their fundamental values and keep market efficient (Shleifer and Vishny, 1997). Hence, if arbitrage activities are engaged by marginal investors after CDS became available, we shall expect that the current price mis-alignment between the bond and CDS markets may lead to future price convergence as a result of the arbitrage. This line of reasoning provides us with a second empirical hypothesis that the mis-pricing between bond and CDS spreads predicts future bond returns and CDS spread change through the arbitrage activity.

We take four progressive steps to test the hypothesis. First, we compute the level of basis—a measure of price mis-alignment between CDS and each corporate bond of the same firm. We find that investment grade bonds with more negative basis are older and smaller, and have lower rating, longer maturity, higher coupon, duration and convexity. However, we do not find such a clear relation between the basis and the various characteristics of speculative grade bonds. The results are consistent with the market understanding that certain investment grade bonds are more prone to the mis-pricing than other bonds and therefore become the targets of the basis arbitrage (e.g., Deutsche Bank, 2009).

Second, we construct quintile bond portfolios based on their past basis levels and see whether there is a relation between the basis and future bond returns. The results show that the bond portfolios with negative basis earn positive returns in the future, indicating price convergence in the bond portfolios. On the contrary, we find that the bond portfolios with positive basis earn

[2] Hull, Predescu and White (2004), Norden and Weber (2004), and Blanco, Brennan, Marsh, (2005), and Alexopoulou, Andersson and Georgescu (2009) among others have examined the parity relation between CDS and corporate bond spread.

positive future returns, indicating price divergence in these portfolios. Since most of the investment grade bond portfolios (four out of five) are associated with negative basis while most of the speculative grade bond portfolios are associated with positive basis, our results suggest that price convergence is more prevalent for investment grade bond portfolios.

In the third step, we test whether the past price mis-alignment can also predict future movement of individual bonds. Similar to the results found in the bond portfolios, past basis predicts the future returns of investment grade bonds at a 1% significance level. In economic magnitude, one standard deviation increase in the current basis level predicts -10 basis points (bps) loss in the future return on an annual basis. The negative relation between the basis and future returns represents price convergence in the bonds. Our robustness tests also eliminate three alternative hypotheses that can explain these results. Specifically, we include past CDS spread as a control variable to reduce the concern that the predictability is caused by the leading information from CDS spreads for the bonds in pricing credit risk. If marginal investors are only using CDS to insure the credit risk of their bond investments, we expect that the relation between past CDS spread and future bond returns be significantly negative. However, such relation is not found in the analysis. Moreover, we also include past change of CDS spread and past bond returns as additional control variables to demonstrate that the price convergence we found is not due to the reversals in CDS spreads or bond returns. The results in speculative grade bonds are largely similar in the signs of the coefficients of the basis across different model specifications but not in terms of statistical significance. This result shows that the price convergence in speculative grade bonds via the arbitrage is more plausibly contaminated by other noise traders, and is also consistent with our previous result that the basis is not related to the characteristics of these bonds in a clear pattern.

In the final step, we test the predictability of the basis for future CDS spread movements to confirm that the basis arbitrage is the leading explanation for the price convergence between the two credit securities involved in the basis trade. Indeed, our results show that the past basis predicts price convergence in investment grade CDS spread change at the 10% significance level. On average, one standard deviation increase in the basis predicts a 5% reduction in the CDS spread in the future. On the other hand, we do not find any significant predictability of the basis for the speculative grade CDS spreads. In comparison to the basis predictability for the investment grade bonds, it is not surprising to find that the predictability for the investment grade

CDS spreads is statistically weaker because the CDS market is much bigger in sheer size and much more liquid than corporate bond market in the normal period.

To sum up, we find strong and consistent evidence that CDS leads to price convergence between the investment grade bonds and CDS spreads in the normal period. Such prediction is not driven by the insuring role of CDS for credit risk or by price reversals in the markets, but is likely due to a popular trading strategy in a normal market condition –CDS-bond basis arbitrage.

It is important to note that recent literature shows that the two credit markets have experienced significant price disruptions during the 2007-2008 financial crisis (e.g., Fontana, 2010; Bai and Collin-Dufresne, 2011). Duffie (2010) attributes the prolonged deviation between CDS spreads and credit spreads of corporate bonds to the lack of arbitrageurs and arbitrage capital. Similarly, Mitchell and Pulvino (2012) show that the loss of confidence about primary brokers and the subsequently spillover to the rehypothecation lenders and their clients—hedge funds slow down the movement of investment capital. Hence, we will examine whether the beneficial role of CDS continues to hold when the prevailing trading activities are adversely affected by the limits of arbitrage in the crisis. This is our third empirical hypothesis.

The first test shows that past negative basis leads to negative future returns in both investment grade and speculative grade bond portfolios. Since on average, the basis is much more negative in the crisis period, the result indicates that a high level of mis-pricing leads to price divergence in the bonds, opposite to what happens in the normal period. We continue the test at the individual bond level. We find that past negative basis still predicts price convergence in investment grade bonds, but the insuring role of the CDS is much more dominant for investment grade bonds, leading to an overall price divergence in the bonds. As for the speculative grade bonds, the predictability of the basis for the returns can be completely explained away by past CDS spread and the price reversals in the bonds.

More importantly, past basis can no longer predict any convergence in the CDS spreads at all in the crisis, unlike before in the normal period. After we control for past CDS spreads, we actually find that the basis leads to significant price divergence in the CDS spreads in the future. This result suggests that the basis arbitrage may lose money due to uncertainty in the CDS movement. Hence, combining the results found in the two markets, we conclude that CDS fails to reduce the price divergence between corporate bonds and CDS spreads in the crisis, plausibly due to the lack of basis arbitrage as it can incur significant losses due to high uncertainty in price movements of the CDS spreads.

In summary, we find that CDS provides the insurance for credit risk and offers new trading opportunities to reduce the mis-pricing of credit risk in the related credit securities. When CDS is initially introduced, we observe the insurance role of CDS is more significantly manifested in the bonds with high credit risk through the reductions of illiquidity and liquidity risk. In the normal market condition, we also observe that the marginal investors of investment grade credit securities enjoy better price discovery through arbitrage activities that are made available by CDS. However, in the financial crisis, we observe that such improvement of price efficiency largely disappears because the usual arbitrage may incur great losses due to heightened market uncertainties. Although conventional rational finance theory would suggest that significant price mis-alignment shall attract new investors to arbitrage away the mis-pricing, but the literature has shown that alternative investment capital fails to flow in time to profit from the prolonged price divergence in the two credit markets during the crisis because of inattention or fear. Hence, the beneficial role of CDS through arbitrage activities is greatly hindered by the prevailing trading activities in the crisis. Still, CDS continues to provide credit risk insurance even during the crisis.

The contribution of our study is four folded. First, this study is among the first to provide a comprehensive empirical analysis on the positive and negative pricing impacts of CDS on the credit markets including corporate bond and CDS markets. We find that the pricing impact of CDS is highly dependent on the prevailing trading activities of CDS in the markets. Our results provide empirical support for the economic roles played by CDS as suggested in theory by Stulz (2010) and Jarrow (2010). We find that CDS provides insurance for credit risk and improves market efficiency in normal period but doesn’t help much when investors arbitrage much less.

Second, our study also complements the existing literature that examines the impact of CDS trading on different security markets such as equity, option, and corporate bond markets (e.g., Boehmer, Chava, and Tookes, 2011; Acharya and Johnson, 2007; Das, Kalimipalli, and Nayak, 2011). Most of the prior studies conclude with a negative impact of CDS on the equity or bond markets. Our paper finds two positive roles of the credit derivative in corporate bond market such as providing insurance for credit risk and improving price discovery in normal market condition. A recent study also examines the impact of sovereign CDS market on the sovereign bond market and finds some positive effects of the sovereign CDS there as well (e.g., Ismailescu and Philips, 2012).

Third, our findings also shed lights on how arbitrage force affects fixed income securities as a result of the introduction of CDS. Prior literature such as Mitchell and Pulvino (2001) and Duarte, Longstaff, and Yu (2007) have documented significant rewards for risky arbitrage strategies. A related study by Arora, Gandhi, and Longstaff (2012) also show that the market friction such as counterparty risk is priced in CDS. Consistent with these findings, we also find that trading strategies based on past basis—an empirical proxy of mis-pricing can generate significant abnormal returns on the portfolio level.

Lastly, our study also contributes to the existing literature on CDS-bond basis. While earlier literature mainly focuses on the co-integration of CDS and bond spread, some recent studies have examined the existence and determinants of the basis. For example, Bai and Collin-Dufresne (2011) show that funding liquidity risk, counterparty risk, and collateral quality jointly determine the basis level. Nashikkar, Subrahmanyam and Mahanti (2011) find that some determinants of the basis are related to a bond's accessibility, liquidity, and probably short-sale constraints faced by bond investors. Trapp (2009) shows that the basis is related to bond, CDS, and market-wide liquidity measures. Fontana (2010) also finds that basis dynamics is driven by economic variables such as funding liquidity, market liquidity and counterparty risk. Our paper differs from these studies in fundamental ways. Instead of finding the determinants of the basis, we employ the basis as a convenient proxy for the level of mis-pricing between the two credit markets and examine the impact of CDS through an arbitrage trading strategy to reduce such mis-pricing. The arbitrage works well in normal market condition and improves price efficiency in bond market but not as well in the crisis when arbitrage activities are limited by market imperfections. As far as we know, this is the first study that relates the arbitrage activity to the economic role of the derivatives in the related markets.

The rest of the paper is organized as follows. Section 2 discusses how CDS affects the liquidity of corporate bonds since its introduction. Section 3 presents the impact of CDS on both the corporate bond market and the CDS market during the normal period by focusing on the role of CDS to reduce mis-pricing between the bond and CDS market. Section 4 investigates the impact of CDS on both credit markets during the recent financial crisis and section 5 concludes.

2. The Impact of CDS on Corporate Bond Liquidity

A CDS is essentially an insurance contract, in which the protection buyer pays a premium (called the CDS spread) to the protection seller periodically for protection against the default of a reference entity. A credit event, such as bankruptcy, triggers a contingent payment from the seller to the buyer. The payment could be in the form of physical settlement, in which the seller receives the defaulted bond and pays par to the buyer, or cash settlement, in which the seller pays the difference between the par and the recovery value of the bond. CDS makes it much more convenient to trade the credit risk of a reference entity. While in the past investors have to borrow and sell the cash bond of a company to short its credit risk, right now this can be easily accomplished by buying the CDS of the company. Since CDS improves the transparency of the pricing of credit risk, it is natural to expect that CDS may improve the liquidity in corporate bonds after it is introduced at the end of 1998. Hence, our first hypothesis is as the followings,

Hypothesis 1: CDS improves the liquidity of the corporate bonds with high credit risk more than that of the bonds with low credit risk.

We conduct several empirical tests on this conjecture both at the individual bond level and the portfolio level.

2.1. The Impact on the Illiquidity of Individual Bonds

At the individual bond level, if the availability of CDS helps bond investors to insure the credit risk of the bond investment, we shall expect that the liquidity level of the bond be improved as a result of the introduction of CDS. To verify the hypothesis, we need to construct bond-level liquidity measures and compare them before and after the inception of CDS. We employ two bond transaction databases NAIC and TRACE from 1994 to 2008 to perform the analysis. The two databases have been widely used in the recent literature.[3] We further merge

[3] TRACE was officially launched in 2002 by the Financial Industry Regulatory Authority (FINRA), which replaced NASD, to disseminate secondary over-the-counter (OTC) corporate bond transactions by its members. TRACE gradually increases its coverage of the bond market over time. By July 1, 2005, FINRA requires all its members to report their trades within 15 minutes of the transaction. Nowadays, TRACE covers all trades in the secondary over-the-counter market for corporate bonds and accounts for more than 99% of the total secondary trading volume in corporate bonds. The only trades not covered by TRACE are trades on NYSE, which are mainly small retail trades. The information contained in TRACE includes transaction dates and transaction price (clean price or price with commissions). We exclude transactions whose prices are mixed with commissions in our study. Due to limited coverage by TRACE before 2002, we supplement the bond transaction information from the NAIC database, which provides all corporate bond transactions by American Life, Health, Property and Casualty insurance companies

them with the Fixed Investment Securities Database (FISD) to obtain bond information, such as age, maturity, size, coupon, and credit ratings. In this paper, we only examine straight bonds that are non-convertible, non-callable, and non-putable with bi-annual fixed coupon payment.

We construct six commonly used liquidity measures used in the literature. We re-define them in such a way that a higher value always represents a higher illiquidity level. The measures include zero-trading days within a month (namely, *Zero Trade*), the inverse of the logarithm of trading volume (*1/Volume*), the inverse of the total number of transactions of each bond per month (*1/Trades*), the inverse of the turnover rate (*1/Turnover*), the logarithm of the total trading volume divided by the number of total trades in each month (*Trade Size*), and the Amihud (2002) measure (*Amihud*). Amihud (2002) constructs the illiquidity measure based on the theoretical model of Kyle (1985) to measure the price impact of a trade. We apply the measure for each bond i in month t as follows,

$$Amihud_{i,t} = \frac{1}{N_t} \sum_{j=1}^{N_t} \frac{\left| \frac{P_j - P_{j-1}}{P_{j-1}} \right|}{Q_j}, \qquad (1)$$

where P_j is the transaction j's price on day t, Q_j is the volume of the transaction j, and N_t is the number of transactions on day t. We take the median of the daily Amihud measure for each bond in each month and multiply it by 10,000 as the original number is very small.

After winsorizing 1% of the data from the top and bottom in terms of the illiquidity measures, we report the summary statistics of the key variables in Panel A of Table 1.

[Insert Table 1 about Here]

Panel A shows that the mean of *Zero Trade* is 0.74, which implies that a bond trades about 16 days apart within a month. The mean of *1/Volume* is at 0.07 which represents an average volume per month is about US$2 million. Given that *1/Trades* measure is at 0.44, an average bond trades 2.2 times every month. The mean of *1/Turnover* is at 0.5, which implies that on average the bond turns over twice every month. The average *Trade Size* is at 6.2, which

since 1994. Insurance companies are estimated to hold between 33%-40% of corporate bonds and have completed 12.5% of the dollar trading volume in TRACE-eligible securities during second half of 2002 (Schultz , 2001; Campbell and Taksler, 2003). A recent study by Lin, Wang and Wu (2011) also uses the combined dataset of NAIC and TRACE to study the liquidity risk in the corporate bond market. NAIC is an alternative to the no-longer available Lehman fixed income database on corporate bonds used in previous studies. When TRACE has no record of a bond's transaction, we keep the observation from NAIC if it is available. Moreover, whenever a bond price becomes available in TRACE, we drop the transactions from NAIC database thereafter.

translates to a transaction size of about \$1 million per trade. The mean of *Amihud* measure is at 0.3. This implies that a trade with size of \$1 million will have a price impact of 0.3%. An average bond in our sample has a credit rating between A to A-, with 8 years-to-maturity, coupon rate of 7%, duration of 5 years and convexity of 46.

We run the following regression specification to test the introduction impact of CDS on bond illiquidity,

$$\begin{aligned} Illiquidity_{i,t} = {} & \beta_1 Dummy_{99} \times IG_{i,t} + \beta_2 Dummy_{99} \times HY_{i,t} + \beta_3 Dummy_{07} \times IG_{i,t} \\ & + \beta_4 Dummy_{07} \times HY_{i,t} + \beta_5 Dummy_{03} \times IG_{i,t} + \beta_6 Dummy_{03} \times HY_{i,t} \\ & + \beta_7 Ratings_{i,t} + \beta_8 Maturity_{i,t} + \beta_9 Coupon_{i,t} + \beta_{10} Issue\ Size_{i,t} \\ & + \beta_{11} Duration_{i,t} + \beta_{12} Convexity_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

where $Dummy_{99}$ is a dummy variable that equals to 1 since January 1999 when CDS first became available and zero otherwise, $Dummy_{07}$ is a dummy variable that equals to 1 after September 2007 when Lehman collapsed and zero otherwise, $Dummy_{03}$ is a dummy variable that equals to 1 after April 2003 when TRACE started to report most of the investment grade bond transactions and zero otherwise,[4] *IG* is a dummy variable that equals to 1 if the bond is an investment grade bond and zero otherwise, *HY* is a dummy variable for speculative grade bonds, *Ratings* are the credit ratings of the bond,[5] *Maturity* is the time to maturity of the bond, *Coupon* is the annual coupon rate, *Issue Size* is the natural logarithmic of the outstanding amount of bonds, *Duration* is the duration of the bond, and *Convexity* is the convexity of the bond. In the regression analysis, we standardize all six illiquidity measures with a mean value of 0 and a standard deviation of 1. Hence, we can directly compare the estimated coefficients across all six illiquidity measures.

Panel B of Table 1 reports the regression results of equation (2) and the standard errors are robust errors and clustered by each bond. We find that the introduction of CDS that is proxied by $Dummy_{99}$ is related to lower *1/Trades* and *Trade Size* for all bonds. This implies that the number of transactions increases and each trade is associated with a smaller transaction size after 1999. Moreover, the coefficient of $Dummy_{99}$ for the illiquidity measure *Zero Trade* is lower for

[4] Dick-Nielsen, Feldhüter, and Lando (2012) explains that there are three stages of the launch of TRACE. The first stage occurred in July 2002 and the 3rd stage occurred in October 2004. The second stage took place in April 2003 when it started to include hundreds of BBB bonds in addition to all bonds with A3/A- above. Hence, the majority of investment grade bonds have been included in TRACE by then.

[5] We use Standard and Poor's (S&P) rating whenever available, followed by Moody's and Fitch's rating. We assign a value of 1 to the highest rating (AAA for S&P or Aaa for Moody's) and 25 to the lowest rating (D for S&P or D for Fitch). We assign values between 2 and 24 for intermediate ratings.

speculative grade bonds but is higher for investment grade bonds. The average reduction of the three illiquidity measures for speculative grade bonds is about 31% compared to that of the investment grade bonds as a result of the availability of CDS. The other two illiquidity measures, *1/Volume* and *Amihud* increases for all bonds, but the increases are smaller for speculative grade bonds, about 8.5 percent less than those of investment grade bonds. *1/Turnover* is the only illiquidity measure among the six measures that increases more for speculative grade bonds, but the difference between the investment and speculative grade bonds is very small in economic magnitude. Overall, we find that five out of six illiquidity measures are lower for speculative grade bonds after 1999 by 22% on average in comparison to those of investment grade bonds.

The validity of the six illiquidity measures can be verified through the coefficients of the dummy variable, $Dummy_{03}$ that captures the improvement of corporate bond market transparency through the dissemination of transaction data TRACE (e.g., Edwards, Harris, and Piwowar, 2007; Goldstein, Hotchkiss, and Sirri, 2007; Dick-Nielsen, Feldhüter, and Lando, 2012). The signs of the estimates confirm prior findings that bond-level illiquidity is reduced for all bonds after TRACE was widely distributed in terms of *Zero Trade*, *1/Trades*, and *Trade Size*. The reductions in these illiquidity measures are unanimously more significant for speculative grade bonds. Furthermore, the other two illiquidity measures, *1/Volume* and *Trade Size* also show that illiquidity drops more for speculative grade bonds. Hence, the bonds with higher credit risk bonds also benefit more from the improvement of data transparency in the bond market.

It is also interesting to note that during the recent financial crisis that is proxied by $Dummy_{07}$, the three illiquidity measures such as *Zero Trade*, *1/Trades* and *Trade Size* drop more for speculative grade bonds than for investment grade bonds. However, other illiquidity measures such as *1/Volume* and *Amihud* increase more for speculative grade bonds. These findings are largely consistent with the mixed results in Friewald, Jankowitsch, and Subrahmanyam (2012), suggesting that different illiquidity proxies may capture different aspects of bond illiquidity.

Undoubtedly, one can argue that the model specified in equation (2) is coarse in capturing the exact availability of the CDS contract because not every CDS is introduced at the same time by the end of 1998. Hereafter, we try to improve the measure of CDS introduction by using a more refined construct than before. Following the approach of Ashcraft and Santos (2009) and Saretto and Tookes (2012), we merge the CDS data from Markit with the earlier sample of the monthly corporate bond data. The CDS quotes from Markit span from 2001 to 2008. We focus on the standardized 5-year CDS contracts for physical settlement that are senior unsecured with modified restructuring clauses and are denominated in U.S. dollar. When the specified CDS spread became available for the first time in the Markit database, the dummy variable $Dummy_{CDS}$ takes the value of 1 from that month onwards to represent the availability of the CDS for the related bond, and zero otherwise.

We re-run the regression model specified in equation (2) by replacing the dummy variable $Dummy_{99}$ by the new dummy variable $Dummy_{CDS}$. Compared to the previous measure, the new measure may still have embedded mis-matching issue because some CDS prices can become available since 1999 but Markit database only started in January 2001. Hence, we continue to interpret the findings with cautious as before.

Panel C of Table 1 reports the new specification regression results with robust and clustered standard errors. Generally, the patterns are similar to the prior results. Five out of the six illiquidity measures except *Amihud* measure are lower for speculative grade bonds than for investment grade bonds after the related CDS became available. On average, the reduction in the five illiquidity measures is about 31%. Consistent with the earlier results in panel B of Table 1, the coefficients of the $Dummy_{CDS}$ for the illiquidity measures such as *Zero Trade*, *1/Trades*, *Trade Size* are much more negative for speculative grade bonds than investment grade bonds. Moreover, the coefficients of the $Dummy_{CDS}$ are negative for the illiquidity measure *1/Volume* and zero for the measure *1/Turnover* for speculative grade bonds whereas they are both positive for investment grade bonds. The illiquidity measure *Amihud* does not show much difference for both types of bonds.

Taking together the results from both tests, our findings suggest that the illiquidity of the speculative grade bonds is on average 27% lower than that of investment grade bonds after CDS became available, supporting **Hypothesis 1** at the individual bond level.

