The CDS-Bond Basis Arbitrage and the Cross Section of Corporate Bond Returns

Gi H. Kim, Haitao Li, Weina Zhang*

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* Kim is from Warwick Business School, University of Warwick, Coventry, CV4 7AL, United Kingdom. His email is gi.kim@wbs.ac.uk, telephone: +44 (0)24 7652 3849. Li is from Cheung Kong Graduate School of Business, Beijing, 100738, China. His email is htli@ckgsb.edu.cn. Zhang is from NUS Business School, National University of Singapore, Singapore. Her email is weina@nus.edu.sg.

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Abstract

We provide a comprehensive empirical analysis on the implication of CDS-Bond basis arbitrage for the pricing of corporate bonds. Basis arbitrageurs introduce new risks such as funding liquidity and counterparty risk into the corporate bond market, which was dominated by passive investors before the existence of CDS. We show that a basis factor, constructed as the return differential between LOW and HIGH quintile basis portfolios, is a superior empirical proxy that captures the new risks. In the cross section of investment grade bond returns, the basis factor carries an annual risk premium of about 3% in normal periods. However, speculative grade bonds are not affected by the basis factor as they are not widely used in the basis arbitrage.

JEL Classification: G10, G12

Keywords: Credit Default Swap, CDS-Bond Basis Arbitrage, Corporate Bond Returns, Basis Risk Factor, Financial Crisis, Funding Liquidity, Counterparty Risk, Limits-to-Arbitrage

The credit derivatives markets have experienced tremendous growth during the past decade. 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. Credit derivatives have fundamentally changed market practices in the investment, trading, and management of credit risk. Traditionally, institutional investors, such as pension funds and insurance companies, typically adopt a buy-and-hold strategy in their investments in cash corporate bonds. Nowadays, speculators, such as hedge funds and proprietary trading desks of investment banks, can easily long and short the credit risk of individual companies or portfolios of companies using credit derivatives.[1]

The single-name credit default swap (CDS) is the most liquid and popular product and accounts for more than two thirds of all outstanding credit derivatives. Since its first appearance in late 1990s, CDS has been widely used 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 and bond spread should follow a co-integrated process since they measure the credit risk of the same company.[2] Investors can easily 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

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

the basis. Since it is generally more difficult to short corporate bonds, the negative basis trade has been more popular in practice.

Unlike standard textbook arbitrage, arbitrage in practice is always risky. Arbitrageurs in the basis trade face a wide variety of risks. First, non-zero basis could be due to contractual differences between cash bond and CDS and does not necessarily represent pure arbitrage profits. Second, due to the well-known limits-to-arbitrage constraints of Shleifer and Vishny (1997), arbitrageurs could lose money even in potentially profitable trades. For example, levered arbitrageurs in the basis trade could face funding liquidity risk. Arbitrageurs could also face counterparty risk, mostly from sellers of CDS contracts, liquidity risks in both bond and CDS markets, as well as deleveraging risks from other levered players. Therefore, in practice, the basis trade is never a pure arbitrage, but a risky investment with its own risks and rewards.

The huge losses in the basis trade suffered by Deutsche Bank, Merrill Lynch, Citadel and others during the current financial crisis highlight the risks involved in this trade. The equal- and value-weighted index of the basis for investment grade bonds in Figure 2 exhibit wild fluctuations during extreme market turmoil in 2007 and 2008. The widening of the negative basis was further accelerated by the unwinding of levered arbitrageurs due to heightened uncertainty and their funding constraints, creating significant disruptions in the credit market. The basis only started to revert back to a normal level after the U.S. government stepped in and injected capital to major financial firms through the Troubled Asset Relief Program and the Supervisory Capital Assessment Program.[3]

Given the dramatic disruptions in the credit market caused by the unwinding of the basis trade, in this paper, we study the potential impacts of the basis trade on the pricing of underlying cash corporate bonds. The basis arbitrage attracts arbitrageurs to the bond market, which has

[3] See the Board of Governors of the Federal Reserve System (2009) and Duffie (2010).