2.2. The Impact on the Liquidity Risk of Bond Portfolios

The literature has shown that bond-market liquidity risk is also priced in corporate bond market in addition to bond liquidity.[6] In this section, we examine whether the pricing of the

[6] For example, Chacko (2005), Ericsson and Renault, 2006; Downing, Underwood, and Xing (2005), Lin, Wang and Wu (2011), and Dick-Nielsen, Fedlhütter and Lando (2012) have shown that bond-market liquidity risk is priced in the corporate bond market while other studies, such as Longstaff, Mithal and Neis (2005), Chen, Lesmond and Wei (2007) and Bao, Pan and Wang (2011) show that the liquidity level affects corporate bond prices.

liquidity risk is affected by the availability of CDS for corporate bond portfolios.[7] Following the approach of Das, Kalimipalli, and Nayak (2011), we merge the CDS data from Markit with the corporate bond pricing databases from 2001 to 2006.[8] As a CDS contract is written against an underlying firm, we sort all bonds first into two groups (cross-sectional and time series): those that are issued by the firm of which there is a CDS contract and those without. We name the bonds as pre-CDS and post-CDS bonds. Given the differences we found in investment grade bonds (IG) and speculative grade bonds (HY) from the previous section, we also sort bonds into the two rating groups respectively. After the double sorting, we have four groups of bonds, such as Pre-CDS IG bonds, Pre-CDS HY bonds, Post-CDS IG bonds, and Post-CDS HY bonds. Panel A of Table 2 reports the number of firms, bonds and transactions in each of the four groups.

[Insert Table 2 about Here]

We observe that there are less bonds or firms without CDS as time passes by. The number of firms without CDS contracts declines from 169 in 2001 to 14 in 2006 and the number of bonds without CDS drops from 361 in 2001 to 31 in 2006. On the other hand, the number of bond transaction increases from 1,521 in 2001 to 3,326 in 2006. This latter result is plausibly due to the launch of bond transaction database TRACE since 2002 in various stages.

Next, we perform the regression analysis of the bond portfolio returns on existing systematic risk factors to test whether the pricing of the bond-market liquidity risk varies across these four groups of bond portfolios. The regression model is specified as the followings,

$$HPR_{t-k,t} - r_{f,t-k,t} = \alpha_k + \mathrm{B}_1 \bullet F + \mathrm{B}_2 \bullet F \times HY_{k,t} + \varepsilon_{k,t}, \qquad (3)$$

where $HPR_{t-k,t}$ is the equally-weighted or value-weighted k-day holding period return of the bond portfolios from day $t-k$ to t (where $k=20, 40, or 60$), B is the beta loadings of all bond-market systematic risk factors F, and HY is a dummy variable that equals to 1 when it is the speculative grade bond portfolio.

Before we construct the equally- and value-weighted returns for the four bond portfolios, we first compute the holding period return HPR for each bond i as the followings,

[7] Unlike the tests of illiquidity on the individual bond level, we cannot conduct similar test of liquidity risk at the individual bond level because individual bond would have very high idiosyncratic risk whereas the liquidity risk we consider here is the systematic risk in the bond market.

[8] We stop the sample in 2006 because we do not want the recent financial crisis to contaminate our results given the previous findings that liquidity risk significantly increased during the recent financial crisis (e.g., Dick-Nielsen, Feldhüter, and Lando, 2012; Friewald, Jankowitsch, and Subrahmanyam, 2012). We will devote the entire section 4 to show the impact of CDS during the financial crisis.

$$HPR_{i,t-k,t} = \frac{(P_{i,t} + AI_{i,t}) + C_{i,t-k,t} - (P_{i,t-k} + AI_{i,t-k})}{(P_{i,t-k} + AI_{i,t-k})}, \qquad (4)$$

when $P_{i,t}$ is the closest available transaction price of bond portfolio *i* on day *t*, $AI_{i,t}$ is the accrued interest on day *t*, $C_{i,t-k,t}$ is the coupon payment from day *t-k* to day *t*, $P_{i,t-k}$ is the closest available transaction price of bond portfolio *i* on day *t-k*, $AI_{i,t-k}$ is the accrued interest on day *t-k*.[9] We choose the three time horizons, namely 20 days, 40 days, and 60 days to overcome small sample issue as our final testing sample only spans from 2002 to 2006 after deleting those bonds with less than 5 transactions within the specified holding horizon. The three holding horizons approximate monthly, bi-monthly, and quarterly frequencies respectively in the usual asset pricing test. The conventional systematic risk factors *F* include MKT_k_t, SMB_k_t, HML_k_t, DEF_k_t, and $TERM\_k_t$ which are standard systematic risk factors in Fama and French (1993) from day *t-k* to day *t*, LIQ_k_t measures the liquidity level of the bond market and is defined as the turnover in the bond market as the ratio of logarithmic of total trading volume divided by the total number of bonds outstanding from day *t-k* to day *t*, and AMH_k_t is the bond-market Amihud (2002) liquidity risk factor measured from day *t-k* to day *t* by following the exact construction procedures in Lin, Wang and Wu (2011).

Panel B of Table 2 shows the summary statistics of all the systematic risk factors in percentage terms. There are no outliers in the risk factors. Panel C of Table 2 reports the regression results. The beta of the liquidity risk factor, *AMH* is significant for the HY bond portfolio in the post-CDS period for 40- and 60-day horizons. The reduction in the liquidity risk beta for equally-weighted HY portfolio is -0.28 at 20-day horizon and -0.42 at 60-day horizon. The reduction for value-weighted HY portfolio is slightly lower at -0.25 for 20-day horizon and -0.40 for 60-day horizon. The reduction is quite economically significant after taking into account the beta for liquidity risk is almost zero for IG bonds.[10] In economic terms, the reduction of the liquidity risk translates to an annual return reduction of 1 percent for the HY bond portfolio compared to that

[9] If there is no price available on day *t*, we check whether there is any transaction price on day *t-1*, *t-2*, *t-3*, *t-4* and *t-5* in the order of priority. If there is no transaction price available on day *t-k*, we will check whether there is any transaction on day *t-k-1*, *t-k-2*, *t-k-3*, *t-k-4*, and *t-k-5* in the order of priority. If there are no transactions within the five-day window, the bond will be deleted from our sample.

[10] Our finding here differs from Lin, Wang and Wu (2011) as we include the LIQ factor in our regression whereas their tests only include *AMH* factor. *LIQ* factor captures the liquidity level and our result shows that it is significant across most of the regression specification in Panel C of Table 2. This finding is also consistent with the prior literature that the liquidity level is priced in corporate bonds (e.g., Longstaff, Mithal and Neis, 2005; Chen, Lesmond and Wei, 2007; and Bao, Pan and Wang, 2011).

of the IG portfolio. Given that on average, the historical average annual return of bonds in past twenty years is about 5 percent, the 1 percent reduction in the return is economically significant.

Overall, we find that after CDS became available, the corporate bonds with high credit risk such as speculative grade bonds experience significant reduction in bond-level illiquidity and portfolio-level liquidity risk compared to investment grade bonds. This finding reveals the CDS's positive role of providing credit risk insurance more for speculative grade bond investors.

3. The Impact of CDS on Credit Markets in Normal Period

Since CDS is introduced at the end of 1998, it has made the trading of credit risk much easier than before. Besides buying CDS to insure the credit risk in the underlying bond investment, investors can also engage in other types of trading strategies such as CDS-bond basis arbitrage. We explore in this section the impact of CDS as a result of arbitrage activities during the normal period. First, we explain in details what the basis arbitrage is. Second, we compute the level of basis for each pair of CDS and bond and discuss how it is related to the usual bond characteristics. Third, we test whether the past basis can predict price convergence at bond portfolio level to infer the role of the basis arbitrage. Subsequently, we also test its predictability at the individual bond level. Lastly, we conduct the predictability test in the CDS market as well.

3.1. CDS-Bond Basis Arbitrage

A basis is defined as the difference between a CDS spread and a bond's credit spread for the same company with the same maturity. Many studies have shown that CDS spreads and credit spreads are largely co-integrated because CDS and bond are two ways to invest in the credit risk of the same company and should have the same payoff in either default and at maturity. Therefore, non-zero basis presents trading opportunities for arbitrageurs if they expect the basis to narrow in the future. When the basis is positive, the arbitrageur can short the cash bond, which is typically done through a reverse repo, and sell a CDS on the same reference name with the same maturity and notional amount. When the basis is negative, an arbitrageur can buy the cash bond (probably need to use repo to fund the purchase) and buy a CDS on the same reference name. The arbitrageurs will hold their positions in both bond and CDS for a period of time till the basis narrows. Then the arbitrageurs can unwind their initial positions to log into some profits. If the basis becomes widen, however, arbitrageurs will lose money. Hence, the expected profitability of the basis trade hinges on whether investors believe that the basis may narrow in the near horizon. Practically, it is more difficult for arbitrageurs to engage in long-term arbitrage trades because long-term financing is not easy to be obtained from bond securities lenders, especially during the recent financial crisis (e.g., Mitchell and Pulvino, 2012).

Since the introduction of CDS, the basis trade has been very popular among hedge funds and proprietary trading desks at Wall Street firms (see e.g., Choudhry, 2006; JP Morgan, 2006). To engage in the basis arbitrage, arbitrageurs need to use short-term financing or borrow securities on the margin. If the margin requirements are perceived to change dramatically, the actual high financing cost (such as repo or reverse repo rate) can easily erode the arbitrageurs' potential profits. Traders, while deciding on candidate bonds for the basis trade, tend to consider bonds with funding spreads between -500 basis points (bps) and 1000 bps, which would usually rule out distressed bonds (e.g., Deutsche Bank, 2009). A positive funding spread is usually related to a negative basis, which indicates that a bond is cheaper than CDS. In practice, the negative basis trade is more popular than the positive basis trade.

During the few years before the recent financial crisis when credit was easily available, arbitrageurs also tend to lever up the basis trade many times to magnify the profits from small price discrepancies. However, when such highly levered arbitrageurs face a sudden shortage of capital or funding liquidity shock, their deleveraging activities can cause significant price distortions in the related markets. Moreover, there existed significant heightening of counterparty risk as a result of bankruptcies of some major bond securities lenders. Hence, the role of CDS in the crisis might be significantly different from that in the normal period because usual investors face constraints. Hence, we examine the role of CDS in the normal period and crisis period separately.

Our second empirical hypothesis focuses on the role of CDS in the normal market condition,

Hypothesis 2: CDS leads to a more efficient price discovery in corporate bond and CDS markets through CDS-Bond basis arbitrage in normal period.

Given that the **Hypothesis 2** makes two conjectures for the bond and CDS markets, we break it down to two sub-hypotheses for each market respectively,

Hypothesis 2a: CDS leads to a more efficient price discovery in corporate bond market through CDS-Bond basis arbitrage in normal period.

Hypothesis 2b: CDS leads to a more efficient price discovery in CDS market through CDS-Bond basis arbitrage in normal period.

For basis arbitrageurs to make money there must be a sufficient level of price mis-alignment between the two credit securities such as bonds and CDS in the first place. The second consideration for arbitrageurs is whether they expect price convergence to occur in the future. We examine how the arbitrage affects the bond market first and then move on to the CDS market.

3.2. CDS-Bond Basis and Bond Characteristics

To understand how the arbitrage impacts the bond market, we first compute the basis level for each bond, and then we study how the basis level is related to the usual bond characteristics as well as bond returns. To compute the basis, we focus on senior-unsecured fixed-rate straight bonds with semi-annual coupon payments. We delete bonds without credit ratings from any of the three rating agencies (i.e., Standard & Poor's, Moody's, and Fitch). We also delete bonds with embedded options (callable, puttable, or convertible bonds), floating coupons, and less than one year to maturity from 2001 to 2006. On the other hand, CDS spreads are obtained from Markit and are quoted in basis points per year for a notional amount of $10 million. While previous studies have mainly focused on CDS contracts with five year maturity, we use the complete credit curve of CDS spreads for 6 month, 1, 2, 3, 5, 7, 10, 15, 20, and 30 year maturities for most companies to match with different bonds. Panel A of Table 3 shows the number of bonds and firms in each year of the sample. We have on average 236 firms and 862 bonds in investment grade and 62 firms and 180 bonds in speculative grade per year.

[Insert Table 3 about Here]

The basis for a given firm i at time t for a given maturity τ is defined as

$$Basis_{i,t,\tau} = CDS_{i,t,\tau} - Z_{i,t,\tau}, \qquad (5)$$

where $CDS_{i,t,\tau}$ ($Z_{i,t,\tau}$) is the CDS (bond) spread of firm i at time t for maturity τ. While there are many different ways to compute the bond spread, in our empirical analysis, we mainly use Z-spread, which has been widely used in industry in defining the basis according to Choudhry (2006). Z-spread is defined as a parallel shift of the credit curve such that the present value of future cash flows equals to the current bond price. A simple definition of the Z-spread for a 3-year plain vanilla bond with annual coupon is the value of Z that solves the following equation:

$$P = \frac{c}{(1+s_1+Z)} + \frac{c}{(1+s_2+Z)^2} + \frac{c+1}{(1+s_3+Z)^3}, \qquad (6)$$

where P is the current price of the bond with face value of 1, c is the coupon rate, s_i is the zero-coupon yield to maturity based on the swap rate curve for a maturity of i year (where i = 1, 2, and 3). In order to compute basis, we first need to compute the Z-spread for each bond on each day in our dataset. Then we match the Z-spread with the CDS spread with the same maturity. In case we do not have the exact match for maturity, we linearly interpolate the CDS curve to obtain a CDS spread that has the same maturity as the bond. Then the basis for each bond is constructed by subtracting the Z-spread from the CDS spread. After matching, cleaning, and winsorizing by 1% at the bottom and the top, our final dataset has a total of 266,787 daily observations with investment grade and 63,125 with speculative grade from 2001 to 2006.

Panel B of Table 3 reports the summary statistics of basis and bond characteristics. The average investment grade bond in our sample has a basis of -23 bps, has a rating between A and A-, 8 years to maturity, 5 years old, with a coupon rate of 6%, an issue size of $0.4 billion, a duration of 5 years, and a convexity of 57. The lowest basis for investment grade bond is -370 bps and the highest is 98 bps. On the other hand, the average speculative grade bond in our sample has a basis of 73 bps, has a rating between BB- to B+, 8 years to maturity, 6 years old, with a coupon rate of 8%, an issue size of $0.3 billion, a duration of 5 years, and a convexity of 47. The standard deviation of the basis for speculative grade bonds is at 216 bps, much higher than that of investment grade bonds that is about 51 bps. The range of the basis for speculative grade bonds is also much wider than investment grade bonds, ranging from -712 bps to 1521 bps.

To examine the relation between the basis and bond characteristics, we sort the bonds into groups based on each of the characteristics and calculate the average basis in each group. Panel C of Table 3 present the results based on rating, maturity, age, coupon, issue size, duration, and convexity, respectively. The four rating groups for investment grade bonds are those with ratings of AAA, AA, A, and BBB respectively. The four rating groups for speculative grade bonds are those with ratings of BB, B, CCC, and CC. The five maturity groups contain bonds with 1-3, 3-5, 5-7, 7-10 and more than 10 years to maturity. The five age groups contain bonds with less than 3, 3-5, 5-7, 7-10 and more than 10 years of age. The five coupon groups consist of bonds with annual coupon of 0-5.5%, 5.5%-6.5%, 6.5%-7%, 7-8% and more than 8%. The five issue size groups contain bonds with issue size of 0-0.2, 0.2-0.3, 0.3-0.5, 0.5-0.6 and more than 0.6 billions of dollars. The five duration groups contain bonds with duration of 0-3, 3-5, 5-7, 7-10 and more than 10 years. The five convexity groups contain bonds with convexity of 0-10, 10-30, 30-50, 50-70 and more than 70.

For investment grade bonds, there is a strict monotonic relation between the basis and rating, maturity, age, coupon, and duration. The lower the rating, the more negative the basis is. For example, the basis decreases from -3 bps for AAA bonds to -29 bps for BBB bonds. The standard deviation of the basis also increases as rating declines. The basis is strictly more negative for the bond that is older, with longer maturity, higher coupon and duration. Interestingly, although De Wit (2006) shows that the most liquid CDS is concentrated on 5 year-to-maturity, the basis for the bond with 5 year-to-maturity is not the closest to zero, suggesting that basis level may be affected by other factors besides liquidity. The relations between the basis and issue size and convexity are largely monotonic except one group out of the five. The issue size group 1 (the smallest size) has the lowest basis at -35 bps and group 4 (instead of group 5) has the highest basis at -11 bps. The convexity group 1 has the least negative basis at -10 bps whereas the convexity group 5 has the most negative basis at -47 bps.

However, for speculative grade bonds, the relations between the basis level and bond characteristics are mostly non-monotonic. Rating is the only characteristic that is related to the basis level monotonically. Lower rating is associated with higher basis. For other characteristics, the lowest basis level mostly falls into characteristic group 2 or 3 (e.g., maturity, age, coupon, issue size and convexity). The other exception is for the Duration group 5 that has the least basis level at 32 bps.

In summary, we find that the basis is mostly monotonically related to bond characteristics for investment grade bonds: the bond with more negative basis tends to be older and smaller, and have lower rating, longer maturity, higher coupon, higher duration, and higher convexity. The patterns are not clear for speculative grade bonds. These results suggest that the basis level can serve as a reasonable empirical proxy for arbitrage interests for the investment grade bonds as the bonds that are associated with higher level of non-zero basis are those bonds that are more likely to be mispriced. This result is also consistent with the recent finding that investment grade bonds are more widely borrowed by short-term investors for plausible arbitrage from bond depository institutions (e.g., Asquith, Au, Covert, and Pathak, 2011).

3.3. The CDS-Bond Basis and the Future Returns of Bond Portfolios

If the basis is very significantly different from zero, which is not caused by technical differences,[11] investors may consider the under or overpricing of the credit spreads with respect to the related CDS spreads. Hence, they may explore such temporary mis-pricing opportunity if they believe that the prices shall be more aligned in the future. If such arbitrage trade does happen, the demand for bond will drive the bond price up if the current basis is negative and vice versa. Hence, our prediction is that basis shall be negatively related to future bond returns if arbitrage helps to improve price convergence. We now test how the past basis is related to the future returns of bond portfolios in the data.

If basis is served as a measure of mis-pricing, we expect that bond market will converge in price to be better aligned with the CDS market. Hence, if the portfolio has a negative basis now, we expect the credit spread of the bond portfolio to decline, which implies a positive future return. On the other hand, if the portfolio has a positive basis, we expect the credit spread to increase, which implies a negative future return. Given the differences between investment grade and speculative grade bonds, we will examine them separately.

We form five basis quintile bond portfolios based on their past 60-day basis levels on day t, we then compute the value-weighted returns of each portfolio from day t to day t+k (where k = 20, 40, or 60 respectively). This way we can see how the past basis is related to the returns in 20-day, 40-day, and 60-day holding horizons respectively. We believe that the 60-day holding horizon is a reasonable length to include most of arbitrage trades because the arbitrageurs need to

[11] For example, as pointed out by Blanco, Brennan and Marsh (2005), one reason for the existence of non-zero basis is the contractual differences between cash bond and CDS contract as one might not be able to find a CDS with exactly the same maturity as the cash bond. A second deviation can arise from a default event when the accrued interest is paid upon default in CDS but it is not paid for defaulted bond. Thirdly, the interest payment of CDS is on a quarterly frequency whereas it is semi-annual for most cash bonds. Fourthly, the cheapest-to-deliver option embedded in CDS contract can be extremely valuable in some default events. The option gives the buyer the right to deliver the cheapest bond for the single name entity when a credit event occurs. For example, when Fannie Mae and Freddie Mac were put into conservatorship by their federal regulator, the companies' bonds increased in value because of government guarantees and the benefits of having embedded cheapest-to-deliver options (D.E. Shaw, 2009). Lastly, CDS investors may not enjoy the same rights as those in cash corporate bonds either. Bolton and Oehmke (2011) highlight the empty creditor problem where debtholders and CDS holders have different preferences for bankruptcy resolution.

maintain costly daily borrowing or lending of the related interest rate securities and credit securities (Mitchell and Pulvino, 2012).

Panel A of Table 4 reports the raw and excess holding period returns of the five value-weighted basis portfolios from 2001 to 2006. The excess return is the difference between the raw return and the risk free rate during the same holding period. On average, each basis portfolio contains about 35 bonds. For four out of five investment grade basis portfolios with negative basis (ranging from -62 bps to -5 bps), the future returns are all positive at three different holding horizons, indicating price convergence for these bonds. In the fifth quintile portfolio with positive basis at 12 bps, the future return is still positive, indicating price divergence in this portfolio. Indeed, if investors buy the bond portfolio with the lowest basis (1^{st} quintile) and sell the portfolio with the highest basis (5^{th} quintile) at the same time, they can realize an average annual return of 3.7%. Hence, price convergence is more dominant for an average investment grade bond portfolio.

[Insert Table 4 about Here]

For speculative grade bond portfolios, only one of the five speculative grade basis portfolios has a negative basis at -70 bps on average and has a positive future return, indicating price convergence. However, the rest four portfolios with positive basis (ranging from 1 bps to 528 bps) are related to positive future returns, indicating price divergence in the bonds. Moreover, the difference in the returns on the two extreme quintile portfolios with speculative grade is statistically and economically significant at -14.9% per year. Hence, price divergence is more dominant for an average speculative bond portfolio.

Given the understanding that the negative basis arbitrage is more popular in reality as it may be costly to short the bonds to engage in positive basis arbitrage, the previous results indicate that the popular negative basis arbitrage is plausibly contribute to a better price convergence in most of the investment grade bonds and a few of the speculative grade bonds.

Similar to many fixed-income arbitrage strategies, the basis arbitrage is not riskless. One important risk in the arbitrage is funding liquidity risk for arbitrageurs who purchase cash bonds using borrowed money. Margin requirements, perceived changes to margin requirements, terms of financing, conditions under which financing can be renewed or terminated, actual financing cost (such as repo or reverse repo rate) are all important considerations for evaluating funding risk (e.g., Gârleanu and Pedersen, 2011; Liu and Mello, 2011). Arbitrageurs also face counterparty risk in the basis trade, the majority of which arises from the default risk of protections sellers. When highly levered arbitrageurs face a sudden shortage of capital or funding liquidity, their deleveraging activities can affect the basis level in a significant way, which could lead to deleveraging risk. The liquidity risks in both CDS and bond markets might affect the unwinding of the basis arbitrage positions.[12] Given that Brunnermeier and Pedersen (2009) and Aragon and Strahan (2011) both suggest that market liquidity can interact with funding liquidity, such joint effect can complicate the risks involved in the basis arbitrage. Bai and Collin-Dufresne (2011) also point out that the collateral risk of the underlying bonds is another important consideration for the basis trade. Lastly, it is possible that the underlying firms are selling the cash bond and their affiliated financial institutions are also the sellers of the CDS contract. Hence the default risk of the cash bond and the counterparty risk embedded in the CDS can be highly correlated.