been dominated by buy-and-hold investors. Consequently, the risks involved in the basis trade could affect the pricing of cash corporate bonds through trading activities of the arbitrageurs. The existence of arbitraging channel can transmit not only the new risk from CDS market but also the risk of basis trade into corporate bond pricing.[4] Such pricing impact is very similar to that of foreign speculators on emerging market equity returns documented in Bekaert and Harvey (2000). While one can test whether each individual risk involved in the basis trade affects corporate bond returns, it is more important to understand the total pricing effect of these new risks on corporate bond returns together with existing systematic risk factors. Recent literature also suggests that these new risk factors may not capture all the risks involved in the basis trade and these risk factors can reinforce each other.[5] Hence, we construct a new risk factor based on basis level as a convenient empirical proxy of all the risks involved in the basis trade and test whether it plays a role for pricing corporate bonds.

Our paper provides several interesting new empirical findings on the basis and its relation to both the time series and cross section of corporate bond returns. First, we show that the basis level of each individual bond can outperform conventional bond characteristics in predicting its future return. We compute the basis for each corporate bond in our sample using CDS spread from Markit and bond prices from TRACE and NAIC between 2001 and 2008. We have about

[4] For example, Liu and Mello (2011) argue that the capital fragility of arbitrageurs such as hedge funds can disrupt the pricing of their traded financial assets. Gârleanu and Pedersen (2011) also predict that the sudden increase of margin requirements for some assets can cause the price to deviate from its fundamental value and margin requirements are common in arbitrage activities. Moreover, Arora, Gandhi, and Longstaff (2012) show that counterparty risk is non-negligibly priced in CDS. Intuitively, the expected return of a given asset mainly depends on its exposure to systematic risk factors that influence the marginal rate of substitution (hereafter MRS) of the dominant investors in the asset. Without CDS, expected returns of cash corporate bonds should depend mainly on their exposures to risk factors that influence the MRS of traditional buy-and-hold investors. With CDS and the basis trade, expected returns of corporate bonds should depend also on the risk factors that influence the MRS of basis arbitrageurs.

[5] For example, Bai and Collin-Dufresne (2013) find that a few risks in the basis trade explain less than 50% of the whole basis. Moreover, Brunnermeier and Pedersen (2009) show that market liquidity and funding liquidity can be mutually reinforcing and Aragon and Strahan (2012) also provide empirical evidence that shocks to traders' funding liquidity reduce the market liquidity of the assets that they trade.

890 investment grade bonds in each year. The time series average of the basis for individual bonds is negative at -35 basis points, suggesting a somewhat permanent discrepancy between CDS and bond spread. We find that bonds with more negative basis tend to be older, have lower rating, longer maturity, higher coupon, duration, and convexity. In Fama-Macbeth (1973) regression, we find that the basis level is negatively related to future returns of individual bonds.

Second, we provide strong evidence that the basis is a new risk factor in explaining the cross section of expected corporate bond returns. We form five bond portfolios based on past average basis and find that the return of longing the LOW quintile basis portfolio and shorting the HIGH one (i.e., a LMH strategy) is significantly positive. After we group bonds according to their characteristics and subsequently construct a LMH basis portfolio within each characteristic group, we still find significant returns for the LMH portfolio in most groups. This finding suggests that this portfolio formation method can plausibly provides a convenient new risk proxy that is independent of bond characteristics and known risks. Using the LMH portfolio formed on all bonds as a new basis risk factor, we run Fama-Macbeth (1973) regression for twenty bond portfolios sorted on rating and maturity on this basis risk factor after controlling for all existing systematic risk factors. We find that the risk premium associated with the basis risk factor is significantly positive at about 3% per annum between 2002 and 2006.