Hence, if basis arbitrage is the plausible driving force of our previous results, we would expect that the returns from the previous step cannot be fully explained by the existing systematic risk factors documented in the corporate bond literature (such as Fama and French, 1997; Gebhardt, Hvidkjaer, and Swaminathan, 2005; Lin, Wang and Wu, 2011) that do not include the above mentioned arbitrage risks such as funding liquidity, counterparty risk, and collateral risk. We verify through further asset pricing tests on the returns obtained from the previous step. Specifically, we regress the returns of the five basis quintile portfolios and the return difference of the two extreme portfolios on the existing systematic risk factors, such as MKT, SMB, HML, DEF, TERM, LIQ, and AMH risk factors defined in Table 2.

$$\begin{aligned} HPR_{q,t-k,t} - r_{f,t-k,t} &= \alpha_{q,k} + \beta_{m,q,k} MKT\_k_t + \beta_{size,q,k} SMB\_k_t + \beta_{bm,q,k} HML\_k_t \\ &+ \beta_{def,q,k} DEF\_k_t + \beta_{term,q,k} TERM\_k_t + \beta_{l,q,k} LIQ\_k_t + \beta_{amh,q,k} AMH\_k_t + \varepsilon_{q,k,t}, \end{aligned} \quad (7)$$

where $HPR_{q,t-k,t}$ is the k-day holding period return of the basis quintile portfolio q formed on past 60-day basis ($q=1,2,\ldots,5$) from day t-k to t, MKT_k_t, SMB_k_t, and HML_k_t are the three standard factors used in Fama and French (1993) from day t-k to day t, DEF_k_t and $TERM\_k_t$ are the two standard bond factors of Fama and French (1993) from day t-k to day t, LIQ_k_t measures the turnover in the bond market as the ratio of total trading volume divided by the total number of bonds outstanding from day t-k to day t, and AMH_k_t is the Amihud (2002) liquidity risk factor

[12] Many studies, such as Collin-Dufresne, Goldstein and Martin (2001), Elton, Gruber, Agrawal and Mann (2001), and Chen, Lesmond and Wei (2007) have shown that liquidity is an important factor in the credit spreads of corporate bonds. Tang and Yan (2007) also find evidence that liquidity premium exists in CDS spreads.

measured from day *t-k* to day *t*. $\beta_{m,q,k}$ is the market beta, $\beta_{size,q,k}$ is the SMB beta, $\beta_{bm,q,k}$ is the HML beta, $\beta_{def,q,k}$ is the DEF beta, $\beta_{term,q,k}$ is the TERM beta, $\beta_{l,q,k}$ is the LIQ beta, and $\beta_{amh,q,k}$ is the Amihud liquidity beta.[13] If we find significantly positive intercept after estimating the equation (7), it indicates that the return is abnormal and is plausibly a reward for investors who bear the new arbitrage risks mentioned above.

The regression results are reported in panel B to panel D of Table 4 for three different time horizons, 20- (panel B), 40- (panel C) or 60-day (panel D). Panel B shows that the abnormal return of each of the five quintile portfolio ranges from 3 bps to 5 bps per year for investment grade bonds. These results indicate that some part of the returns is abnormal for investment grade bonds, in support of the role of CDS-bond basis arbitrage. Interestingly, we do not find any abnormal return in speculative grade bonds in the 20-day horizon shown in panel B. These results again confirm our earlier conjecture that the arbitrage is more popular among investment grade bond investors than speculative grade bond investors.

Panel C and D of Table 4 largely display similar results for 40-day and 60-day holding horizons. The abnormal returns for investment grade quintile portfolios are significantly positive, ranging from 8 bps to 25 bps. On the other hand, the results for speculative grade bonds are either insignificant or negative, contrary to the existence of any new arbitrage risk.

In sum, we find that past basis can predict price convergence in bond portfolios if the basis is negative. Since most of the investment grade bond portfolios are associated with negative basis, they benefit more from the negative basis arbitrage than speculative grade bond portfolios. We also show that the returns from the arbitrage cannot be fully explained by the conventional systematic risk factors documented in the literature, suggesting the abnormal return may be a reward for new sources of risk involved in the arbitrage. In the next section, we test whether such results are found at the individual bond level.

3.4. The CDS-Bond Basis and the Future Returns of Individual Bonds

If the basis arbitrage is at force, we expect that past basis is also negatively related to future bond returns at the individual bond level. If investment grade bonds are more widely used in the

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[13] We have also constructed Pastor and Stambaugh (2003) liquidity risk measure as shown in Lin, Wang, and Wu (2011) and conducted robustness checks. The results are largely similar to the ones we report here.

basis arbitrage than speculative grade bonds, we expect that the prediction is stronger in the former group than the latter one.

We consider the following Fama-MacBeth (1973) regression of excess return of each bond i on its past basis level, past bond characteristics, and past liquidity level:

$$\begin{aligned} HPR_{i,t,t+k} - r_{f,t,t+k} = \alpha + \beta_1 Basis_{i,t} + \beta_2 Rating_{i,t} + \beta_3 Maturity_{i,t} + \beta_4 Age_{i,t} \\ + \beta_5 Coupon_{i,t} + \beta_6 Issue\ Size_{i,t} + \beta_7 Indliq\_k_{i,t} + \varepsilon_{i,t}, \end{aligned} \quad (8)$$

where $HPR_{i,t,t+k}$ is the k-day (where k = 20, 40, 60) holding period return for individual bond i from day t to $t+k$, $r_{f,t,t+k}$ is the cumulative risk free rate from day t to $t+k$, $Basis_{i,t}$, $Rating_{i,t}$, $Maturity_{i,t}$, $Age_{i,t}$, $Coupon_{i,t}$, $Issue\ Size_{i,t}$, and $Indliq\_k_{i,t}$ is the basis level, credit rating, maturity, age, coupon, issue size, and liquidity of bond i on day t, respectively. The liquidity factor $Indliq\_k_{i,t}$ is the sum of the turnover of bond i that is defined as the total trading volume divided by the total amount outstanding for the bond between day t-k to day t. We run cross-sectional regression on each day and report the time series averages of the estimates of the coefficients. Robust Newey-West (1987) t-statistics of coefficients with 3 lags are reported in brackets. The results are reported in Model 1 of Panel A and Panel B in Table 5 for investment grade bonds and speculative grade bonds respectively.

[Insert Table 5 about Here]

Model 1 in Table 5 panel A shows that the coefficients of the basis are statistically significantly negative for investment grade bonds at a 1% significance level for all three holding horizons. The three coefficients of the basis factor range from -0.02 to -0.03. In economic terms, one standard deviation reduction in the basis can generate on average an annual return of 8 bps. Future positive bond return is related to past negative basis, implying that investment grade bonds experience significant convergence in the credit spread if the CDS spread is unchanged. On the other hand, the coefficients of other bond characteristics, such as credit rating, maturity, age, duration, and liquidity factors, are not consistently significant across different models and holding horizons.

The prediction of basis for bond future return can also be a result of a more efficient price discovery in the CDS market than bond market (e.g., Zhu, 2004; Alexopoulou, Andersson and Georgesu, 2009). If this is the case, we include past CDS spread and see whether the predictability of basis disappears at the presence of the CDS spread information. Model 2 in

Table 5 panel A shows the results. Among 3 different holding horizons, the past basis continues to be negatively related to the future bond return, but statistically significant at the 5% level for the 20-day and 60-day horizons. The coefficients become more negative in Model 2 than in Model 1 as one standard deviation drop in basis predicts an average positive return of 17 bps.

In addition to the explanatory power of past CDS spread, we also want to check whether the convergence of the bond price is a spillover effect of the convergence of the CDS spread itself. Hence, Model 3 further includes the change of past CDS spread as a control variable in addition to the past CDS spread. The results show that the basis continues to predict price convergence in the presence of past CDS change for 40-day and 60-day horizons at a 1% significance level.

Lastly, another alternative explanation is that the explanatory power of the basis is driven by the return reversal observed in bonds.[14] Model 4 in Table 5 panel A replaces the past CDS change by the past bond return as a control variable.[15] We still observe that past basis is significantly and negatively related to future bond returns at the 40-day horizon, but the statistical significances of the coefficients of the other two horizons drop below the 10% significance level. Hence, we find that past bond returns may explain some portion of the basis predictability, but not completely. In sum, we find that the basis is a robust predictor for the future returns of individual investment grade bonds after we consider three alternative explanations, suggesting that the CDS-bond basis arbitrage is a more plausible reason.

Similar to the results found at the portfolio level, we do not find statistically significant prediction power of the basis for the future speculative grade bond returns. Model 1 in Panel B of Table 5 shows that only the coefficient for 60-day horizon is statistically significant at the 10% level with a value of -0.0407. It represents that one standard deviation increase of the basis can predict a return of -32 bps on the annual basis. This result indicates that if the basis level is significantly negative for speculative grade bonds for a long period of time, then it may attract investors' interests in arbitraging in speculative grade bonds as well. The coefficients of the past basis in Model 2 to Model 4 are mostly insignificant except for one. But the sign of the coefficients are largely negative. These results show that marginal investors of speculative grade bonds are very unlikely to be the basis arbitrageurs.

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[14] For example, Pospisil and Zhang (2010) have analyzed the predictability of the bond returns and found that return reversals are observed strongly among investment grade bonds.

[15] We do not include the past CDS spread, the change of CDS and bond returns altogether in the same regression to reduce the multi-collinearity concern because technically, basis is the difference between CDS spread and credit spread of the bond. When we include the past bond returns, we remove the past change of CDS spread in the model.

Overall, our results show that the basis has significant predictive power for future excess returns of individual investment grade bonds after controlling for well-known bond characteristics and liquidity measures. We verify that such predictability is not driven by the leading information of the CDS spread, or price reversals in the CDS or the bond markets. The predictable power of basis is much less significant statistically for speculative grade bonds. These results are also largely consistent with the anecdotal evidence that investment grade bonds are much more widely employed in the basis arbitrage (e.g., Deutsche Bank, 2009), and the recent finding in Asquith, Au, Covert, and Pathak (2011) that show 68.9% of the borrowed bonds are investment grade and are more likely to be fixed rate and less likely to default by using a proprietary database of bond loan transactions from a major depository institution from 2004 to 2007. Bonds are likely to be borrowed or lent in the typical basis arbitrage. Hence, our empirical results support **Hypothesis 2a**.

3.5. The Impact of CDS-Bond Basis Arbitrage in the CDS Market

In this section, we test whether basis can predict future CDS spread change as well. If investors indeed engage in the basis arbitrage, they need to trade both in the bond and CDS markets at the same time. However, given that CDS market is much bigger and more liquid than the corporate bond market, the marginal investors in CDS market may not be basis arbitrageurs even if they are in the related bond market. According to the Bank for International Settlements (BIS, 2010), the notional value of outstanding credit derivatives by the end of 2007 was 58 trillion dollars, more than six times that of the corporate bond market as shown in Figure 1. Moreover, prior studies have also shown that CDS market leads bond market in price discovery in normal market condition (e.g., Zhu, 2004; Alexopoulou, Andersson and Georgesu, 2009; Coudert and Gex, 2010). In terms of liquidity, CDS market is also more liquid than the bond market as we use only the most liquid 5-year CDS spreads here in the prediction tests among all available CDS contracts (De Wit, 2006). Hence, we need to test the **Hypothesis 2b** explicitly.

Following Tang and Yan (2011), we employ the following regression model to verify the prediction power of the past basis for the future change of CDS spread,

$$\begin{aligned}\Delta(CDS)_{i,t,t+k} &= c + \delta_1 Basis_{i,t} + \delta_2 \text{Stock Return}_{i,t} + \delta_3 \Delta(\text{Stock Volatility})_{i,t} \\ &+ \delta_4 \Delta(\text{Leverage})_{i,t} + \delta_5 \Delta(\text{Size})_{i,t} + \delta_6 \Delta(\text{Profitability})_{i,t} + \delta_7 \Delta(\text{Cash ratio})_{i,t} + \varsigma_{i,t},\end{aligned} \tag{9}$$

where stock return is the percentage change in stock price for the past three months, i.e. from the four months to one months prior to the month when day t belongs to, Δ(Stock Volatility) is the change in stock volatility, defined as the standard deviation of daily stock prices for the past three months, Δ(leverage) is the change in market leverage, defined as the book value of debt divided by the market value of asset for the past three months, Δ(size) is the change in the logarithm of the market value of asset, defined as the book value of debt plus the market value of equity for the past three months, Δ(Profitability) is the change in profitability, defined as the income before the tax and interests divided by the market value of asset for the past three months, and Δ(Cash Ratio) is the change in the ratio of cash divided by the market value of asset for the past three months. We run Fama-Macbeth (1973) regressions as before. The standard errors are Newey-West errors with 3 lags.

Table 6 reports the results. Panel A and B report the summary statistics and the regression result for investment grade CDS spread change. Panel C and D report the summary statistics and the regression result for speculative grade CDS spread change. On average, there are 107,243 observations for investment grade CDS spreads. The number is smaller than that of the investment grade bonds because some firms have multiple bonds but only one CDS spread. We compute the value-weighted basis for each CDS if there are multiple bonds related to the same CDS.

Model 1 in panel B of Table 6 shows that the past basis is negatively related to the future change of CDS spread for all three horizons with an average coefficient of -0.03. In economic magnitude, one standard deviation increase of basis leads to a change of the CDS spread by -63 bps in 20 days. The reductions are about -86 bps to -207 bps in 40 and 60 days respectively. These results indicate that the past basis also predicts the price convergence in CDS spread.

[Insert Table 6 about Here]

Model 2 includes the past CDS spread as a control variable. Model 3 further includes the change of CDS spread in past 60 days, and Model 4 includes past bond return instead. Same rationality as before applies here to include these control variables to eliminate alternative explanations. The coefficient of the past CDS spread is positive in Model 2 whereas the coefficient of the basis is still negative as before although not statistically significant at the 10% significance level. This result still reveals that the basis predicts the change of CDS spread opposite to that of the past CDS spread. The inclusion of the change of past CDS spread in

Model 3 has improved the prediction power of basis by two times than Model 1 and the coefficients of basis are statistically significantly negative at the 10% significance level. One standard deviation increase in the basis predicts a change of CDS spread by -104 bps, 340 bps, and -228 bps in 20-day, 40-day, and 60-day horizons. Model 4 shows that basis is negatively related to the CDS change in 40-day horizon even after the inclusion of the past bond returns at the 10% significance level. These results confirm that the basis arbitrage is plausibly the driving force for the price convergence in investment grade CDS spread rather than other reasons.

We have a much smaller sample for the speculative grade CDS sample, a total of 24,514 observations shown in panel C of Table 6. Panel D shows that the basis has no prediction power for speculative grade CDS spread across all three time horizons. This result, again, is consistent with our earlier findings that the basis does not improve the price convergence in the speculative grade bonds as they are much less employed in the conventional basis arbitrage. All these results support the **Hypothesis 2b**.

In summary, we find that CDS leads to more efficient price convergence in investment grade bonds both at the portfolio and individual bond level through CDS-bond basis arbitrage. It also leads to better price convergence in investment grade CDS contracts. However, we find that the price convergence by the arbitrage is weak for speculative grade bonds and doesn't work for the speculative grade CDS contracts. This is also consistent with anecdotal evidence that marginal investors in speculative grade bonds are not the basis arbitrageurs. Taking together, we find strong evidence that CDS improves price convergence between two credit markets through the basis arbitrage in the normal period. In the next section, we will examine the role of CDS in the recent financial crisis.

4. The Impact of CDS on Credit Markets during the Crisis Period

The recent literature has shown that both the corporate bond and CDS market had experienced significant price disruptions during the recent financial crisis. For example, both Duffie (2010) and Mitchell and Pulvino (2012) document a significant widening of negative basis in the crisis period for both investment grade and speculative grade credit securities. Such widening is further worsened by the unwinding of the basis trade because arbitrageurs who faced a sudden capital shortage had to de-lever their previous high leveraging positions. News media revealed that investment banks and hedge funds such as Deutsche Bank, Merrill Lynch, and Citadel, among others, have lost billions of dollars due to the basis trade in the crisis period. As shown in Figure 2, the basis of investment grade index in late 2008 is about -250 bps whereas that of the speculative grade index is about -400 bps in our sample. On the other hand, the potential cash-rich investors (or "smart-money") are reluctant to step in to bring the price back to its fundamental value due to fear or uncertainty (e.g., Duffie, 2010). The joint effects of forced-deleveraging by the financial-constrained arbitrageurs and a lack of investment capital significantly delay the price discovery and therefore the price deviation stays significantly longer than usual. Taking the view of Gabaix, Krishnamurthy and Vigneron (2007), according to the limits of arbitrage theory, the marginal investor in a particular asset market is an investor who specializes in that market. Hence, forced liquidations by arbitrageurs can change the marginal investors in the credit markets back to the conventional buy-and-hold bond investors and those investors who purchase CDS for insuring the credit risk. Hence, our third empirical hypothesis proposes the role of CDS during the crisis,

Hypothesis 3: CDS does not help to reduce price divergence between corporate bond and CDS markets due to the lack of the basis arbitrage during the crisis.

Similar to before, we split the **Hypothesis 3** into two sub-hypotheses for the corporate bond and CDS markets separately.

Hypothesis 3a: CDS does not help to reduce price divergence in corporate bond due to the lack of the basis arbitrage during the crisis.

Hypothesis 3b: CDS does not help to reduce price divergence in CDS market due to the lack of the basis arbitrage during the crisis.

As we have shown that CDS-bond basis arbitrage is very likely to help improve the price convergence in investment grade bonds and CDS spreads in the normal period in the previous section, we want to verify whether there is plausibly a lack of the basis arbitrage since there exists significant price divergence between the two credit markets during the crisis as shown in Figure 2 as well as in the literature.

First, we show how the past basis is related to the future return of bond portfolios. Second, we test the relationship at the individual bond level. Lastly, we examine how the past basis is related to future movement in CDS spreads.

4.1. The CDS-Bond Basis and the Future Returns of Bond Portfolios

We form five basis portfolios for investment grade bonds and speculative grade bonds respectively and report the holding period returns from 2007 to 2008 based on the average level of basis in past 60 days. Table 7 panel A reports both the raw returns and the excess returns of the portfolios. We observe that the basis level for investment grade bonds is much more negative in the crisis than that in the normal period. For example, the 1st quintile portfolio has a basis level of -96 bps, about 34 bps lower than before. The 5th quintile portfolio has a basis level of 2 bps, about 10 bps lower than before. Similar results are also found in speculative grade bonds. The 1st quintile portfolio has a basis level of -163 bps, whereas it is used to be at -70 bps in the normal period. The 5th quintile portfolio has a basis level of 276 bps, about 252 bps lower than that in the normal period.

Panel A shows that the negative past basis is related to negative future excess returns in the investment grade bond portfolios in 11 of the 12 cases whereas positive past basis is also related to negative future excess returns. For instance, the 1st quintile (with the lowest basis level) investment grade basis portfolio has a future excess return of -5.9% and the 5th one (with the highest basis level) has a future excess return of -1.6%. If investors buy the portfolio with the lowest basis and short the portfolio with the highest basis, they earn a return of -4.4% per year. These results indicate that there is significant price divergence in an average investment grade bond portfolio given that its past basis is much more negative than in the normal period. It is very unlikely that investors can engage in profitable negative basis arbitrage given that fact that a significant negative return can arise from the bond side even if CDS spread does not move. A further concern is that investment grade CDS spread on average continues to widen even more in the crisis on average as we will show later.

Similar results are found in speculative grade bond portfolios with negative basis. Negative past basis is related to negative future returns, indicating that speculative grade bond portfolios continue to experience price divergence if past basis is significantly negative. If speculative grade bond portfolios have positive basis in the past, they generate negative future returns. The 1st quintile speculative grade basis portfolio has a future return of -13.4% and the 5th one has a future return of -25.5% on average. This indicates that if basis arbitrageurs can engage in positive basis arbitrage by selling the speculative grade bonds, they can earn positive returns from the price convergence of the speculative grade bonds. However, it is very unlikely to happen during the crisis as there is more supply than demand for speculative grade bonds due to a flight to quality observed in the crisis (Mitchell and Pulvino, 2012). Moreover, even there exists attractive arbitrage opportunities for speculative grade bonds with positive basis, investors may be reluctant to engage in the basis trade if the change of CDS spreads is volatile and unpredictable in the crisis as we will show later.

[Insert Table 7 about here]

Next, we also test whether the negative returns found in most of the bond portfolios can be explained by conventional systematic risk factors. Panel B shows the regression result of equation (7) for value-weighted 20-day holding returns. Unlike before, only one of the five intercepts for investment grade portfolios is significantly different from zero at 10% significance level. This indicates that there is no additional risk beyond traditional risk factors for the return of an average investment grade bond portfolio. This again, suggests that it is likely that there is a lack of basis arbitrage for investment grade bonds during the crisis. If arbitrage is still at force, we would expect the abnormal returns are significant since all the new arbitrage risks heightened significantly during the crisis.

On the contrary, the intercepts for speculative grade portfolios are significantly negative for four out of five quintile portfolios. These results indicate that there are significantly downward mis-pricings in the speculative grade bonds during the crisis, consistent with the anecdotal evidence that there is significant high selling pressure for high risky bonds from bond investors. Moreover, Mitchell and Pulvino (2012) also show that rehypothecation lenders—necessary financial intermediaries that provide funding for arbitrage—are more reluctant to accept relative illiquid high-yield bonds as collateral during the crisis.

Panel C and D report largely similar results for 40-day and 60-day holding horizons. The intercepts for investment grade bond portfolios are more negative than the 20-day results for those portfolios with negative basis and the intercepts are slightly more significantly different from zero compared to the results in the 20-day horizon. These results indicate that the price divergence in investment grade bonds cannot be fully explained by the conventional risk factors, but the explanatory power of the conventional systematic risk factors is still better than that in the normal period. As for speculative grade bonds, the results are largely similar across all time horizons. The intercepts for almost all speculative grade bond portfolios are significantly negative at a 1% significance level, indicating the selling pressure is very strong in the crisis.

In sum, our results show that there is a lack of negative basis arbitrage because both investment grade and speculative grade bonds with negative basis experience price divergence across three different time horizons. The bond portfolios with positive basis are unlikely to be engaged in the basis arbitrage because the profits can only be realized if there are enough buying interests for speculative grade bonds during the crisis and there are no widening of CDS spreads. Further evidence reveals that almost all the speculative grade bonds have experienced abnormal negative returns, indicating there are significant downward mis-pricings for speculative grade bonds. Moreover, we will show later that CDS spread market becomes much more unpredictable in the crisis. Hence, it is very unlikely that positive basis arbitrage becomes popular during the crisis. Given the reduction of negative basis arbitrage and implausible positive arbitrage, we find evidence in support for the **Hypothesis 3a** at the bond portfolio level.

4.2. The CDS-Bond Basis and the Future Returns of Individual Bonds

Here, we test whether CDS helps to reduce price divergence in investment grade bonds through the basis arbitrage. Table 8 reports the summary statistics and the regression results of the equation (8).

[Insert Table 8 about here]

Panel A in Table 8 shows that the average basis level for individual investment grade bonds during the crisis is at -61 bps, about 38 bps lower than that of the normal period. Other bond characteristics, such as ratings, maturity, age, coupon, issue size, duration, and convexity are largely similar to those in the normal period shown in panel B in Table 3.

Model 1 in panel B of Table 8 shows that past basis is significantly negatively related to the future investment grade bond returns. In terms of economic magnitude, one standard deviation increase in basis can generate an annual return of about -10 bps in the future. The prediction is similar to what we find in the normal period and predicts price convergence in the bonds. However, after we include past CDS spread, the change of CDS spread, and past bond returns as control variables in Model 2 to Model 4, we find that these control variables move returns on the opposite directions to what the basis does to future bond returns. For example, Model 2 shows that the coefficients of the past CDS spread are all statistically significantly negative in all three time horizons. This implies that investment grade bonds are strongly led by past CDS spreads during the crisis, and the bond price can still diverge away from the CDS spread if the past basis is negative. In economic magnitude, one standard deviation increase in past CDS spread predicts a return -74 bps on average. Hence, if the past basis is negative, CDS spread is lower than the credit spread. Such prediction would imply that credit spread will increase more, causing a larger mis-pricing between CDS and bond spreads. More interestingly, the past CDS spread dominates in economic significance than the past basis in predicting future bond returns. Similar results are also observed in Model 3 as the past change of CDS spread also leads to further divergence of the bonds. One standard deviation increase in past CDS change predicts a return of -19 bps on average. The combined impact of past basis, past CDS spread, and past CDS spread change leads to price divergence in investment grade bonds if the past basis is negative. Model 4 also shows that the predictability of basis is further reduced by 25%-35% once the past bond returns are included. Hence, all these results suggest that although the basis arbitrage can lead to price convergence in theory, but in reality, the investment grade bonds experienced further divergence due to the strong spillover effect of the CDS market and the strong reversals in the bond returns in the crisis.

These results show that CDS has two roles to play in the credit markets, including providing hedging benefits for credit risk and providing trading opportunities to reduce market mis-pricings. During the crisis, the first role seems to be more dominating than the second role. This result is plausibly due to the lack of basis arbitrage during the crisis due to the market frictions such as the limits of arbitrage. The marginal investors of investment grade bonds are likely becoming conventional buy-and-hold investors again in the crisis rather than the basis arbitrageurs in the normal period.

Panel C and D in Table 8 present the results for speculative grade bonds. We also find that the basis level is more negative for speculative grade bonds in the crisis. Panel D shows that although the past basis has significant prediction power for future bond returns, the predictability disappears once the past CDS spread and past bond returns are controlled for in Model 4.

In sum, our results show that although the past basis predicts negative future bond returns, such predictability reduces for investment grade bonds and disappears for speculative grade bonds once we control for past CDS spread and past bond returns. More importantly, the net effect on the investment grade bond returns if the past basis is negative is that the bond prices would diverge further from the CDS spread. This result shows that CDS market provides more of the hedging benefits rather than providing better price discovery through arbitrage during the crisis. This finding is also consistent with Coudert and Gex (2010) that shows that CDS market leads bond market much more in the crisis than in the normal period. Moreover, the economic insignificance of the basis arbitrage in affecting bond returns are likely due to the fact that the usual arbitrageurs are greatly affected by market frictions such as the limits of arbitrage. Hence, we find supporting evidence for **Hypothesis 3a** at both the portfolio and individual bond levels.

4.3. The CDS-Bond Basis and the Future Change of CDS Spreads

Alexopoulou, Andersson and Georgesu (2009) find that during the recent financial crisis, the CDS market reacts more towards systematic risk whereas the corporate bond market reacts more to liquidity and idiosyncratic risk. Hence, we examine whether the predictability of the basis for CDS spread changes during the crisis is significantly different from that in normal period. We re-estimate equation (9) here for the crisis period and Table 9 reports the results.

[Insert Table 9 about here]

Panel A in Table 9 shows the summary statistics of investment grade CDS and other firm characteristics. The CDS spreads tend to increase more significantly during the crisis, unlike in the normal period when they usually decline. Basis level is more negative during the crisis period at -61 bps. Stock return is also more negative, with higher volatility. Leverage increases more and size increases less in the crisis period compared to the normal period. Profitability of the firm reduces more and the cash ratio increases more during the crisis period.

Panel B in Table 9 shows that the basis no longer predicts the change of investment grade CDS spreads in the future as in normal period. After we include past CDS, we find that the sign of the coefficient of the basis even turns into positive, rather than negative as before. This result indicates that the past basis level predicts price divergence in CDS spread in the crisis. The signs of the coefficients of past CDS spread and the change of CDS spreads are sometimes significantly negative, implying some mean-reversion of the CDS spread during the crisis.

Panel C shows the summary statistics of the speculative grade CDS spreads and firm characteristics. Similar trends are found in these firms as those with investment grade. During the crisis, CDS spreads increase more, basis becomes more negative, stock returns is more negative, stock volatility is higher, leverage is higher, size reduces, and cash ratio is higher than the normal period. Panel D shows that past basis cannot predict the future change of CDS spreads at all model specifications. Even after the inclusion of past CDS spread, past change of CDS spread, and past bond returns, basis has no predictability power for the change of speculative grade CDS spreads. Hence, we find supporting evidence for **Hypothesis 3b**.

In summary, the basis arbitrage does not help to reduce the price divergence in either the bond market or the CDS market during the financial crisis. Furthermore, there is some new evidence that the past basis leads to price divergence for investment grade CDS spreads. Hence, the beneficial role of CDS through arbitrage activities does not play out in the credit markets during the recent financial crisis. Moreover, we find that CDS market leads the bond market more strongly during the crisis than the normal period. The net impact of CDS predicts price divergence for the two credit markets as the hedging role becomes more significant whereas arbitraging activities decline. All these findings suggest that the net pricing impact of CDS is highly dependent on the prevailing trading activities in different market conditions. Our study is among the first to provide novel empirical evidence from the CDS market.

5. Conclusion

In this paper, we provide a comprehensive analysis on the economic impact of CDS on both the corporate bond and CDS markets since its inception. The initial introduction of CDS helps to improve the trading activities of speculative grade bonds with high credit risk. This benefit is consistent with the insurance role provided by CDS for credit risk. Moreover, we show that CDS improves the price convergence between the bond market and CDS market, especially for those credit securities with investment grade. This is due to the possibility that CDS can be used to arbitrage away any mis-pricing of the credit risk through a popular trading strategy—CDS-bond basis arbitrage. The arbitrage works quite well in the normal market conditions. However, in the recent crisis, the arbitrage benefits of CDS are adversely affected by the limits of arbitrage. The lack of arbitrage limits the CDS's role of reducing price divergence between the two markets. Interestingly, we still find that CDS market leads the bond market in pricing credit risk.

Our study is among the first that analyze the impact of CDS to the credit markets from a time series dimension. Our study provides robust empirical evidence for the theoretical benefits and costs of the CDS proposed in the literature. While some regulators propose for the suspension of the CDS trading completely, our study suggests that the right focus might be to improve the market efficiency or reduce market imperfection in relation to trading activities. Many of the recent regulations such as Basel III, Frank-Douglas Act, and the proposal to set up the centralized clearing house for CDS trading are moving toward the right direction to reduce market frictions such as arbitrage risks.

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Table 1. Liquidity in Corporate Bond Market from 1994 to 2008

The table reports the monthly bond-level liquidity in corporate bond market from January 1994 to December 2008. The bond data is from NAIC, TRACE and FISD. Panel A reports the summary statistics for bond-level liquidity measures and bond characteristics. Zero Trade is the number of zero-trade for each bond in each month. 1/Volume is the inverse of the logarithmic of trading volume for each bond within each month. 1/Trades is the inverse of the number of transactions for each bond within each month. 1/Turnover is the inverse of the turnover. Trade Size is the monthly average size of each transaction. Amihud is the Amihud (2002) liquidity risk measure for each bond to capture the price impact relative to the volume. Ratings are the discrete measure of ratings from S&P (for example, AAA is coded as 1, AA+ is coded as 2, and et al.). We use the S&P ratings whenever available, followed by Moody's (Aaa to Baa3) and Fitch's ratings. Maturity is denominated in years. Coupon is in percentage terms. Issue size is the natural logarithm of issuance amount in billions. Duration and Convexity are computed duration and convexity for each bond in each month. Panel B reports the regression results of the six liquidity measures on the various control variables. $Dummy_{99}$ is the dummy variable that equals to 1 since January 1999 when CDS is first introduced. $Dummy_{07}$ is the dummy variable that equals to 1 since September 2007 when Lehman collapsed. $Dummy_{03}$ is the dummy variable that equals to 1 since May 2003 when TRACE started to include most of the investment grade bonds. IG is the dummy variable that equals to 1 if the bond is an investment grade bond. HY is the dummy variable that equals to 1 if the bond is a speculative grade bond. All the six bond-level liquidity measures are normalized for easy comparisons. The regression in Panel B is clustered by each bond and robust standard errors are reported. Panel C reports the regression results of the six liquidity measures on the various control variables when CDS introduction is measured on the bond level. $Dummy_{CDS}$ is the dummy variable that equals to 1 when CDS is first introduced as proxied by the first month when the related 5-year CDS spread is reported in the Markit. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics

Name	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Zero Trade	195,952	0.7355	0.3108	-0.05	0.96	0.90	-1.35	0.33
1/Volume	195,952	0.0689	0.0108	0.05	0.14	0.07	1.30	2.21
1/Trades	195,952	0.4390	0.3962	0.00	1.00	0.33	0.45	-1.42
1/Turnover	195,952	0.5005	1.7606	0.00	25.00	0.06	7.60	72.46
Trade Size	195,952	6.1591	5.5089	0.00	18.13	4.87	0.49	-1.25
Amihud	195,952	0.2839	0.7920	0.00	8.77	0.02	5.38	35.92
Ratings	195,952	6.7468	3.0641	1.00	25.00	6.00	1.20	3.70
Maturity	195,952	7.9967	8.9332	1.00	100.00	5.00	4.49	34.39
Coupon	195,952	6.9077	1.4321	0.00	18.00	6.88	-0.27	1.21
Issue Size	195,952	12.2488	1.0791	5.30	16.52	12.32	-0.91	2.73
Duration	195,708	5.0000	3.1611	0.91	18.22	4.20	0.92	0.10
Convexity	195,708	46.4049	63.1528	0.66	615.66	20.36	2.31	6.13

Panel B: Individual Bond Monthly Liquidity Measures Pre- and Post-1998

	Dependent Variables					
Independent Variables	**Zero Trade**	**1/Volume**	**1/Trades**	**1/Turnover**	**Trade Size**	**Amihud**
$Dummy_{99}$ * IG	0.0895***	0.2112***	-0.0653***	0.0969***	-0.0957***	0.1846***
	[12.80]	[21.10]	[-7.20]	[13.33]	[-10.80]	[29.24]
$Dummy_{99}$ * HY	-0.2965***	0.0885***	-0.3214***	0.1622***	-0.3859***	0.1392***
	[-9.28]	[2.70]	[-10.04]	[6.85]	[-12.31]	[5.57]
$Dummy_{07}$ * IG	-0.0742***	0.0685***	-0.0876***	0.0610***	-0.0945***	0.3730***
	[-3.52]	[3.75]	[-8.99]	[4.35]	[-10.16]	[19.01]
$Dummy_{07}$ * HY	-0.1561***	0.1130**	-0.1701***	0.0527	-0.1790***	0.8252***
	[-2.74]	[2.28]	[-6.27]	[1.49]	[-7.14]	[9.83]
$Dummy_{03}$ * IG	-0.9708***	0.2043***	-1.0218***	0.0892***	-1.0910***	0.5427***
	[-54.80]	[12.33]	[-83.08]	[6.56]	[-93.20]	[45.17]
$Dummy_{03}$ * HY	-1.1364***	-0.0343	-1.0310***	-0.0921***	-1.0715***	0.6195***
	[-22.39]	[-0.84]	[-30.23]	[-4.00]	[-32.29]	[13.65]
Ratings	0.0398***	0.0041	0.0181***	-0.0095***	0.0208***	0.0094***
	[10.59]	[1.22]	[8.23]	[-3.93]	[9.79]	[3.40]
Maturity	0.0013	0.0013	0.0037***	0.0007	0.0040***	0.0050**
	[0.60]	[0.57]	[2.62]	[0.31]	[3.00]	[2.05]
Coupon	0.1962***	0.2327***	0.1140***	0.0532***	0.1011***	0.1055***
	[29.65]	[41.00]	[31.23]	[13.23]	[29.28]	[26.87]
Issue Size	-0.1147***	-0.1607***	-0.0326***	-0.0356***	-0.0223***	-0.1215***
	[-28.24]	[-42.71]	[-13.45]	[-13.52]	[-9.58]	[-41.20]
Duration	0.0425***	0.0277***	-0.0026	-0.0052	-0.0049	0.0618***
	[6.40]	[4.16]	[-0.67]	[-0.94]	[-1.32]	[12.15]
Convexity	-0.0010**	-0.0015***	-0.0001	0.0010***	0.0001	-0.0016***
	[-2.13]	[-3.53]	[-0.46]	[2.97]	[0.31]	[-3.68]
N	195,708	195,708	195,708	195,708	195,708	195,708
R^2	0.46	0.15	0.38	0.01	0.42	0.19

Panel C: Individual Bond Monthly Liquidity Measures Pre- and Post-CDS

	Dependent Variables					
Independent Variables	**Zero Trade**	**1/Volume**	**1/Trades**	**1/Turnover**	**Trade Size**	**Amihud**
$Dummy_{CDS}$ * IG	-0.0220***	0.0699***	-0.1495***	0.1390***	-0.1628***	0.0916***
	[-3.24]	[8.62]	[-27.43]	[12.57]	[-32.35]	[9.54]
$Dummy_{CDS}$ * HY	-0.7265***	-0.4170***	-0.2948***	0.0273	-0.2884***	0.1012***
	[-36.89]	[-21.54]	[-20.92]	[1.30]	[-22.11]	[3.08]
$Dummy_{07}$ * IG	-0.0767***	0.0674***	-0.0890***	0.0611***	-0.0960***	0.3725***
	[-8.40]	[6.81]	[-15.70]	[5.56]	[-18.42]	[26.90]
$Dummy_{07}$ * HY	-0.1088***	0.1394***	-0.1496***	0.0501**	-0.1586***	0.8198***
	[-4.60]	[5.60]	[-9.99]	[2.00]	[-11.91]	[16.01]
$Dummy_{03}$ * IG	-0.9175***	0.2889***	-1.0158***	0.1039***	-1.0952***	0.6103***
	[-207.37]	[49.45]	[-232.72]	[15.84]	[-264.97]	[100.79]
$Dummy_{03}$ * HY	-1.1695***	0.1067***	-1.1823***	0.0057	-1.2681***	0.6360***
	[-88.44]	[7.02]	[-99.81]	[0.40]	[-113.50]	[30.75]
Ratings	0.0352***	0.0044***	0.0140***	-0.0080***	0.0158***	0.0096***
	[48.92]	[4.68]	[17.90]	[-7.75]	[20.87]	[9.64]
Maturity	0.0019***	0.0013*	0.0038***	0.0008	0.0041***	0.0044***
	[4.23]	[1.94]	[7.44]	[0.92]	[8.06]	[4.11]
Coupon	0.1958***	0.2287***	0.1176***	0.0497***	0.1054***	0.1023***
	[152.30]	[140.22]	[97.62]	[28.37]	[92.04]	[59.94]
Issue Size	-0.1087***	-0.1479***	-0.0366***	-0.0293***	-0.0280***	-0.1102***
	[-135.55]	[-148.97]	[-47.70]	[-26.69]	[-38.16]	[-99.43]
Duration	0.0406***	0.0200***	0.0002	-0.0086***	-0.0008	0.0545***
	[26.86]	[9.84]	[0.12]	[-3.48]	[-0.52]	[26.99]
Convexity	-0.0010***	-0.0012***	-0.0002	0.0010***	-0.0000	-0.0013***
	[-9.41]	[-8.98]	[-1.53]	[6.51]	[-0.01]	[-6.90]
N	195,708	195,708	195,708	195,708	195,708	195,708
R^2	0.47	0.14	0.38	0.01	0.42	0.19

Table 2. Systematic Risk in Corporate Bonds for Pre- and Post-CDS Periods

The table reports the asset pricing tests for both investment and speculative grade bonds before and after CDS is introduced. The sample period is from January 2001 to December 2006. The bond data is constructed from NAIC, TRACE and FISD. Panel A reports the number of bonds in the sample. IG represents investment grade bonds and HY represents speculative grade bonds. Pre-CDS represents the bonds without CDS and Post-CDS represents the bonds with CDS. Panel B reports the summary statistics of systematic risk factors computed for a time horizon k, where k=20, 40 and 60 days. The systematic risk factors include MKT_k, SMB_k, HML_k, TERM_k, DEF_k, LIQ_k, and AMH_k. MKT_k is the cumulative excess daily market return from day t-k to t (from Kenneth French's website). SMB_k and HML_k are defined similarly. TERM_k is the difference between the daily return of the Barclays long-term government bond index from Datastream and the daily T-bill return (from Kenneth French's website). DEF_k is the daily difference between the return of the Barclays long-term corporate bond index and that of the Barclays long-term government bond index from Datastream. LIQ_k is the sum of the turnover defined as the total trading volume divided by the total number outstanding for all corporate bonds from day t-k to t. AMH_k is the Amihud (2002) bond market liquidity risk factor, in which k is the time horizon used to calculate the price impact relative to the volume. We demeaned all risk factors. Panel C reports the beta loadings of the excess returns of the equally-weighted and value-weighted bond portfolios constructed for the same time horizon k. The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A: Sample Descriptions

Year	IG/HY	The Number of Firms			The Number of Bonds			The Number of Bond Transactions		
		Pre-CDS	Post-CDS	All	Pre-CDS	Post-CDS	All	Pre-CDS	Post-CDS	All
2001	**IG**	169	74	243	361	202	563	1,521	971	2,492
	HY	50	11	61	86	21	107	652	160	812
2002	**IG**	102	128	230	186	358	544	1,562	2,878	4,440
	HY	43	26	69	71	69	140	1,044	1,509	2,553
2003	**IG**	74	172	246	148	493	641	4,291	21,720	26,011
	HY	44	40	84	72	109	181	951	2,194	3,145
2004	**IG**	55	206	261	109	621	730	3,287	31,834	35,121
	HY	29	55	84	50	134	184	1,205	5,003	6,208
2005	**IG**	37	228	265	75	665	740	3,431	47,792	51,223
	HY	22	71	93	46	194	240	4,113	19,862	23,975
2006	**IG**	21	223	244	42	654	696	2,263	48,191	50,454
	HY	14	88	102	31	204	235	3,326	21,703	25,029
Total		**660**	**1,322**	**1,982**	**1,277**	**3,724**	**5,001**	**27,646**	**203,817**	**231,463**

Panel B: Summary Statistics of Systematic Risk Factors

	N	MEAN	STD	MIN	MAX
MKT_20	1703	0.43	4.25	-20.21	16.61
SMB_20	1703	0.15	2.24	-8.51	6.08
HML_20	1703	0.21	2.44	-9.38	12.47
DEF_20	1703	0.34	1.21	-4.12	4.88
TERM_20	1703	0.01	2.52	-9.27	7.43
LIQ_20	1703	0.06	0.72	-1.34	1.65
AMH_20	1663	0.09	0.59	-3.03	3.67
MKT_40	1683	0.88	6.07	-23.63	19.65
SMB_40	1683	0.31	3.09	-9.18	7.64
HML_40	1683	0.40	3.68	-10.28	19.23
DEF_40	1683	0.66	1.73	-6.52	8.19
TERM_40	1683	0.16	3.84	-12.63	10.02
LIQ_40	1683	0.05	0.68	-1.16	1.49
AMH_40	1603	0.11	0.66	-4.03	2.38
MKT_60	1663	1.28	7.01	-27.84	20.73
SMB_60	1663	0.45	3.76	-9.58	11.29
HML_60	1663	0.52	4.22	-9.60	21.91
DEF_60	1663	0.99	2.07	-7.34	8.38
TERM_60	1663	0.35	4.70	-12.20	11.53
LIQ_60	1663	0.05	0.67	-1.08	1.46
AMH_60	1543	0.13	0.70	-2.73	2.07