Third, we provide more direct evidence that the basis risk factor outperform the existing empirical proxies for the new risks from basis arbitrage. Following the literature, we use TED spread, FINRET, and VIX to proxy for funding liquidity, counterparty risk, and aggregate collateral risk respectively.[6] We find that the basis risk factor is significantly related to them

[6] Specifically, TED spread is the difference between 3-month uncollateralized LIBOR rate minus 3-month T-bill rate, FINRET is the value-weighted excess return of all investment bank equities from CRSP with SIC code 6211, and VIX is the Chicago Board Options Exchange (CBOE) Market Volatility Index that is the implied volatility of S&P 500 index options.

individually and jointly in the presence of existing systematic risk factors. More important, the basis risk premium remains to be significant when we run standard asset pricing tests by including these new risk proxies. The success of the basis risk factor in the horse race confirms our conjecture that the basis factor is a superior empirical proxy for new risks. We also verify that the basis factor is not significantly priced in speculative grade bonds, which are less popular among arbitrageurs for the basis trade.

Finally, we provide interesting evidence on the breakdown of normal pricing relation in the corporate bond market during the current financial crisis in 2007 and 2008. In fact, the basis risk premium becomes negative at about -5% per annum in 2007 and 2008. Other systematic risk factors, such as the market, *HML*, *DEF*, and liquidity factors, exhibit negative risk premiums as well during the crisis. The negative basis risk premium indicates that the corporate bond market experienced significant price disruptions as it was abandoned by investors during the financial crisis. The normal price-adjusting mechanism fails to correct for the mispricing of these bonds. The heightened counterparty risk, funding risk, and uncertainty after the Lehman bankruptcy drive corporate bond prices far away from their fundamental values. Further forced sale of highly leveraged arbitrageurs in credit market drives the demand for corporate bonds further down. As a result, the risk premiums become negative during the crisis. Moreover, we also find that both counterparty risk and funding liquidity factors still carry economically and statistically significant risk premiums in the presence of the basis risk factor, suggesting that basis arbitrageurs between CDS and bond market have not priced in these new risks sufficiently during the crisis as compared to normal periods. Our findings here establish the severity of market imperfections in the financial market during the financial crisis.

There is a fast growing literature on CDS spread and the basis. While earlier studies mainly focus on the co-integration of CDS and bond spread, recent studies have examined the existence and determinants of the basis and the cause of the abnormal basis level during the financial crisis. For example, Mitchell and Pulvino (2012) show that loss of confidence about primary brokers and subsequently spread-over effect to the rehypothecation lenders and their clients - hedge funds, slow down the movement of investment capital. Duffie (2010) generalizes that slow-moving capital is a pervasive market friction over time and across different asset classes. Bai and Collin-Dufresne (2013) 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.

Our paper differs from the above studies in fundamental ways. Instead of focusing on the determinants of the basis, we study the potential impacts of the basis arbitrage trade on the pricing of cash corporate bonds. By constructing a new risk factor based on the basis level for corporate bond returns, our paper contributes to the well-established asset pricing literature on corporate bonds. Fama and French (1993) find that a two-factor model with *TERM* and *DEF* factors captures almost all the common variations in investment grade bond excess returns.[7] Gebhardt, Hvidkjaer and Swaminathan (2005) find that systematic risk factors such as *TERM* and *DEF* are more important than the characteristics measures such as ratings and duration in explaining the cross-sectional returns of bond portfolios and individual bonds. Many recent papers also demonstrate that liquidity risk is an important systematic risk in the returns of

[7] *TERM* is the difference between long-term government bond return and the one-month Treasury bill rate, and *DEF* is the difference between long-term corporate and government bond return.

corporate bonds.[8] We demonstrate that even after controlling for all the systematic risk and liquidity factors, the basis factor still carries significant positive risk premium during normal market conditions. It is important to note that our basis risk factor is not a simple proxy for liquidity effect (but certainly can be affected by it through funding liquidity as suggested by Brunnermeier and Pedersen (2009) and Aragon and Strahan (2012)) because we extensively control for both liquidity factors and liquidity risks in our tests. Moreover, a recent paper by Friewald, Jankowitsch, and Subrahmanyam (2012) shows that liquidity effect is more pronounced for speculative grade bonds during crisis period. Similarly, Dick-Nielsen, Feldhütter and Lando (2012) also find that illiquidity increases more for speculative bonds than investment grade bonds from 2005 to 2009. In contrast, our basis risk factor is only significantly priced in investment grade bonds but not speculative bonds. Therefore, our basis risk factor is likely to represent a new risk factor in corporate bond returns due to basis arbitrage activities.