Panel C: Beta Loadings of Corporate Bond Portfolios

	k=20				k=40				k=60			
	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	EW	**VW**	**EW**	**VW**	**EW**	**VW**	**EW**	**VW**	**EW**	**VW**	**EW**	**VW**
Intercept	0.2448***	0.2687***	0.1837***	0.1799***	0.3760***	0.4014***	0.3316***	0.3287***	0.4299***	0.4969***	0.3855***	0.3876***
	[7.53]	[7.38]	[6.38]	[6.05]	[9.10]	[8.54]	[10.40]	[10.27]	[8.26]	[8.60]	[10.58]	[10.30]
HY	0.2075***	0.1811***	0.3027***	0.3201***	0.2188***	0.2031**	0.4124***	0.4313***	0.3211***	0.2657**	0.6389***	0.6630**
	[3.26]	[2.64]	[5.42]	[5.53]	[2.66]	[2.24]	[5.48]	[5.56]	[3.27]	[2.50]	[7.18]	[7.30]
MKT_k	0.0222**	0.0297***	0.0396***	0.0421***	0.0793***	0.0879***	0.0607***	0.0641***	0.0888***	0.1064***	0.0585***	0.0629***
	[2.20]	[2.69]	[3.82]	[4.12]	[6.70]	[6.60]	[6.04]	[6.52]	[7.01]	[7.54]	[5.66]	[6.03]
SMB_k	0.0635***	0.066***	0.0085	0.0119	0.0052	-0.0026	0.0078	0.0043	-0.0079	-0.0226	0.0289*	0.0249
	[3.56]	[3.29]	[0.57]	[0.78]	[0.28]	[-0.13]	[0.54]	[0.32]	[-0.44]	[-1.14]	[1.87]	[1.59]
HML_k	-0.0103	-0.0062	0.0106	0.0032	-0.0516***	-0.0590***	0.0301*	0.0213	-0.0326*	-0.0425**	0.0313**	0.0270*
	[-0.50]	[-0.28]	[0.56]	[0.17]	[-2.63]	[-2.78]	[1.83]	[1.25]	[-1.85]	[-2.21]	[2.05]	[1.65]
DEF_k	0.0097**	0.0078*	0.0044	0.0053*	0.0139***	0.0158***	0.0089***	0.0108***	0.0096***	0.0104***	0.0113***	0.0114***
	[2.51]	[1.82]	[1.49]	[1.84]	[4.21]	[4.42]	[4.04]	[4.87]	[2.99]	[3.10]	[4.72]	[4.71]
TERM_k	0.2982***	0.3412***	0.3571***	0.3783***	0.2986***	0.3153***	0.3300***	0.3383***	0.3380***	0.3611***	0.3610***	0.3725***
	[10.94]	[11.57]	[17.24]	[17.35]	[12.64]	[11.56]	[18.12]	[17.68]	[11.68]	[11.57]	[21.32]	[20.87]
LIQ_k	-0.0072***	-0.0086***	-0.0077***	-0.0079***	-0.0085***	-0.0088***	-0.0056***	-0.0058***	-0.0079***	-0.0092***	-0.0038***	-0.0041***
	[-2.75]	[-2.96]	[-3.18]	[-3.23]	[-4.68]	[-4.46]	[-4.00]	[-4.19]	[-5.86]	[-6.24]	[-2.80]	[-2.94]
AMH_k	0.1135***	0.0878**	0.0388*	0.0208	-0.018	-0.0346	0.0097	-0.005	-0.2003***	-0.2562***	-0.0187	-0.0253
	[3.34]	[2.30]	[1.67]	[0.83]	[-0.37]	[-0.61]	[0.29]	[-0.16]	[-3.08]	[-3.57]	[-0.50]	[-0.64]
HY*MKT_k	0.051***	0.0268	0.0701***	0.0768***	0.0126	-0.0066	0.0929***	0.0883***	-0.0443*	-0.0558**	0.0347	0.0356
	[2.52]	[1.26]	[3.66]	[3.90]	[0.58]	[-0.27]	[4.81]	[4.50]	[-1.95]	[-2.26]	[1.54]	[1.57]
HY*SMB_k	0.0467	0.0489	0.1073***	0.0998***	0.0468	0.0492	0.1092***	0.1263***	0.0999***	0.097***	0.1072***	0.1116***
	[1.40]	[1.34]	[3.68]	[3.37]	[1.45]	[1.36]	[3.69]	[4.25]	[2.98]	[2.58]	[3.21]	[3.23]
HY*HML_k	-0.008	-0.0305	0.0761**	0.0794**	0.05	0.0503	0.0782**	0.0676**	0.0334	0.0581	0.0297	0.0315
	[-0.21]	[-0.76]	[2.19]	[2.21]	[1.45]	[1.33]	[2.52]	[2.12]	[1.00]	[1.62]	[0.96]	[1.00]
HY*DEF_k	0.0049	0.0055	0.01*	0.0085	0.0149**	0.0117*	0.0043	0.0023	0.0252***	0.0239***	-0.0002	-0.0026
	[0.71]	[0.74]	[1.84]	[1.51]	[2.25]	[1.66]	[0.82]	[0.41]	[3.91]	[3.53]	[-0.04]	[-0.41]
HY*TERM_k	-0.2277***	-0.2556***	-0.2492***	-0.2683***	-0.2820***	-0.2914***	-0.1741***	-0.1825***	-0.3588***	-0.3772***	-0.0867**	-0.0889**
	[-4.43]	[-4.51]	[-6.14]	[-6.37]	[-5.65]	[-5.25]	[-4.29]	[-4.33]	[-7.30]	[-7.39]	[-2.12]	[-2.10]
HY*LIQ_k	0.0007	0.0011	-0.0041	-0.0039	0.0078**	0.0077**	-0.0026	-0.0026	0.0098***	0.0105***	-0.0029	-0.0037
	[0.17]	[0.23]	[-0.98]	[-0.91]	[2.33]	[2.15]	[-0.86]	[-0.83]	[3.55]	[3.56]	[-1.00]	[-1.29]
HY*AMH_k	-0.0746	-0.0143	-0.0286	-0.0227	-0.1317	-0.1137	-0.2843***	-0.2538**	0.121	0.0963	-0.4216***	-0.3957***
	[-1.04]	[-0.19]	[-0.46]	[-0.35]	[-1.20]	[-0.90]	[-2.68]	[-2.31]	[1.02]	[0.77]	[-3.85]	[-3.56]
N	2,611	2,611	2,664	2,664	2,491	2,491	2,583	2,583	2,378	2,378	2,505	2,505
R^2	16.63	16.63	25.15	26.16	26.51	25.27	40.56	41.53	30.12	31.17	43.09	43.66

Table 3. The CDS-Bond Basis and Individual Bond Characteristics in Normal Period

The table reports the relation between the basis and various bond characteristics, such as rating, maturity, age, coupon, size, duration and convexity for both investment grade and speculative grade bonds during the normal period from January 2001 to December 2006. Panel A reports the number of firms and bonds in each year in our sample. Panel B reports summary information of the basis and bond characteristics. Bond ratings are categorized from 1 to 20 for all bonds (S&P rating AAA to CC). We use the S&P ratings whenever available, followed by Moody's and Fitch's ratings. Coupon is in percentage terms. Issue size is the natural logarithm of issuance amount in billions. Maturity, age and duration are all in years. Panel C reports the mean and standard deviation of the basis and the bond characteristics in groups, including ratings, maturity, age, coupon, issue size, duration and convexity. Rating group 1 to 4 are defined for investment grade bonds with S&P rating AAA, AA, A to BBB respectively, and for speculative grade bonds with rating BB, B, CCC to CC respectively. Maturity group 1 to 5 are defined for bonds with 1-3 years, 3-5 years, 5-7 years, 7-10 years and more than 10 years to maturity respectively. Age groups 1 to 5 are defined for bonds that are less than 3 years, 3-5 years, 5-7 years, 7-10 years and more than 10 years old. Coupon is defined from 1 to 5 to represent bonds with annual coupon of 0-5.5, 5.5-6.5, 6.5-7, 7-8 and more than 9 (in percentage terms). Issue is defined from 1 to 5 to represent bonds with the amount of issuance of 0-0.2, 0.2-0.3, 0.3-0.5, 0.5-0.6 and more than 0.6 billions of dollars. Duration groups 1 to 5 are defined for bonds with duration of 0-3 years, 3-5 years, 5-7 years, 7-10 years and more than 10 years respectively. Convexity is defined from 1 to 5 to represent bonds with convexity of 0-10, 10-30, 30-50, 50-70 and more than 70.

Panel A: The Number of Firms and Bonds by Year

	2001	2002	2003	2004	2005	2006	Average
				Investment Grade			
Firm	145	200	238	263	288	283	**236**
Bond	531	770	889	970	1,026	986	**862**
				Speculative Grade			
Firm	14	33	59	71	86	107	**62**
Bond	29	96	181	227	270	278	**180**

Panel B: Summary Information of the Basis and Bond Characteristics

Characteristics	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
				Investment Grade				
Basis	266,787	-0.23	0.51	-3.70	0.98	-0.10	-2.06	7.19
Ratings	266,787	6.73	2.24	1.00	10.00	6.00	-0.34	-0.52
Maturity	266,787	8.23	7.45	1.00	30.00	5.55	1.42	0.91
Age	266,787	5.05	3.77	0.00	47.90	4.14	1.10	1.89
Coupon	266,787	6.31	1.42	0.25	11.75	6.50	-0.44	0.25
Issue Size	266,787	12.82	0.65	8.57	14.91	12.69	0.09	1.29
Duration	266,787	5.44	3.42	0.92	15.01	4.59	0.81	-0.36
Convexity	266,787	57.32	73.04	1.32	336.54	25.69	1.67	1.66
				Speculative Grade				
Basis	63,125	0.73	2.16	-7.12	15.21	0.20	2.67	10.56
Rating	63,125	13.74	2.24	11.00	20.00	14.00	0.58	-0.43
Maturity	63,125	8.38	6.52	1.00	29.42	6.27	1.27	0.65
Age	63,125	5.73	3.80	0.00	47.87	5.07	1.13	2.36
Coupon	63,125	7.83	1.23	3.50	12.50	7.70	0.46	1.60
Issue Size	63,125	12.75	0.58	9.86	14.51	12.77	-0.19	0.65
Duration	63,125	5.10	2.59	0.72	12.95	4.73	0.58	-0.34
Convexity	63,125	47.02	49.73	0.79	251.86	28.42	1.58	1.81

Panel C: Basis and Bond Characteristics Groups

Characteristics	Groups	Investment Grade			Speculative Grade		
		N	CDS-Bond Basis		N	CDS-Bond Basis	
			MEAN	STD		MEAN	STD
Ratings	1	7,134	-0.03	0.43	31,454	0.15	1.26
	2	32,142	-0.13	0.47	24,127	0.63	1.56
	3	119,498	-0.22	0.49	6,729	3.17	3.86
	4	108,013	-0.29	0.53	815	5.70	4.06
Maturity	1	66,640	-0.10	0.52	11,436	0.68	2.68
	2	55,499	-0.12	0.48	10,917	0.47	2.14
	3	38,461	-0.20	0.46	14,318	0.63	2.11
	4	47,324	-0.27	0.46	9,802	0.80	1.98
	5	58,863	-0.48	0.49	16,652	0.96	1.85
Age	1	97,582	-0.15	0.46	17,222	0.40	1.44
	2	54,387	-0.20	0.48	13,885	0.39	2.18
	3	40,984	-0.26	0.49	9,998	0.84	2.61
	4	45,123	-0.27	0.55	15,179	0.71	1.87
	5	28,711	-0.47	0.59	6,841	2.10	2.80
Coupon	1	61,610	0.03	0.29	1,174	0.32	0.86
	2	55,837	-0.14	0.42	3,221	0.07	0.96
	3	58,785	-0.30	0.49	8,941	0.26	1.25
	4	54,856	-0.40	0.54	17,490	0.44	1.48
	5	35,699	-0.46	0.64	32,299	1.09	2.66
Issue Size	1	55,527	-0.35	0.58	15,048	0.74	2.12
	2	37,527	-0.25	0.54	6,464	0.89	2.39
	3	72,320	-0.21	0.51	18,871	0.67	2.04
	4	42,361	-0.11	0.41	13,126	0.44	1.40
	5	59,052	-0.24	0.44	9,616	1.08	2.92
Duration	1	77,778	-0.10	0.52	14,961	0.73	2.75
	2	67,263	-0.15	0.47	19,777	0.70	2.30
	3	51,556	-0.28	0.49	13,520	0.87	1.93
	4	29,717	-0.33	0.52	11,082	0.94	1.29
	5	40,473	-0.49	0.43	3,785	-0.32	0.69
Convexity	1	72,651	-0.10	0.52	13,602	0.75	2.75
	2	71,307	-0.15	0.47	19,454	0.65	2.28
	3	37,390	-0.27	0.49	11,429	0.55	1.67
	4	25,727	-0.24	0.44	3,689	1.81	2.67
	5	59,712	-0.47	0.48	14,951	0.67	1.32

Table 4. The Risk and Returns of the Quintile Basis Portfolios in Normal Period

The table reports the returns and risk of the quintile basis portfolios for the investment- or speculative-grade bonds for the pre-crisis period. Panel A reports the average holding period returns (HPR) of five basis portfolios sorted on past 60-day basis. We delete trading days with less than five bonds traded, and our sample period is shortened to the period between July 2002 and December 2006. The quintile portfolios are sorted from the lowest (quintile 1) to the highest (quintile 5) basis within investment- or speculative grade bonds. For each quintile, we compute the holding period returns for k = 20-, 40- and 60-day horizons. All portfolios are rebalanced daily and are value-weighted by market capitalization, which is calculated from the last available transaction price of the bond. To be included in the quintile portfolios, bonds must have more than 20 trades in past 60 trading days. When computing the holding period return for the basis portfolio, we use the starting price from the formation date t whenever available, followed by the latest price with a five-day window prior to the formation date. We use the end transaction price on day t+k (where k = 20, 40, 60 respectively) whenever available, followed by the last available transaction price within five day before day t+k. Bonds without the starting and ending prices are eliminated from the analysis. We report both raw and excess returns for three different holding periods. The row '1-5' refers to the difference in returns between basis portfolio 1 and 5. Basis and returns are in percentage terms. The t-statistics are reported in square bracket. Panel B reports the time series regression of the basis portfolios returns on existing systematic risk factors for corporate bonds for holding horizon k=20. The dependent variable is the value-weighted HPR return of the basis quintile portfolio. The MKT, SMB, and HML are the usual stock market risk factors downloaded from Kenneth French's website on the daily frequency. The TERM factor is difference between the daily return of the 10-year-to-maturity government bond index and the daily T-bill return (from Kenneth French's website). The DEF factor is the difference between the daily return of the Lehman investment grade bond index return from Datastream and the daily 10-year-to-maturity government bond return from CRSP. LIQ is the sum of the turnover defined as the total trading volume divided by the total number outstanding for all corporate bonds from day t-k to t. AMH is the Amihud (2002) bond market liquidity risk factor computed from day t-k to day t. The row labeled '1-5' refers to the differences of intercept and slope coefficients between portfolio 1 and portfolio 5. The intercept terms and adjusted R-squared terms are in percentage terms. Panel C reports the results for the holding horizon k=40 and panel D reports the results for the holding horizon k=60. An *** (**, *) denotes significance at the 1% (5%, 10%) level.

Panel A: Construction of Basis Quintile Bond Portfolios

Investment Grade Bonds							
Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-0.62	0.5358	0.3938	1.1537	0.8510	1.6931	1.2334
2	-0.35	0.4202	0.2559	0.8417	0.5003	1.2525	0.7331
3	-0.20	0.3077	0.1558	0.6513	0.3270	0.9975	0.4849
4	-0.05	0.3142	0.1478	0.6707	0.3335	1.0082	0.5007
5	0.12	0.2302	0.0692	0.4732	0.1330	0.6854	0.1594
1 – 5		**0.3055***** **[7.49]**		**0.6804***** **[11.38]**		**1.0078***** **[14.11]**	
Speculative Grade Bonds							
Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-0.70	0.2392	0.0302	0.6815	0.2540	1.2723	0.6157
2	0.01	0.4340	0.2250	0.6696	0.2421	1.2416	0.5849
3	0.49	0.8040	0.5950	1.5108	1.0833	2.5556	1.8994
4	1.40	1.4507	1.2417	3.2025	2.7751	4.2816	3.6249
5	5.28	1.8626	1.6171	2.9596	2.5321	6.1529	5.4962
1 – 5		**-1.5869***** **[-5.23]**		**-2.2781***** **[-5.44]**		**-4.8805***** **[-10.82]**	

Panel B: Risk and Return of Basis Quintile Bond Portfolios for k=20

Investment Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**0.0145*** **	0.0010***	-0.0015***	0.0001	0.0017**	-0.0002	-0.0002***	-0.0015*
	[3.80]	[2.80]	[-3.05]	[0.12]	[2.05]	[-1.65]	[-3.64]	[-1.89]
2	**0.0133*** **	0.0011***	-0.0015***	0.0001	0.0015**	-0.0002**	-0.0002***	-0.0011
	[4.18]	[3.85]	[-4.16]	[0.32]	[2.37]	[-2.08]	[-4.48]	[-1.64]
3	**0.0102*** **	0.0006***	-0.0010***	0.0000	0.0011*	-0.0001	-0.0002***	-0.0008
	[3.87]	[2.59]	[-2.86]	[-0.03]	[1.90]	[-1.30]	[-4.36]	[-1.47]
4	**0.0097*** **	0.0004**	-0.0007***	-0.0004	0.0008**	-0.0001*	-0.0002***	-0.0006
	[5.25]	[2.41]	[-3.27]	[-1.47]	[2.21]	[-1.79]	[-5.57]	[-1.64]
5	**0.0089*** **	0.0005***	-0.0009***	-0.0003	0.0009***	-0.0001**	-0.0002***	-0.0006*
	[6.20]	[3.79]	[-4.89]	[-1.50]	[3.35]	[-2.21]	[-6.38]	[-1.76]
1-5	**0.0057***	0.0005*	-0.0006	0.0004	0.0008	-0.0001	-0.0001	-0.0009
	[1.93]	[1.83]	[-1.42]	[0.96]	[1.28]	[-1.11]	[-1.35]	[-1.53]

Speculative Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0167**	0.0011*	-0.0014	-0.0035***	0.0024	-0.0004**	0.0003*	-0.001
	[-1.57]	[1.71]	[-1.41]	[-3.28]	[1.37]	[-2.36]	[1.70]	[-0.89]
2	**-0.0091**	0.001	-0.0009	-0.0053***	0.0049***	-0.0009***	0.0002	0.0008
	[-0.71]	[1.04]	[-0.69]	[-3.14]	[2.63]	[-3.72]	[0.73]	[0.65]
3	**0.0037**	0.0012	-0.0024**	-0.0061***	0.0080***	-0.0011***	0.0000	-0.0014
	[0.25]	[1.48]	[-2.09]	[-3.85]	[3.08]	[-3.60]	[-0.09]	[-0.86]
4	**0.0300**	0.0026	-0.0063**	-0.0096***	0.0088	-0.0019***	-0.0004	-0.0034
	[1.02]	[1.62]	[-2.54]	[-2.75]	[1.43]	[-3.26]	[-0.90]	[-1.13]
5	**-0.0119**	0.0072***	-0.0064**	-0.0055	0.0032	-0.0002	0.0005	-0.0238***
	[-0.42]	[5.22]	[-2.58]	[-1.62]	[0.70]	[-0.41]	[0.93]	[-3.38]
1-5	**-0.0048**	-0.0061***	0.0050**	0.002	-0.0008	-0.0002	-0.0002	0.0228***
	[-0.17]	[-4.26]	[2.18]	[0.62]	[-0.20]	[-0.30]	[-0.32]	[3.46]

Panel C: Risk and Return of Basis Quintile Bond Portfolios for k=40

Rank	Intercept	MKT	SMB	HML	DEF	TERM	LIQ	AMH
Investment Grade Bonds								
1	**0.0398*****	0.0000	-0.0016***	0.0012**	-0.0001	-0.0005***	-0.0003***	-0.0107***
	[7.76]	[-0.01]	[-3.77]	[2.54]	[-0.21]	[-5.38]	[-7.05]	[-7.36]
2	**0.0317*****	0.0002	-0.0015***	0.0006	-0.0002	-0.0004***	-0.0003***	-0.0076***
	[7.86]	[0.63]	[-4.41]	[1.56]	[-0.38]	[-5.01]	[-8.13]	[-6.46]
3	**0.0247*****	0.0000	-0.0009***	0.0007**	-0.0002	-0.0003***	-0.0002***	-0.0050***
	[7.21]	[0.05]	[-3.32]	[2.19]	[-0.42]	[-5.03]	[-7.99]	[-6.50]
4	**0.0238*****	-0.0002	-0.0007***	-0.0001	0.0001	-0.0002***	-0.0002***	-0.0039***
	[9.85]	[-1.10]	[-2.87]	[-0.6]	[0.16]	[-4.43]	[-9.64]	[-6.23]
5	**0.0205*****	0.0000	-0.0008***	0.0000	0.0003	-0.0002***	-0.0002***	-0.0030***
	[9.99]	[-0.13]	[-3.88]	[-0.19]	[1.06]	[-5.16]	[-9.91]	[-5.86]
1-5	**0.0192*****	0.0000	-0.0007**	0.0012***	-0.0004	-0.0003***	-0.0001***	-0.0077***
	[5.03]	[0.06]	[-2.37]	[3.41]	[-0.81]	[-4.66]	[-3.86]	[-7.19]
Speculative Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0099**	-0.0029***	0.0025**	-0.0045***	-0.0061***	0.0002	0.0002	-0.0059***
	[-0.66]	[-3.95]	[1.97]	[-3.59]	[-2.95]	[0.91]	[1.48]	[-3.94]
2	**-0.0089**	-0.0029**	0.0041**	-0.0035**	-0.0038**	-0.0001	0.0002	-0.0069***
	[-0.63]	[-2.16]	[2.14]	[-2.20]	[-2.03]	[-0.43]	[1.31]	[-3.71]
3	**0.0266**	-0.0052***	0.0040**	-0.0058***	-0.0038	0.0002	0.0000	-0.0117***
	[1.55]	[-4.38]	[2.47]	[-3.55]	[-1.20]	[0.63]	[-0.23]	[-4.52]
4	**0.1141*****	-0.0056***	0.0051*	-0.0060**	-0.0094**	0.0011**	-0.0006***	-0.0279***
	[4.50]	[-2.72]	[1.90]	[-2.11]	[-2.51]	[2.18]	[-2.88]	[-7.10]
5	**-0.0237**	-0.0041*	0.0043	-0.0103***	-0.001	-0.0004	0.0006	-0.0394***
	[-0.59]	[-1.83]	[1.25]	[-2.62]	[-0.16]	[-0.54]	[1.63]	[-5.52]
1-5	**0.0138**	0.0012	-0.0018	0.0058	-0.005	0.0006	-0.0004	0.0336***
	[0.31]	[0.56]	[-0.56]	[1.54]	[-0.84]	[0.90]	[-0.94]	[4.99]

Panel D: Risk and Return of Basis Quintile Bond Portfolios for k=60

Investment Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**0.0682*****	-0.0012***	-0.0016***	0.0008*	-0.0022***	-0.0004***	-0.0004***	-0.0071***
	[11.42]	[-3.55]	[-3.62]	[1.95]	[-3.34]	[-4.38]	[-8.99]	[-3.40]
2	**0.0517*****	-0.0010***	-0.0010***	0.0003	-0.0016***	-0.0003***	-0.0003***	-0.0047***
	[11.21]	[-3.83]	[-2.81]	[0.83]	[-3.06]	[-4.68]	[-9.65]	[-2.84]
3	**0.0392*****	-0.0006***	-0.0008***	0.0002	-0.0009**	-0.0003***	-0.0002***	-0.0039***
	[10.61]	[-2.96]	[-2.87]	[0.73]	[-2.31]	[-5.50]	[-9.73]	[-3.71]
4	**0.0387*****	-0.0008***	-0.0007***	-0.0003	-0.0007**	-0.0001***	-0.0002***	-0.0032***
	[12.76]	[-4.09]	[-2.93]	[-1.24]	[-2.28]	[-2.99]	[-11.07]	[-4.23]
5	**0.0307*****	-0.0002*	-0.0010***	0.0000	0.0000	-0.0002***	-0.0002***	-0.0026***
	[12.87]	[-1.87]	[-5.19]	[0.12]	[-0.10]	[-5.52]	[-11.88]	[-4.35]
1-5	**0.0375*****	-0.0009***	-0.0006*	0.0008**	-0.0022***	-0.0002***	-0.0002***	-0.0046***
	[8.20]	[-3.40]	[-1.77]	[2.52]	[-4.26]	[-2.66]	[-5.59]	[-2.72]
Speculative Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**0.0223**	-0.0005	-0.0013	-0.0028*	-0.0084***	0.0005*	0.0000	-0.0040**
	[1.52]	[-0.78]	[-0.93]	[-1.94]	[-2.92]	[1.72]	[-0.18]	[-1.98]
2	**0.0208**	0.0014	-0.0037**	-0.0025**	-0.0051**	0.0005	0.0000	-0.0025
	[1.14]	[1.00]	[-2.44]	[-2.11]	[-2.17]	[1.62]	[-0.34]	[-0.97]
3	**0.0869*****	-0.0008	-0.0037***	-0.0047***	-0.0021	0.0003	-0.0004***	0.0005
	[4.81]	[-0.67]	[-2.95]	[-3.43]	[-0.72]	[0.92]	[-3.02]	[0.13]
4	**0.1855*****	0.0005	-0.0102***	-0.0124***	-0.0149***	0.0014**	-0.0008***	-0.0098
	[6.15]	[0.16]	[-3.89]	[-5.7]	[-3.42]	[2.46]	[-3.35]	[-1.50]
5	**0.2333*****	0.0013	-0.0074**	-0.0132***	-0.0066	-0.0017**	-0.0011***	-0.0252***
	[4.61]	[0.50]	[-2.38]	[-4.35]	[-1.03]	[-2.11]	[-3.75]	[-4.54]
1-5	**-0.2110*****	-0.0018	0.0061**	0.0104***	-0.0019	0.0022***	0.0011***	0.0212***
	[-4.54]	[-0.79]	[2.23]	[3.96]	[-0.31]	[2.95]	[4.12]	[4.32]

Table 5: The Prediction Power of Basis for Future Bond Returns in Normal Period

This table reports the predicting power of the CDS-Bond basis for future individual bond returns during the normal period from 2001 to 2006. We run Fama-Macbeth regression on future individual bond returns at k-day horizon (where k =20, 40, 60) from day t onwards. Future return is the excess return of the holding period return for each bond by subtracting the risk-free return. In addition to the basis, we include the following bond characteristics: rating, maturity, age, duration, coupon, issue size, and liquidity on day t. Indliq_k is the sum of the turnover of the individual bond defined as the total trading volume divided by the total number outstanding for the bond from day t-k to t. We use the demeaned value of coupon and $Indliq_k$. Bond ratings are numbered from 1 to 20 for bonds (S&P ratings from AAA to CC). The basis is in percentage terms. Maturity, age, and duration are in years. Additional control variables include past CDS spread on day t (Past CDS), the change of CDS from day t-k to t ($\Delta(\text{CDS Spread})_k$), and the bond return from day t-k to day t (Bond Return_k). Panel A reports the results for investment grade bonds. Panel B reports the results for speculative grade bonds. The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A: Investment Grade Bonds

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0210***	-0.0347***	-0.0199***	-0.0449***	-0.0739	-0.0318**	0.0619	-0.0225***	-0.0476***	-0.0016	-0.0356***	-0.0121
	[-4.73]	[-2.91]	[-4.90]	[-3.30]	[-1.32]	[-1.99]	[0.66]	[-4.32]	[-2.67]	[-0.12]	[-3.90]	[-1.21]
Past CDS				-0.0044	0.0675	-0.0519	0.1382	0.0023	-0.0432	0.0027	0.0039	0.0038
				[-0.52]	[1.04]	[-1.21]	[0.99]	[0.44]	[-0.91]	[1.04]	[1.17]	[1.41]
Δ(CDS Spread)$_k$							1.6102	0.0275	-0.0212			
							[0.96]	[0.79]	[-0.94]			
Bond Return$_k$										-0.1173**	-0.0372	-0.1047***
										[-2.16]	[-0.32]	[-2.58]
Ratings	0.0018	-0.0010	-0.0001	-0.0003	-0.0096	-0.0006	-0.0243	0.0010	0.0051**	0.0000	0.0000	-0.0003
	[1.14]	[-0.23]	[-0.13]	[-0.32]	[-1.28]	[-0.47]	[-0.99]	[0.43]	[2.22]	[0.06]	[0.02]	[-1.08]
Maturity	0.0028	-0.0011	0.0124	-0.0002	0.0025	0.0009	-0.0004	0.0004	0.0014	-0.0002***	0.0001	-0.0002
	[1.18]	[-0.98]	[0.94]	[-0.16]	[1.05]	[1.13]	[-0.62]	[1.28]	[1.01]	[-2.79]	[0.38]	[-1.13]
Age	0.0056	0.0067	0.0114	0.0028	-0.0112	0.0070	-0.0005	-0.0005	0.0017	-0.0001	-0.0003	0.0001
	[1.62]	[0.97]	[0.87]	[1.02]	[-0.99]	[1.33]	[-0.74]	[-0.48]	[1.53]	[-0.81]	[-1.00]	[0.46]
Coupon	-0.1573	-0.5570	0.0873	-0.5428	0.0834	0.2104	0.0115	-0.1366	-0.6498	-0.0566***	-0.1343**	-0.0425*
	[-0.65]	[-1.36]	[0.47]	[-1.41]	[0.49]	[0.74]	[0.06]	[-0.63]	[1.30]	[-4.32]	[-2.23]	[-1.82]
Issue Size	-0.0003	0.0522	-0.0008	0.0037**	0.0029	0.0037***	0.0014	0.0014	0.0061**	0.0003*	0.0003	0.0005
	[-0.10]	[1.03]	[-0.18]	[2.02]	[1.02]	[2.72]	[1.13]	[0.33]	[2.10]	[1.91]	[0.60]	[0.81]
Indliq$_k$	-0.0710	0.0789	-0.0105	0.0020	0.0251***	0.0170	0.0416**	0.0086	0.0184	0.0015	0.0040***	0.0030
	[-1.18]	[0.82]	[-0.60]	[0.12]	[2.59]	[1.57]	[2.04]	[1.33]	[0.66]	[1.10]	[3.02]	[0.75]
Intercept	-0.0474	-0.6949	-0.1104	-0.0526	-0.0421	-0.0168	0.1614	-0.0250	-0.0101	0.0014	-0.0085	0.0004
	[-1.32]	[-1.03]	[-0.73]	[-1.61]	[-0.93]	[-0.47]	[0.85]	[-0.42]	[-1.53]	[0.21]	[-1.04]	[0.04]
N	233,958	232,965	232,281	233,958	232,965	232,281	210,659	212,165	209,836	146,569	142,688	136,301
R^2	0.27	0.34	0.37	0.41	0.38	0.43	0.30	0.39	0.44	0.43	0.47	0.52

Panel B: Speculative Grade Bonds

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0056	-0.0394	-0.0407*	-0.0104	-0.0181	-0.0163	-0.0179	-0.0523	-0.0042	-0.0161**	0.0645	-0.0355
	[-0.51]	[-0.73]	[-1.70]	[-0.65]	[-0.30]	[-0.61]	[-0.83]	[-0.89]	[-0.13]	[-2.13]	[0.78]	[-1.53]
Past CDS				0.0082	-0.0066	0.0058	0.0010	0.0023	0.0425*	0.0074**	0.0012	0.0074
				[1.19]	[-0.56]	[0.99]	[0.19]	[0.40]	[1.72]	[2.22]	[0.12]	[0.41]
Δ(CDS Spread)$_k$							0.0422	0.0255	-0.1153			
							[0.24]	[0.20]	[-1.51]			
Bond Return$_k$										0.0732	0.2909	-1.2270
										[0.36]	[1.15]	[-1.55]
Ratings	0.0272	-0.0005	-0.0071	0.0069	-0.0107	-0.0035	0.0095	0.0015	-0.0236*	-0.0083	-0.0147	0.0195
	[0.97]	[-0.04]	[-0.72]	[1.16]	[-0.97]	[-0.39]	[1.14]	[0.24]	[1.92]	[-1.02]	[-0.96]	[0.67]
Maturity	0.0630	0.0041	-0.0210	-0.0090	-0.0056	-0.0133	0.0000	-0.0133	0.0055	0.0037	0.0046	-0.0425
	[1.02]	[0.24]	[-1.02]	[-1.28]	[-0.56]	[-0.93]	[0.00]	[-1.25]	[0.97]	[0.46]	[0.60]	[-1.26]
Age	0.0512	-0.0056	-0.0186	-0.0166**	0.0040	0.0025	0.0029	-0.0004	0.0152*	0.0036	0.0051	0.0000
	[1.23]	[-0.27]	[-0.90]	[-2.40]	[0.29]	[0.21]	[0.23]	[-0.06]	[1.89]	[0.55]	[1.30]	[0.01]
Coupon	6.5904	-0.1742	-0.8098	-1.5647**	0.9358	-0.6321	-0.4225	0.2501	2.5094*	-0.3816	0.7305	-0.0602
	[1.16]	[-0.07]	[-0.61]	[-2.15]	[0.37]	[-0.41]	[-0.35]	[0.27]	[1.86]	[-1.00]	[1.62]	[-0.30]
Issue Size	-0.1357	-0.0561	-0.0595	0.0097	0.0158	0.0702	-0.0058	0.0545	0.0036	0.0071**	-0.0042	0.0012
	[-0.95]	[-0.96]	[-1.48]	[0.73]	[0.99]	[1.36]	[-0.71]	[1.13]	[0.36]	[2.05]	[-1.18]	[0.79]
Indliq$_k$	0.8764	0.7235	-0.0076	0.0214	0.1982	-0.0869	-0.0362	-0.0576	-0.0152**	-0.0090*	-0.0110***	-0.0090***
	[1.12]	[0.99]	[-0.41]	[0.22]	[1.25]	-1.29	[-1.12]	[-0.95]	[-2.15]	[-1.65]	[-3.08]	[-3.69]
Intercept	0.8355	0.8129	1.1258*	-0.1298	-0.0080	-0.8059	-0.0387	-0.6528	0.0250	-0.0677	0.1892	0.1048*
	[0.86]	[1.22]	[1.92]	[-0.75]	[-0.04]	[-1.25]	[-0.17]	[-1.14]	[0.16]	[-0.49]	[0.92]	[1.68]
N	57,820	57,561	57,367	57,820	57,561	57,367	51,980	52,179	51,359	38,078	36,664	34,189
R^2	0.22	0.23	0.25	0.30	0.38	0.40	0.33	0.40	0.45	0.35	0.41	0.45

Table 6. The CDS-Bond Basis and Future CDS Spread Change in Normal Period

The table reports the predicting power of the CDS-Bond basis for future individual CDS spread changes during the normal period from 2001 to 2006. We run Fama-Macbeth regression on future individual CDS spread changes at k-day horizon (where k = 20, 40, 60) from day t onwards. Future spread change is the percentage change in CDS spreads. In addition to the basis, we consider the following firm characteristics: stock price, stock volatility, leverage, size, profitability, and cash ratio on day t. Stock return is the percentage change in stock price for the past three months, i.e. from the four months to one month prior to the month when day t belongs to. Δ(Stock Volatility) is the change in stock volatility, defined as the standard deviation of daily stock prices for the past 60 days, for the past three months. Δ(leverage) is the change in market leverage, defined as the book value of debt divided by the market value of asset, for the past three months. Δ(size) is the change in the logarithm of the market value of asset, defined as the book value of debt plus the market value of equity, for the past three months. Δ(Profitability) is the change in profitability, defined as the income before the tax and interests divided by the market value of asset, for the past three months. Δ(Cash Ratio) is the change in the ratio of cash divided by the market value of asset, for the past three months. The basis is in percentage terms. Additional control variables include past CDS spread on day t (Past CDS), the change of CDS from day t-k to t ($\Delta(\text{CDS Spread})_k$), and the bond return from day t-k to day t (Bond Return_k). The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively. Panel A reports the summary statistics for all investment grade bonds. Panel B reports the regression results for all investment grade bonds. Panel C reports the summary statistics for all speculative grade bonds. Panel D reports the regression results for all speculative grade bonds.

Panel A: Summary Statistics for the Investment Grade CDS Spread Change

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Δ(CDS Spread)$_{20}$	107,243	-0.0025	0.1809	-0.67	6.82	-0.02	5.76	102.71
Δ(CDS Spread)$_{40}$	107,132	-0.0045	0.2731	-0.69	9.41	-0.04	7.38	148.49
Δ(CDS Spread)$_{60}$	107,077	-0.0029	0.3543	-0.78	13.23	-0.05	9.41	231.10
Basis	107,243	-0.2765	0.4623	-2.70	0.70	-0.15	-1.69	4.02
Stock Return	107,243	0.0510	0.1398	-0.65	2.21	0.05	0.82	9.33
Δ(Stock Volatility)	107,243	-0.0090	0.0948	-2.26	0.89	-0.01	-5.15	99.72
Δ(Leverage)	107,243	-0.0024	0.0372	-0.85	0.65	0.00	-0.80	47.39
Δ(Size)	107,243	0.0234	0.1351	-2.79	3.40	0.02	5.37	134.36
Δ(Profitability)	107,243	0.0001	0.0168	-0.45	0.48	0.00	-0.38	233.14
Δ(Cash Ratio)	107,243	-0.0001	0.0670	-1.04	1.59	0.00	4.13	121.82
Past CDS	107,243	0.4659	0.5541	0.03	15.67	0.32	6.18	65.96
Bond Return$_{20}$	70,329	0.0013	0.0195	-0.29	0.41	0.00	0.79	19.89
Bond Return$_{40}$	69,939	0.0029	0.0239	-0.35	0.46	0.00	0.69	11.71
Bond Return$_{60}$	67,888	0.0038	0.0276	-0.24	0.43	0.00	0.72	7.98

Panel B: Regression Results for the Investment Grade CDS Spread Change

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0136**	-0.0187*	-0.0449***	-0.5889	-0.8817	-0.6452	-0.0226**	-0.0426**	-0.0495*	0.0249	-0.0737*	-0.0866
	[-2.58]	[-1.85]	[-2.82]	[-1.02]	[-0.99]	[-1.01]	[-2.31]	[-2.42]	[-1.80]	[0.89]	[-1.72]	[-0.83]
Past CDS				2.1163	3.2740	2.2862	-0.0234**	-0.0158	-0.0353	-0.0047	-0.0026	0.0091
				[0.99]	[0.99]	[0.97]	[-2.04]	[-0.81]	[-1.53]	[-0.15]	[-0.06]	[0.10]
Δ(CDS Spread)$_k$							-0.0025	-0.2163*	-0.0884			
							[-0.03]	[-1.85]	[-0.78]			
Bond Return$_k$										0.5555	2.8866	0.2850
										[0.92]	[1.31]	[0.38]
Stock Return	-0.0920**	-0.1211***	-0.1465***	-4.1227	-6.5080	-4.7083	0.0160	-0.3534**	-0.2290**	0.1891	0.2046	-0.2908
	[-5.30]	[-4.39]	[-2.85]	[-1.02]	[-1.04]	[-1.06]	[0.18]	[-2.06]	[-2.55]	[1.54]	[1.31]	[-0.93]
Δ(Stock Volatility)	0.0348	0.0675	0.3612	-1.8283	-3.0933	-1.9321	0.0397	-0.2460	0.1253	0.1961	-0.4088**	0.3497
	[1.49]	[1.60]	[1.15]	[-0.99]	[-1.08]	[-1.01]	[1.16]	[-0.93]	[1.26]	[1.03]	[-2.01]	[1.20]
Δ(Leverage)	0.0367	0.1058	0.5022	-24.4024	-38.1332	-26.5960	0.0123	-0.0002	-0.5241	0.1930	0.1933	0.0901
	[0.62]	[1.15]	[1.60]	[-1.00]	[-1.01]	[-1.00]	[0.09]	[0.00]	[-1.12]	[1.16]	[-0.92]	[0.08]
Δ(Size)	-0.0320	-0.0946***	-0.1823***	-0.0118	0.0296	-0.0470	-0.0150	-0.4034*	0.0991	-0.1359	-0.1515**	0.2356
	[-1.47]	[-2.84]	[-3.59]	[-0.34]	[0.24]	[-0.44]	[-0.44]	[-1.86]	[0.49]	[-1.46]	[-2.26]	[0.62]
Δ(Profitability)	-0.1068	-0.7795***	-1.0913**	-0.1282	1.7925	1.0681	-0.2619	-0.3777	-0.5467	-0.8423**	-0.3817	0.0430
	[-0.71]	[-2.74]	[-2.34]	[-0.55]	[0.68]	[0.59]	[-0.41]	[-0.34]	[-1.58]	[-2.16]	[-0.66]	[0.08]
Δ(Cash ratio)	-0.2385*	-0.2343*	-0.4598**	-0.0563	-0.0724	-0.1383	0.0246	-0.1390	0.2175	-0.0470	-0.2507*	-0.3313***
	[-1.65]	[-1.65]	[-2.11]	[-1.12]	[-0.62]	[-1.17]	[0.30]	[-0.40]	[0.69]	[-0.93]	[-1.86}	[-3.83]
Intercept	0.0026	0.0146	0.0396	-2.4868	-3.8675	-2.6907	0.0066	-0.0313	0.0115	0.0288	-0.0462	0.0015
	[0.45]	[1.59]	[1.48]	[-0.99]	[-1.00]	[-0.98]	[0.65]	[-0.87]	[0.54]	[1.30]	[-0.92]	[0.03]
N	107,243	107,132	107,077	107,243	107,132	107,077	96,000	96,917	96,145	70,329	69,939	67,888
R^2	0.03	0.04	0.04	0.06	0.06	0.08	0.08	0.07	0.09	0.08	0.06	0.07

Panel C: Summary Statistics for the Speculative Grade CDS Spread Change

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Δ(CDS Spread)$_{20}$	24,514	-0.0010	0.2384	-0.94	12.77	-0.02	19.32	899.81
Δ(CDS Spread)$_{40}$	24,495	-0.0017	0.3114	-1.00	13.79	-0.04	11.33	411.93
Δ(CDS Spread)$_{60}$	24,459	-0.0039	0.3700	-1.00	15.32	-0.06	9.50	307.40
Basis	27,566	0.5568	1.9322	-3.08	13.35	0.11	2.93	11.18
Stock Return	24,514	0.0545	0.2967	-0.89	2.81	0.04	1.79	12.53
Δ(Stock Volatility)	24,514	-0.0033	0.1773	-1.81	2.18	-0.01	0.95	22.39
Δ(Leverage)	24,514	0.0004	0.0645	-0.55	0.35	0.00	0.63	5.22
Δ(Size)	24,514	0.0005	0.1569	-4.13	1.07	0.01	-4.21	114.90
Δ(Profitability)	24,514	0.0002	0.0276	-0.20	0.35	0.00	0.77	31.25
Δ(Cash Ratio)	24,514	0.0025	0.0653	-1.05	0.59	0.00	-0.69	38.43
Past CDS	24,514	4.3447	4.8952	0.30	60.16	2.78	2.91	11.20
Bond Return$_{20}$	16,494	0.0062	0.0458	-0.51	0.82	0.00	0.79	19.89
Bond Return$_{40}$	16,243	0.0029	0.0239	-0.35	0.46	0.00	2.46	34.33
Bond Return$_{60}$	15,361	0.0141	0.0718	-0.49	0.80	0.01	1.84	15.53

Panel D: Regression Results for the Speculative Grade CDS Spread Change

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0167	-0.0790	-0.0786	2.9434	0.7386	-1.7195	-0.0984	1.1831	-0.0565	-0.0304	-0.2922	0.4848
	[-0.55]	[-1.61]	[-1.00]	[1.02]	[1.23]	[-0.80]	[-1.01]	[0.98]	[-0.94]	[-1.09]	[-1.34]	[1.34]
Past CDS				-0.1031	-0.0938	-0.1798	-0.0095	0.1551	0.0184	0.0164	0.0473	-0.0266
				[-1.13]	[-1.61]	[-0.96]	[-0.95]	[1.28]	[0.50]	[0.90]	[1.13]	[-0.68]
Δ(CDS Spread)$_k$							-0.2175	1.1846	-0.4143			
							[-0.89]	[1.18]	[-1.07]			
Bond Return$_k$										-0.1408	2.7530	0.3513
										[-0.47]	[1.09]	[0.28]
Stock Return	0.2210	-0.5150**	-0.3158	-0.0891	-0.4941	-0.5985	-0.2731	1.5043	-0.4444**	-0.1973	-2.2204	-0.0010
	[0.82]	[-2.14]	[-1.38]	[-0.10]	[-0.70]	[-0.24]	[-1.40]	[0.91]	[-2.20]	[-0.91]	[-1.12]	[-0.00]
Δ(Stock Volatility)	0.7444	0.6841	1.7860	-22.2020	-1.9094	25.9509	-3.0308	2.5269	0.0278	-0.0989	-0.5901**	-0.0499
	[1.40]	[0.87]	[1.14]	[-1.00]	[-0.38]	[1.40]	[-0.98]	[0.77]	[0.10]	[-1.40]	[-2.17]	[-0.09]
Δ(Leverage)	12.2161	7.2030	8.8809**	-26.7665	5.5364	63.1894	-0.8304	-4.9752	-0.3330	-0.1135	-2.3241	1.8236
	[1.48]	[0.96]	[2.09]	[-0.83]	[0.48]	[1.42]	[-0.84]	[-1.06]	[-0.29]	[-0.26]	[-0.66]	[1.48]
Δ(Size)	4.5292	2.6197	2.6618*	1.1188	-1.8077	-11.0814	0.1787	-2.0810	-0.7205	0.1145	0.0623	0.4376
	[1.36]	[0.86]	[1.67]	[1.03]	[-0.58]	[-0.90]	[0.53]	[-0.78]	[-0.67]	[0.82]	[0.66]	[0.89]
Δ(Profitability)	-12.9344	-6.9365	-6.0259	1.0588	-1.8347	-5.1043	-0.4163	2.3731	-1.0411	-0.4447	-0.0265	-5.0475
	[-1.41]	[-0.83]	[-1.21]	[0.82]	[-0.66]	[-0.45]	[-0.33]	[1.36]	[-0.71]	[-0.76]	[-0.05]	[-1.32]
Δ(Cash ratio)	-0.4205	-0.4636	-0.0219	-1.3957	-6.0664	-23.9591	-0.6837	-0.1409	-0.9003	-0.0007	0.1434***	0.7474
	[-1.21]	[-1.19]	[-0.05]	[-1.37]	[-1.05]	[-1.00]	[-1.18]	[-0.65]	[-1.23]	[-0.01]	[2.92]	[1.25]
Intercept	0.3333	0.2340	0.2491	2.7095	1.0441	-0.1008	-0.1955	-0.3593	-0.1800	-0.0901	-0.6930	0.4986
	[1.19]	[0.90]	[1.49]	[1.02]	[1.52]	[-0.04]	[-1.15]	[-1.38]	[-0.91]	[-1.17]	[-1.16]	[1.47]
N	24,514	24,495	24,459	24,514	24,495	24,459	21,873	22,070	21,784	16,494	16,243	15,361
R^2	0.15	0.13	0.13	0.16	0.16	0.15	0.18	0.19	0.18	0.15	0.15	0.15

Table 7. The Risk and Returns of the Quintile Basis Portfolios in Crisis Period

The table reports the returns and risk of the quintile basis portfolios for the investment- or speculative-grade bonds for the crisis period from 2007 to 2008. Panel A reports the average holding period returns (HPR) of five basis portfolios sorted on past 60-day basis. The quintile portfolios are sorted from the lowest (quintile 1) to the highest (quintile 5) basis within investment- or speculative grade bonds. For each quintile, we compute the holding period returns for k = 20-, 40- and 60-day horizons. All portfolios are rebalanced daily and are value-weighted by market capitalization, which is calculated from the last available transaction price of the bond. To be included in the quintile portfolios, bonds must have more than 20 trades in past 60 trading days. When computing the holding period return for the basis portfolio, we use the starting price from the formation date t whenever available, followed by the latest price with a five-day window prior to the formation date. We use the end transaction price on day t+k (where k = 20, 40, 60 respectively) whenever available, followed by the last available transaction price within five day before day t+k. Bonds without the starting and ending prices are eliminated from the analysis. We report both raw and excess returns for three different holding periods. The row '1-5' refers to the difference in returns between basis portfolio 1 and 5. Basis and returns are in percentage terms. The t-statistics are reported in square. Panel B reports the time series regression of the basis portfolios returns on existing systematic risk factors for corporate bonds. The MKT, SMB, and HML are the usual stock market risk factors downloaded from Kenneth French's website on the daily frequency. The TERM factor is difference between the daily return of the 10-year-to-maturity government bond index and the daily T-bill return (from Kenneth French's website). The DEF factor is the difference between the daily return of the Lehman investment grade bond index return from Datastream and the daily 10-year-to-maturity government bond return from CRSP. LIQ is the sum of the turnover defined as the total trading volume divided by the total number outstanding for all corporate bonds from day t-k to t. AMH is the Amihud (2002) bond market liquidity risk factor, in which k (= 20, 40, or 60) represents the number of days used to calculate the price impact relative to the volume. Panel B reports the results for 20-day value-weighted HPR returns. Panel C reports the results for 40-day HPR returns and panel D reports the results for 60-day HPR returns. The row labeled '1-5' refers to the differences of intercept and slope coefficients between portfolio 1 and portfolio 5. The intercept terms and adjusted R-squared terms are in percentage terms. An *** (**, *) denotes significance at the 1% (5%, 10%) level.

Panel A: Construction of Basis Quintile Bond Portfolios

Investment Grade Bonds							
Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-0.96	-0.2744	-0.5027	-0.6467	-1.1051	-1.0951	-1.7860
2	-0.58	0.0216	-0.2066	-0.1578	-0.6162	-0.4483	-1.1392
3	-0.42	0.1023	-0.1259	-0.1426	-0.6009	-0.4469	-1.1378
4	-0.24	0.2971	0.0688	0.3397	-0.1204	0.2735	-0.4174
5	0.02	0.1360	-0.0922	0.1757	-0.2826	0.0813	-0.6095
1 – 5		**-0.4104*** [-4.17]**		**-0.8224*** [-6.94]**		**-1.1764*** [-9.53]**	

Speculative Grade Bonds							
Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-1.63	-1.0767	-1.3050	-2.1326	-2.5909	-3.0813	-3.7723
2	-0.41	-0.8016	-1.0299	-1.4223	-1.8807	-1.9764	-2.6674
3	0.23	-1.1486	-1.3769	-2.2366	-2.6950	-3.2892	-3.9801
4	0.91	-1.9140	-2.1422	-3.9919	-4.4503	-5.8755	-6.5664
5	2.76	-2.4669	-2.6952	-5.6059	-6.0643	-8.6451	-9.3451
1 – 5		**1.3901*** [4.92]**		**3.4733*** [10.58]**		**5.5727*** [15.40]**	

Panel B: Risk and Return of Basis Quintile Bond Portfolios for k=20

Investment Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0150***	0.0010***	0.0013	-0.0061***	0.0002	-0.0002**	0.0002	-0.0014*
	[-1.75]	[2.72]	[1.29]	[-5.80]	[0.19]	[-2.10]	[1.08]	[-1.70]
2	**-0.0156**	0.0000	0.0000	-0.0061***	-0.0011	-0.0001	0.0003	-0.0008
	[-1.49]	[0.05]	[0.01]	[-4.75]	[-0.76]	[-0.74]	[1.34]	[-0.72]
3	**-0.0116**	0.0002	0.0002	-0.0051***	0.0003	-0.0002**	0.0002	-0.0005
	[-1.47]	[0.60]	[0.18]	[-5.03]	[0.25]	[-2.14]	[1.15]	[-0.50]
4	**-0.0019**	-0.0002	0.0007	-0.0042***	-0.0006	-0.0001	0.0000	-0.0007
	[-0.25]	[-0.59]	[0.86]	[-5.30]	[-0.59]	[-0.64]	[0.17]	[-0.85]
5	**-0.0130**	-0.0008***	-0.0012	-0.0028***	-0.0013	-0.0001	0.0003	0.0004
	[-1.42]	[-2.89]	[-1.03]	[-2.89]	[-1.27]	[-0.53]	[1.31]	[0.42]
1-5	**-0.0020**	0.0018***	0.0025**	-0.0033***	0.0015	-0.0002*	0.0000	-0.0018*
	[-0.27]	[5.74]	[2.38]	[-3.34]	[1.41]	[-1.76]	[-0.26]	[-1.92]

Speculative Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0289****	0.0005	0.0019	-0.0073***	-0.0019	0.0008**	0.0007**	-0.0003
	[-2.04]	[0.67]	[1.16]	[-3.17]	[-0.88]	[2.40]	[2.14]	[-0.15]
2	**-0.0201**	0.0007	0.0024*	-0.0062***	-0.0004	0.0004	0.0004	0.0017
	[-1.64]	[1.04]	[1.85]	[-3.23]	[-0.19]	[1.58]	[1.57]	[0.92]
3	**-0.0391****	0.0009	0.0028	-0.0084***	0.0033	0.0003	0.0008**	-0.0002
	[-2.53]	[0.92]	[1.58]	[-3.97]	[1.18]	[0.77]	[2.28]	[-0.13]
4	**-0.0871*****	0.0012	0.0003	-0.0129***	0.0065	0.0000	0.0017***	-0.003
	[-3.08]	[0.74]	[0.09]	[-2.99]	[1.46]	[0.02]	[2.87]	[-0.87]
5	**-0.0803*****	0.0010	-0.0022	-0.0143***	0.0039	0.0004	0.0015**	0.0000
	[-2.75]	[0.41]	[-0.58]	[-3.19]	[0.62]	[0.75]	[2.46]	[-0.01]
1-5	**0.0515*****	-0.0005	0.0041	0.0070***	-0.0058	0.0004	-0.0009**	-0.0003
	[2.94]	[-0.25]	[1.53]	[2.63]	[-1.18]	[1.25]	[-2.36]	[-0.09]

Panel C: Risk and Return of Basis Quintile Bond Portfolios for k=40

Investment Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0667*** **	-0.0021***	-0.0026***	-0.0043***	-0.0030***	-0.0002	0.0007***	-0.0018
	[-6.11]	[-6.94]	[-2.81]	[-9.38]	[-3.10]	[-1.56]	[5.29]	[-1.08]
2	**-0.0263*** **	-0.0029***	-0.0062***	-0.0030***	-0.0059***	0.0001	0.0002**	-0.0012
	[-3.05]	[-9.49]	[-6.82]	[-6.47]	[-5.86]	[0.92]	[2.44]	[-0.88]
3	**-0.0299*** **	-0.0025***	-0.0047***	-0.0026***	-0.0040***	0.0001	0.0003***	-0.0011
	[-3.36]	[-10.51]	[-5.59]	[-5.52]	[-4.24]	[0.74]	[3.03]	[-0.78]
4	**-0.0038**	-0.0021***	-0.0032***	-0.0024***	-0.0035***	0.0001**	0.0000	-0.0006
	[-0.50]	[-8.91]	[-5.16]	[-5.90]	[-5.32]	[2.22]	[0.38]	[-0.49]
5	**-0.0093**	-0.0019***	-0.0049***	-0.0017***	-0.0027**	0.0001	0.0001	0.0008
	[-1.18]	[-7.83]	[-4.96]	[-3.12]	[-2.57]	[0.65]	[0.75]	[0.67]
1-5	**-0.0574*** **	-0.0003	0.0023**	-0.0026***	-0.0003	-0.0002*	0.0006***	-0.0026*
	[-5.32]	[-0.85]	[2.37]	[-4.71]	[-0.26]	[-1.89]	[4.71]	[-1.82]

Speculative Grade Bonds								
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0845*** **	-0.0016*	-0.0080***	-0.0079***	-0.0019	0.0003	0.0009***	0.0109***
	[-4.89]	[-1.71]	[-4.86]	[-5.85]	[-0.77]	[0.99]	[4.47]	[5.02]
2	**-0.0678*** **	-0.0015**	-0.0043***	-0.0077***	-0.0018	0.0003	0.0007***	0.0101***
	[-4.43]	[-2.09]	[-3.09]	[-6.11]	[-0.87]	[1.12]	[4.05]	[5.58]
3	**-0.1239*** **	-0.0014	-0.0048***	-0.0065***	0.002	-0.0002	0.0012***	0.0113***
	[-7.18]	[-1.54]	[-2.61]	[-4.52]	[0.76]	[-0.46]	[6.15]	[4.79]
4	**-0.2098*** **	-0.0045***	-0.0138***	-0.0079***	0.0030	0.0000	0.0021***	0.0103***
	[-9.55]	[-4.10]	[-4.58]	[-4.49]	[0.81]	[0.05]	[8.31]	[3.21]
5	**-0.2819*** **	-0.0037***	-0.0175***	-0.0067***	0.0052	-0.0001	0.0028***	0.0001
	[-10.84]	[-2.63]	[-6.07]	[-3.15]	[1.17]	[-0.16]	[9.48]	[0.04]
1-5	**0.1974*** **	0.0022	0.0095***	-0.0012	-0.0071*	0.0004	-0.0020***	0.0107***
	[9.55]	[1.65]	[4.56]	[-0.96]	[-1.84]	[0.96]	[-9.09]	[2.93]

Panel D: Risk and Return of Basis Quintile Bond Portfolios for k=60

				Investment Grade Bonds				
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.0756*****	0.0000	-0.0058***	0.0006	-0.0001	-0.0006***	0.0004***	-0.0055***
	[-4.12]	[0.03]	[-5.95]	[0.96]	[-0.05]	[-4.06]	[3.11]	[-2.67]
2	**-0.0287**	0.0009	-0.0073***	0.0022**	0.0013	-0.0004**	0.0001	-0.0068***
	[-1.58]	[1.33]	[-8.23]	[2.35]	[0.75]	[-2.24]	[0.78]	[-2.64]
3	**-0.0376****	0.0004	-0.0062***	0.0019*	0.0011	-0.0004**	0.0002	-0.0068***
	[-2.25]	[0.56]	[-6.99]	[1.79]	[0.65]	[-2.05]	[1.39]	[-2.79]
4	**0.0087**	0.0008	-0.0037***	0.0007	0.0006	-0.0001	-0.0001	-0.0047**
	[0.59]	[1.46]	[-5.16]	[0.84]	[0.47]	[-0.77]	[-1.04]	[-2.54]
5	**-0.0185**	0.0011*	-0.0048***	0.0017**	0.0035**	-0.0004**	0.0001	-0.0059***
	[-1.10]	[1.85]	[-6.13]	[2.01]	[2.13]	[-2.32]	[0.43]	[-2.82]
1-5	**-0.0570*****	-0.0011**	-0.0010	-0.0011**	-0.0036**	-0.0002*	0.0004***	0.0003
	[-3.84]	[-2.24]	[-1.22]	[-2.22]	[-2.38]	[-1.94]	[3.48]	[0.24]
				Speculative Grade Bonds				
Rank	**Intercept**	**MKT**	**SMB**	**HML**	**DEF**	**TERM**	**LIQ**	**AMH**
1	**-0.1167*****	-0.0039***	-0.0201***	-0.0003	-0.0086***	0.0002	0.0007***	-0.0016
	[-3.20]	[-3.44]	[-11.75]	[-0.28]	[-2.66]	[0.69]	[2.73]	[-0.50]
2	**-0.0826****	-0.0034***	-0.0157***	-0.0007	-0.0082***	0.0001	0.0005**	0.0031
	[-2.51]	[-3.21]	[-9.87]	[-0.69]	[-2.79]	[0.34]	[2.12]	[1.07]
3	**-0.1611*****	-0.0048***	-0.0177***	0.0017	-0.0072**	-0.0002	0.0010***	0.0019
	[-4.28]	[-4.12]	[-9.69]	[1.39]	[-2.13]	[-0.91]	[3.72]	[0.63]
4	**-0.3200*****	-0.0074***	-0.0242***	0.0041**	-0.0013	-0.0001	0.0021***	-0.0072*
	[-6.43]	[-4.6]	[-10.05]	[2.25]	[-0.26]	[-0.23]	[6.00]	[-1.70]
5	**-0.4925*****	-0.0072***	-0.0302***	0.0061***	0.0044	-0.0007*	0.0033***	-0.0124**
	[-8.63]	[-3.95]	[-10.7]	[2.99]	[0.82]	[-1.81]	[7.82]	[-2.11]
1-5	**0.3758*****	0.0033**	0.0101***	-0.0064***	-0.0129***	0.0009***	-0.0025***	0.0108**
	[12.62]	[2.42]	[6.01]	[-4.00]	[-4.59]	[3.20]	[-11.67]	[2.05]

Table 8. The CDS-Bond Basis and Future Individual Bond Returns in Crisis Period

The table reports the predicting power of the CDS-Bond basis for future individual bond returns. We run a standard Fama-Macbeth regression on future individual bond returns at k-day horizon (where k = 20, 40, 60) from day t onwards. Future return is the excess return of the holding period return for each bond by subtracting the risk-free return. In addition to the basis, we consider the following bond characteristics: rating, maturity, age, duration, coupon, issue size, and liquidity on day t. $Indliq_k$ is the sum of the turnover of the individual bond defined as the total trading volume divided by the total number outstanding for the bond from day t-k to t. We use the demeaned value of coupon and $Indiq_k$. Bond ratings are numbered from 1 to 10 for investment grade bonds (S&P ratings, AAA to BBB-). The basis is in percentage terms. Maturity, age, and duration are in years. Additional control variables include past CDS spread on day t (Past CDS), the change of CDS from day t-k to t ($\Delta(\text{CDS Spread})_k$), and the bond return from day t-k to day t (Bond Return_k). The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively. The sample period is from January 2007 to December 2008. Panel A reports the summary statistics for all investment grade bonds. Panel B reports the regression results for all investment grade bonds. Panel C reports the summary statistics for all speculative grade bonds. Panel D reports the regression results for all speculative grade bonds.

Panel A: Summary Statistics for Investment Grade Bonds

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Basis	109,533	-0.6070	0.7878	-3.71	0.98	-0.40	-1.38	2.03
Rating	109,533	6.9515	2.1403	1.00	10.00	7.00	-0.50	-0.32
Maturity	109,533	9.1118	7.9246	1.00	30.00	6.18	1.24	0.37
Age	109,533	5.6900	4.2682	0.00	46.76	4.80	1.08	1.35
Coupon	109,533	6.1171	1.2000	1.25	11.13	6.10	0.16	0.07
Issue Size	109,533	12.9848	0.6719	8.57	14.91	13.00	0.23	0.41
Duration	109,533	5.7772	3.4476	0.91	14.67	5.09	0.63	-0.64
Convexity	109,533	63.9065	75.6830	1.30	321.86	31.27	1.47	1.01
Δ(CDS Spread)$_{20}$	103,348	0.1321	0.3430	-0.79	6.76	0.06	2.42	15.07
Δ(CDS Spread)$_{40}$	97,527	0.2737	0.5623	-0.81	9.83	0.13	2.14	8.86
Δ(CDS Spread)$_{60}$	93,281	0.4185	0.7452	-0.87	14.01	0.19	2.23	10.35
Past CDS	109,533	0.8836	1.1976	0.01	29.94	0.56	6.30	78.33
Bond Return$_{20}$	67,472	0.0000	0.0372	-0.52	0.80	0.00	-0.04	28.03
Bond Return$_{40}$	59,633	-0.0033	0.0458	-0.60	0.86	0.00	-0.53	23.99
Bond Return$_{60}$	52,510	-0.0075	0.0468	-0.61	0.78	0.00	-1.62	21.19

Panel B: Regression Results for Investment Grade Bonds

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0195***	-0.0206***	-0.0209***	-0.0192***	-0.0196***	-0.0181***	-0.0195***	-0.0193***	-0.0178***	-0.0153***	-0.0145***	-0.0137***
	[-38.83]	[-29.87]	[-25.16]	[-27.10]	[-20.58]	[-19.68]	[-25.73]	[-19.78]	[-17.07]	[-13.70]	[-15.42]	[-11.75]
Past CDS				0.0011	-0.0013	-0.0065***	0.0013	-0.0011	-0.0059***	-0.0030***	-0.0079***	-0.0137***
				[1.04]	[-0.89]	[-4.26]	[1.28]	[-0.77]	[-3.95]	[-2.62]	[-6.19]	[-9.16]
Δ(CDS Spread)$_k$							-0.0060**	-0.0074***	-0.0075***			
							[-2.40]	[-2.85]	[-3.53]			
Bond Return$_k$										-0.1969***	-0.2014***	-0.1648***
										[-14.29]	[-10.42]	[-7.30]
Ratings	-0.0023***	-0.0030***	-0.0031***	-0.0023***	-0.0029***	-0.0023***	-0.0024***	-0.0029***	-0.0024***	-0.0019***	-0.0020***	-0.0022***
	[-7.31]	[-5.73]	[-6.18]	[-5.66]	[-4.71]	[-4.44]	[-5.94]	[-5.21]	[-4.59]	[-4.74]	[-3.97]	[-4.06]
Maturity	-0.0004***	-0.0008***	-0.0012***	-0.0005***	-0.0006**	-0.0011***	-0.0004***	-0.0006**	-0.0011***	-0.0004***	-0.0009***	-0.0011***
	[-2.77]	[-4.72]	[-7.39]	[-3.36]	[-2.28]	[-7.15]	[-2.88]	[-2.28]	[-7.00]	[-2.61]	[-5.13]	[-6.24]
Age	-0.0002***	-0.0001	-0.0001	-0.0002***	-0.0002	-0.0001	-0.0003***	-0.0002**	-0.0001	-0.0001	-0.0001	0.0000
	[-3.93]	[-0.63]	[-0.51]	[-2.81]	[-1.52]	[-0.88]	[-4.42]	[-1.79]	[-1.08]	[-1.47]	[-0.72]	[0.29]
Coupon	-0.1263***	-0.1784***	-0.1789***	-0.1266***	-0.1447***	-0.1350***	-0.1374***	-0.1495***	-0.1189***	-0.1311***	-0.1381***	-0.1665***
	[-4.77]	[-6.35]	[-6.28]	[-5.77]	[-5.07]	[-5.58]	[-6.45]	[-5.82]	[-5.02]	[-4.52]	[-4.38]	[-5.93]
Issue Size	-0.0010*	-0.0014	-0.0002	-0.0010**	-0.0007	-0.0006	-0.0010**	-0.0009	-0.0008	-0.0002	-0.0011	-0.0004
	[-1.92]	[-1.15]	[-0.26]	[-2.14]	[-1.03]	[-0.80]	[-2.11]	[-1.13]	[-1.02]	-0.27	[-1.50]	[-0.52]
Indliq$_k$	0.0269***	0.0198***	0.0114**	0.0095**	0.0112***	0.0108**	0.0101**	0.0111***	0.0114***	0.0343***	0.0075*	0.0114**
	[3.99]	[3.47]	[2.10]	[2.02]	[3.23]	[2.58]	[2.26]	[3.03]	[2.59]	[2.91]	[1.65]	[2.48]
Intercept	0.0220***	0.0323*	0.0180*	0.0215***	0.0195**	0.0221**	0.0201***	0.0223**	0.0266***	0.0106	0.0257***	0.0238**
	[3.44]	[1.84]	[1.79]	[3.89]	[2.40]	[2.40]	[3.23]	[2.36]	[2.69]	[1.49]	[3.04]	[2.15]
N	109,533	104,472	100,426	109,533	104,472	100,426	103,348	97,527	93,281	67,472	59,633	52,510
R^2	0.20	0.22	0.21	0.26	0.28	0.27	0.27	0.29	0.29	0.31	0.34	0.32

Panel C: Summary Statistics for Speculative Grade Bonds

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Basis	44,350	0.2646	2.4481	-7.12	15.20	0.15	1.38	7.01
Rating	44,350	14.2652	2.1284	11.00	19.00	14.00	-0.01	-1.17
Maturity	44,350	8.1004	6.0881	1.00	29.99	5.95	1.25	0.69
Age	44,350	6.4385	4.4625	0.01	48.71	5.45	1.02	1.83
Coupon	44,350	7.6019	1.2151	3.63	12.25	7.63	0.24	1.19
Issue Size	44,350	12.8300	0.6199	9.90	14.67	12.90	0.16	0.13
Duration	44,350	4.8770	2.4182	0.78	12.82	4.45	0.63	-0.18
Convexity	44,350	42.4852	44.4111	0.93	261.54	25.34	1.67	2.31
Δ(CDS Spread)$_{20}$	41,494	0.0898	0.2705	-0.88	3.48	0.03	2.53	15.75
Δ(CDS Spread)$_{40}$	39,268	0.1818	0.4295	-0.89	5.14	0.07	2.04	7.97
Δ(CDS Spread)$_{60}$	37,547	0.2762	0.5682	-0.90	7.88	0.13	2.17	8.39
Past CDS	44,350	6.1238	6.9241	0.06	111.32	4.32	3.35	16.95
Bond Return$_{20}$	29,555	-0.0140	0.0712	-0.62	0.63	0.00	-1.89	12.66
Bond Return$_{40}$	26,356	-0.0276	0.0943	-0.69	0.55	-0.01	-1.76	7.32
Bond Return$_{60}$	23,388	-0.0412	0.1107	-0.69	0.57	-0.01	-1.58	5.20

Panel D: Regression Results for Speculative Grade Bonds

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0048***	-0.0069***	-0.0080***	-0.0057***	-0.0053***	-0.0033***	-0.0057***	-0.0052***	-0.0031**	-0.0022*	0.0104	-0.0033
	[-11.95]	[-16.81]	[-13.68]	[-9.98]	[-6.13]	[-2.77]	[-9.98]	[-6.04]	[-2.57]	[-1.70]	[0.78]	[-1.35]
Past CDS				0.0009*	-0.0015**	-0.0044***	0.0009*	-0.0014*	-0.0034***	-0.0021***	0.0056	-0.0057*
				[1.75]	[-2.07]	[-4.38]	[1.74]	[-1.94]	[-3.48]	[-2.72]	[0.55]	[-1.79]
Δ(CDS Spread)$_k$							-0.0067	-0.0023	-0.0128***			
							[-1.18]	[-0.52]	[-4.29]			
Bond Return$_k$										-0.1268***	0.4139	-0.2361*
										[-3.10]	[0.75]	[-1.92]
Ratings	-0.0011	-0.0024***	-0.0034***	-0.0010**	-0.0009*	-0.0002	-0.0012***	-0.0012**	-0.0014*	-0.0002	-0.0174	0.0008
	[-1.55]	[-2.88]	[-3.81]	[-2.39]	[-1.66]	[-0.33]	[-2.78]	[-2.18]	[-1.96]	[-0.38]	[-1.00]	[0.66]
Maturity	-0.0005***	-0.0013***	-0.0021***	-0.0006***	-0.0015***	-0.0021***	-0.0006***	-0.0015***	-0.0024***	-0.0009***	-0.0020***	-0.0022***
	[-2.86]	[-5.04]	[-6.81]	[-3.35]	[-5.04]	[-6.32]	[-3.30]	[-5.31]	[-6.88]	[-3.63]	[-4.01]	[-5.64]
Age	0.0000	-0.0003	-0.0007***	0.0000	-0.0003	-0.0007***	0.0000	-0.0003	-0.0006***	-0.0001	0.0044	-0.0011***
	[0.09]	[-1.21]	[-3.83]	[-0.04]	[-1.56]	[-3.55]	[-0.23]	[-1.18]	[-3.20]	[-0.20]	[0.93]	[-2.75]
Coupon	0.0639	-0.0410	-0.0938	0.0665	0.0121	0.0334	0.0439	0.0363	0.0846	0.0394	0.0998	0.2123
	[0.87]	[-0.60]	[-1.10]	[0.93]	[0.19]	[0.39]	[0.66]	[0.54]	[0.89]	[0.34]	[1.23]	[1.41]
Issue Size	-0.0024	-0.0043**	-0.0088***	-0.0022	-0.0035**	-0.0071***	-0.0034**	-0.0048***	-0.0083***	-0.0023	-0.0065***	-0.0160***
	[-1.25]	[-2.26]	[-4.92]	[-1.34]	[-2.06]	[-4.74]	[-2.10]	[-2.72]	[-5.13]	[-0.81]	[-3.22]	[-3.77]
Indliq$_k$	0.0370*	0.0068	-0.0045	0.0348*	0.0117	0.0037	0.0291	0.0114	-0.0049	0.0509	0.0031	-0.0143
	[1.84]	[0.40]	[-0.27]	[1.96]	[0.85]	[0.27]	[1.56]	[0.88]	[-0.36]	[1.48]	[0.20]	[-0.67]
Intercept	0.0350	0.0701**	0.1352***	0.0320	0.0489*	0.0903***	0.0494**	0.0677**	0.1202***	0.0317	0.2535	0.1977***
	[1.23]	[2.33]	[4.94]	[1.37]	[1.96]	[4.23]	[2.13]	[2.54]	[5.02]	[0.80]	[1.39]	[3.57]
N	44,350	42,621	41,081	44,350	42,621	41,081	41,494	39,268	37,547	29,555	26,356	23,388
R^2	0.14	0.18	0.19	0.19	0.24	0.25	0.21	0.26	0.27	0.27	0.32	0.33

Table 9. The CDS-Bond Basis and Future CDS Spread Change in Crisis Period

The table reports the predicting power of the CDS-Bond basis for future individual CDS spread changes. We run a standard Fama-Macbeth regression on future individual CDS spread changes at k-day horizon (where k = 20, 40, 60) from day t onwards. Future spread change is the percentage change in CDS spreads. In addition to the basis, we consider the following firm characteristics: stock price, stock volatility, leverage, size, profitability, and cash ratio on day t. Stock return is the percentage change in stock price for the past three months, i.e. from the four months to one month prior to the month when day t belongs to. Δ(Stock Volatility) is the change in stock volatility, defined as the standard deviation of daily stock prices for the past 60 days, for the past three months. Δleverage is the change in market leverage, defined as the book value of debt divided by the market value of asset, for the past three months. Δ(size) is the change in the logarithm of the market value of asset, defined as the book value of debt plus the market value of equity, for the past three months. Δ(Profitability) is the change in profitability, defined as the income before the tax and interests divided by the market value of asset, for the past three months. Δ(Cash Ratio) is the change in the ratio of cash divided by the market value of asset, for the past three months. The basis is in percentage terms. Additional control variables include past CDS spread on day t (Past CDS), the change of CDS from day t-k to t ($\Delta(\text{CDS Spread})_k$), and the bond return from day t-k to day t (Bond Return_k). The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively. The sample period is from January 2007 to December 2008. Panel A reports the summary statistics for all investment grade bonds. Panel B reports the regression results for all investment grade bonds. Panel C reports the summary statistics for all speculative grade bonds. Panel D reports the regression results for all speculative grade bonds.

Panel A: Summary Statistics for the Investment Grade CDS Spread Change

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Δ(CDS Spread)$_{20}$	50,603	0.1355	0.3469	-0.79	6.76	0.07	2.61	17.05
Δ(CDS Spread)$_{40}$	48,517	0.2889	0.5761	-0.81	9.83	0.16	2.50	12.83
Δ(CDS Spread)$_{60}$	46,721	0.4425	0.7636	-0.88	13.53	0.24	2.63	14.22
Basis	50,603	-0.6126	0.8292	-5.02	2.16	-0.41	-1.58	4.26
Stock Return	50,603	-0.0111	0.1729	-0.92	1.24	0.00	-0.41	3.03
Δ(Stock Volatility)	50,603	0.0476	0.1545	-1.31	2.14	0.02	3.87	33.50
Δ(Leverage)	50,603	0.0084	0.0356	-0.63	0.33	0.00	1.17	17.53
Δ(Size)	50,603	0.0103	0.1265	-0.89	0.66	0.00	-0.80	5.06
Δ(Profitability)	50,603	-0.0009	0.0264	-0.76	0.81	0.00	-2.20	461.02
Δ(Cash Ratio)	50,603	0.0027	0.0491	-0.45	0.56	0.00	-0.15	22.85
Past CDS	50,603	0.8417	1.3331	0.03	31.20	0.48	7.39	90.64
Bond Return$_{20}$	35,877	-0.0003	0.0385	-0.49	0.94	0.00	1.25	59.89
Bond Return$_{40}$	33,596	-0.0045	0.0465	-0.54	1.20	0.00	0.58	50.26
Bond Return$_{60}$	31,950	-0.0084	0.0466	-0.55	1.03	0.00	-1.56	32.50

Panel B: Regression Results for the Investment Grade CDS Spread Change

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0043	-0.0090	-0.0053	0.0044	0.0089	0.0200	-0.0931	0.0176	0.0415**	0.0291	0.6144	-0.0093
	[-0.65]	[-0.78]	[-0.38]	[0.68]	[0.72]	[1.27]	[-1.01]	[1.36]	[2.17]	[1.37]	[0.87]	[-0.24]
Past CDS				-0.0571***	-0.1200***	-0.1449***	-0.0679***	-0.0783***	-0.0919**	-0.0663	0.1483	-0.1854***
				[-4.71]	[-4.54]	[-3.35]	[-2.70]	[-2.78]	[-2.36]	[-1.65]	[0.70]	[-2.81]
Δ(CDS Spread)$_k$							-0.0609	-0.1078***	-0.0952***			
							[-0.62]	[-2.65]	[-3.24]			
Bond Return$_k$										0.4471	-0.9312	-0.7534
										[1.09]	[-0.62]	[-1.22]
Stock Return	-0.1569***	-0.2508***	-0.3791***	-0.1953***	-0.2939***	-0.3917***	-0.1773***	-0.3168***	-0.4224***	0.2361***	-8.3636	-0.3663*
	[-3.71]	[-3.58]	[-4.12]	[-4.35]	[-4.08]	[-4.26]	[-4.67]	[-4.68]	[-4.87]	[-3.22]	[-1.02]	[1.70]
Δ(Stock Volatility)	0.0017	0.0420	0.0814	0.0476	0.1308	0.15	0.0278	0.1253	0.1586	-0.0051	-1.4031	-0.0071
	[0.03]	[0.50]	[0.69]	[0.91]	[1.51]	[1.19]	[0.54]	[1.53]	[1.31]	[-0.04]	[-1.05]	[-0.03]
Δ(Leverage)	0.3563***	1.1422***	1.9288***	0.3685***	1.2152***	2.1296***	0.3592***	1.4342***	2.2480***	0.5206	-30.1478	2.4569***
	[2.86]	[5.42]	[8.10]	[2.93]	[5.51]	[8.01]	[3.03]	[6.09]	[7.40]	[0.92]	[-0.94]	[3.99]
Δ(Size)	0.0162	-0.0006	0.1036	0.0313	0.0089	0.0691	0.0077	0.0164	0.0440	-0.0487	15.6915	0.0017
	[0.32]	[-0.01]	[0.80]	[0.60]	[0.09]	[0.54]	[0.16]	[0.18]	[0.34]	[-0.33]	[1.00]	[0.01]
Δ(Profitability)	-0.5466***	-0.4874*	0.5501	-0.6848***	-0.7432**	0.3294	-0.6084***	-0.4435	0.6198	-2.5682*	-63.3013	-0.5115
	[-3.57]	[-1.65]	[1.14]	[-4.45]	[-2.45]	[0.73]	[-3.71]	[-1.29]	[1.31]	[-1.91]	[-1.02]	[-0.23]
Δ(Cash ratio)	-0.0220	-0.1023	-0.3597**	-0.0293	-0.0608	-0.1525	0.0121	-0.0625	-0.1686	-0.6231	2.321	0.6985
	[-0.24]	[-0.74]	[-2.15]	[-0.31]	[-0.45]	[-0.96]	[0.13]	[-0.47]	[-1.07]	[-1.23]	[0.97]	[1.13]
Intercept	0.1173***	0.2537***	0.3964***	0.1428***	0.3019***	0.4551***	-0.0295	0.3111***	0.4514***	0.1546***	0.5345	0.4497***
	[5.90]	[7.18]	[8.24]	[6.75]	[7.58]	[8.44]	[-0.17]	[7.30]	[8.55]	[5.63]	[1.38]	[7.99]
N	50,603	48,517	46,721	50,603	48,517	46,721	47,743	45,372	43,535	35,877	33,596	31,950
R^2	0.08	0.10	0.11	0.11	0.12	0.14	0.13	0.17	0.15	0.13	0.14	0.17

Panel C: Summary Statistics for the Speculative Grade CDS Spread Change

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
Δ(CDS Spread)$_{20}$	14,969	0.0922	0.2662	-0.64	2.36	0.03	2.19	8.81
Δ(CDS Spread)$_{40}$	14,438	0.2020	0.4268	-0.62	4.53	0.09	1.99	6.41
Δ(CDS Spread)$_{60}$	13,940	0.3126	0.5698	-0.71	5.50	0.16	2.16	7.69
Basis	14,969	0.0485	2.0604	-10.13	12.83	0.03	0.54	6.79
Stock Return	14,969	-0.0226	0.2861	-0.89	2.57	-0.02	0.55	4.22
Δ(Stock Volatility)	14,969	0.0560	0.2113	-1.22	1.91	0.03	1.49	12.70
Δ(Leverage)	14,969	0.0083	0.0695	-0.32	0.38	0.00	0.57	4.41
Δ(Size)	14,969	-0.0113	0.1762	-0.82	0.84	0.00	-0.65	3.93
Δ(Profitability)	14,969	0.0002	0.0335	-0.27	0.26	0.00	-0.78	31.67
Δ(Cash Ratio)	14,969	0.0041	0.0771	-0.56	0.39	0.00	-2.17	21.69
Past CDS	14,969	5.7205	6.7749	0.23	93.30	3.87	3.48	17.05
Bond Return$_{20}$	10,951	-0.0125	0.0637	-0.56	0.95	0.00	-1.84	15.36
Bond Return$_{40}$	10,447	-0.0225	0.0861	-0.71	0.50	0.00	-1.88	8.95
Bond Return$_{60}$	9,917	-0.0302	0.1018	-0.76	-0.50	0.00	-1.72	6.71

Panel D: Regression Results for the Speculative Grade CDS Spread Change

	Model 1			Model 2			Model 3			Model 4		
	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60	k=20	k=40	k=60
Basis	-0.0040	0.0010	0.0058	-0.0047	0.0046	0.0053	-0.0074	0.0018	-0.0117	-0.0523	-0.2336	0.1056
	[-1.31]	[0.22]	[1.03]	[-1.05]	[0.81]	[0.65]	[-1.58]	[0.29]	[-1.38]	[-1.07]	[-1.24]	[0.87]
Past CDS				-0.0001	-0.0045	-0.0051	0.0026	-0.0019	0.0003	0.0489	-0.0024	0.0452
				[-0.03]	[-1.07]	[-1.04]	[0.95]	[-0.43]	[0.06]	[0.96]	[-0.10]	[0.62]
Δ(CDS Spread)$_k$							0.0230	-0.0681**	0.0252			
							[0.64]	[-2.10]	[0.54]			
Bond Return$_k$										3.6913	0.0211	-1.0478
										[0.90]	[0.02]	[-1.02]
Stock Return	-0.1790***	-0.2651***	-0.2558***	-0.1679***	-0.2767***	-0.2808***	-0.1846***	-0.3324***	-0.3143***	-0.1858***	-0.0322	-0.3022***
	[-7.06]	[-6.59]	[-5.22]	[-5.88]	[-5.87]	[-5.08]	[-5.33]	[-5.12]	[-4.14]	[-3.87]	[-0.20]	[-4.38]
Δ(Stock Volatility)	-0.0133	-0.0509	-0.0424	-0.0172	-0.0674*	-0.0637	-0.0243	-0.0745*	-0.1202*	0.0687	-0.0769	-0.1594**
	[-0.65]	[-1.55]	[-0.86]	[-0.81]	[-1.88]	[-1.27]	[-1.05]	[-1.83]	[-1.94]	[0.48]	[-1.25]	[-2.06]
Δ(Leverage)	-0.0537	0.2071	0.5682***	-0.0262	0.1899	0.5200***	-0.0625	0.1301	0.3668*	-0.0319	0.1668	0.2566
	[-0.64]	[1.41]	[3.17]	[-0.30]	[1.21]	[2.74]	[-0.67]	[0.68]	[1.75]	[-0.30]	[0.96]	[1.05]
Δ(Size)	0.0194	0.0807*	0.0948	0.0157	0.0937*	0.1136*	0.0308	0.1308**	0.1992***	-0.0522	0.0537	0.1973*
	[0.66]	[1.74]	[1.49]	[0.51]	[1.81]	[1.69]	[0.91]	[2.20]	[2.61]	[-1.60]	[0.97]	[1.69]
Δ(Profitability)	-0.4399***	-0.8590***	-0.3509	-0.4466***	-0.8600***	-0.4674	-0.5158***	-0.9905***	-0.0007	-0.4744**	-1.0600***	-0.0846
	[-2.92]	[-3.65]	[-1.07]	[-2.99]	[-3.57]	[-1.41]	[-3.29]	[-3.81]	[0.00]	[-2.51]	[-3.73]	[-0.26]
Δ(Cash ratio)	-0.2898***	-0.6675***	-1.4073	-0.2778***	-0.6274***	-1.3510***	-0.2358***	-0.6693***	-1.6201***	-0.3889***	-0.7468***	-1.6997***
	[-3.91]	[-4.67]	[-6.66]	[-3.65]	[-4.33]	[-6.28]	[-2.88]	[-4.52]	[-5.83]	[-4.88]	[-4.32]	[-5.17]
Intercept	0.0925***	0.2247***	0.3485***	0.0786***	0.2240***	0.3415***	0.0671***	0.2328***	0.3357***	0.0269	0.1417	0.2969**
	[6.20]	[8.40]	[9.53]	[4.13]	[6.89]	[8.77]	[3.42]	[6.93]	[8.56]	[0.37]	[1.05]	[2.37]
N	14,969	14,438	13,940	14,969	14,438	13,940	14,002	13,354	12,846	10,951	10,447	9,917
R^2	0.06	0.06	0.04	0.08	0.07	0.05	0.12	0.09	0.08	0.11	0.10	0.08

Figure 1: The Size of CDS and Corporate Bond Market

This figure displays the time trend of the outstanding notional amount of the credit default swap (CDS) and Corporate Bond market from December 2004 to June 2009 from Bank of International Settlement. The three data series represent the amount of the CDS contracts, the single-name CDS contracts and the corporate bonds respectively.

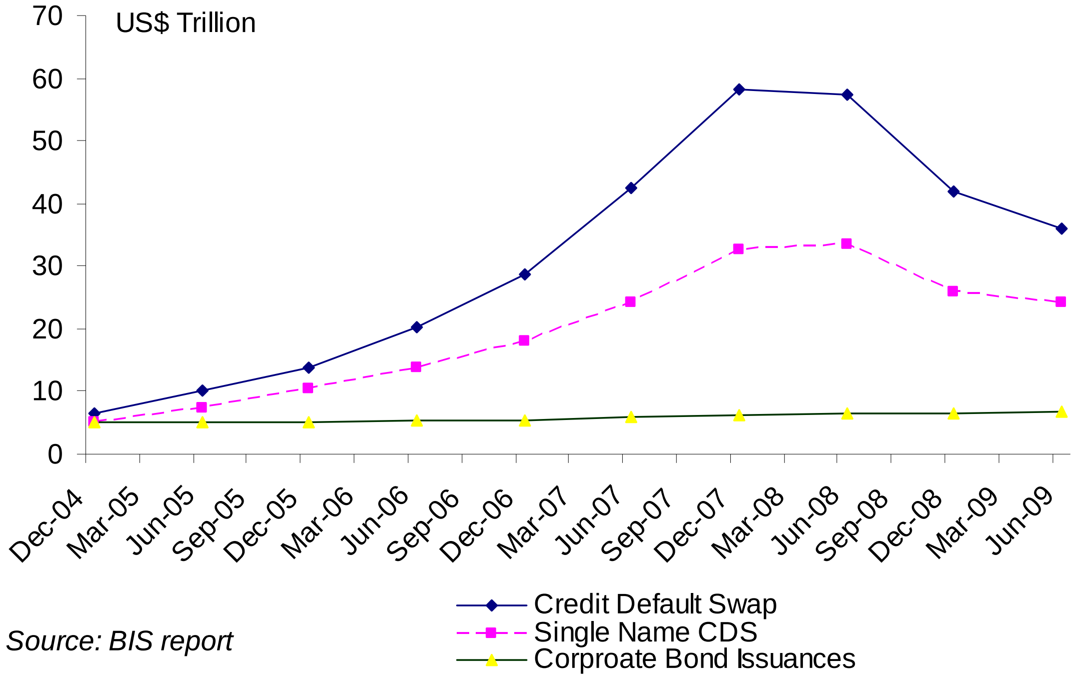
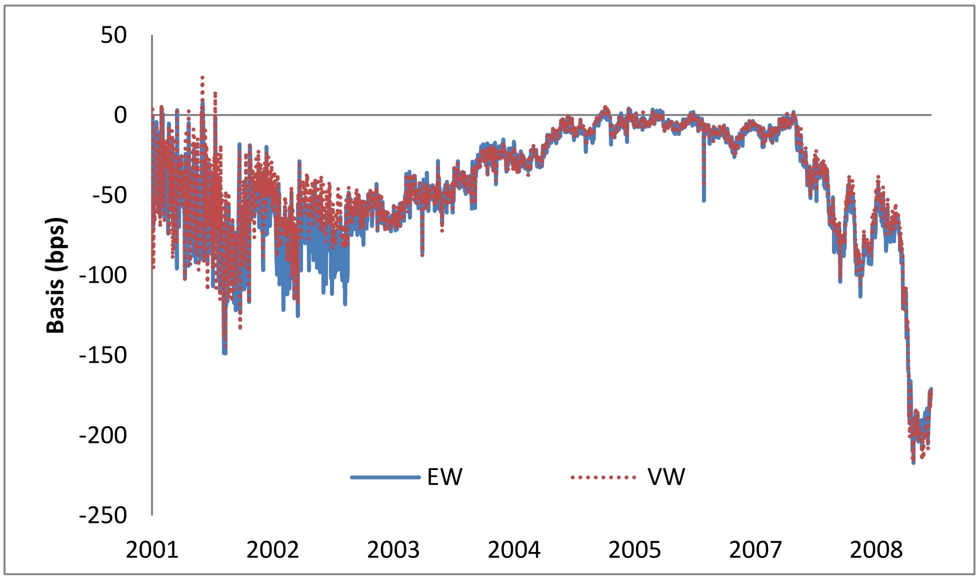


Figure 2: The Time Series of CDS-Bond Basis Indices

This figure provides the time series plots of equally- and value-weighted CDS-Bond basis indices constructed from the corporate bonds between 2001 and 2008. The CDS-Bond basis is the difference between the CDS spread of a reference firm and the Z-spread of the corresponding firm's cash corporate bond. Panel A presents the equally-weighted (EW) and value-weighted (VW) basis indices for investment grade bonds and Panel B for speculative grade bonds.

Panel A: The Basis Index for Investment Grade Bonds



Panel B: The Basis Index for Speculative Grade Bonds