Our study also sheds lights on the impacts of the introduction of derivatives and associated arbitrage activities on the pricing of the underlying securities. While many studies have examined potential impacts of options on underlying securities, our paper is the first to study the pricing impact of CDS and CDS-bond basis arbitrage on cash corporate bonds. While Arora, Gandhi, and Longstaff (2012) show that counterparty risk is priced in CDS market, we find that it is also priced in cash bond market. Moreover, as prior studies (e.g., Mitchell and Pulvino, 2001; Duarte, Longstaff, and Yu, 2007) have documented the risk and return properties of different arbitrage strategies, our paper is one of the first to show that the pricing impacts of basis arbitrage trade on the cross-sectional returns of corporate bonds are significant.

[8] See e.g., Ericsson and Renault (2006), Chen, Lesmond and Wei (2007), Edwards, Harris and Piwowar (2007), Goldstein, Hotchkiss and Sirri (2007), Lin, Wang and Wu (2011), and Bao, Pan and Wang (2011).

The rest of the paper is organized as follows. In section 1, we discuss the basis arbitrage trade and the risks involved. Section 2 describes the data and the construction of the basis. Section 3 documents the relation between the basis, bond characteristics, and future bond returns. Section 4 shows that the basis is a new risk factor in determining the cross-sectional returns of corporate bonds. Section 5 verifies that the basis risk is a superior proxy for new risks and Section 6 concludes.

1. The CDS-Bond Basis Arbitrage

This section describes how investors arbitrage on the non-zero CDS-Bond basis and potential risks involved in such arbitrage activities.

1.1. The CDS-Bond Basis Trade

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 protection 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 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 one has 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.

The basis is defined as the difference between the CDS spread and bond spread for the same company at the same maturity. Many studies argue that CDS and bond spread should be 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 who 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. In either case, the arbitrageur can probably hedge the interest rate risk embedded in cash bond by using some interest rate derivatives. The negative basis trade is more popular in practice since it is more difficult to short corporate bonds.

The basis trade was very popular among hedge funds and proprietary trading desks at Wall Street firms before the current financial crisis (see e.g., Choudhry, 2006; JP Morgan, 2006). 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 rule out distressed and speculative grade bonds (see Deutsche Bank, 2009). A positive funding spread can usually lead to a negative basis, which indicates that a bond is cheaper than CDS. During the few years before the crisis when credit was easily available, speculators tend to lever up the basis trade many times to magnify the profits from small price discrepancies.

1.2. Risks Involved in the Basis Trade

It is important to realize that non-zero basis may arise due to market imperfections and does not necessarily represent pure arbitrage profits. As pointed out by Blanco, Brennan and Marsh (2005), one main reason for non-zero basis is contractual differences between cash bond and CDS contract. For example, one might not be able to find a CDS with exactly the same maturity as the cash bond. Second, in case of default, although the accrued interest is paid upon default in

CDS, it is not paid for defaulted bond. Moreover, the interest payment of CDS is on a quarterly frequency whereas it is semi-annual for most cash bonds. The cheapest-to-deliver option embedded in CDS contract can be extremely valuable in some default events.[9] Investors in CDS may not enjoy the same rights as those in cash corporate bonds either. Bolton and Oehmke (2011) highlight the empty creditor problem where debtholders with CDS protection might desire for quick bankruptcy resolution whereas it might hurt the rights of debtholders without CDS. The cash bond holder might prefer to restructure rather than bankruptcy resolution.

Non-zero basis could also be due to more efficient price discovery in the CDS market. Acharya and Johnson (2007) show that private information of informed banks tends to be reflected in CDS but not cash bond market. Alexopoulou, Andersson and Georgesu (2009) show that the CDS market usually lead corporate bond market in price discovery. But 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.

In addition to the above reasons for non-zero basis, arbitrageurs in the basis trade are also exposed to a wide variety of risks. One important risk 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. 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

[9] 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).

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.[10] Given that Brunnermeier and Pedersen (2009) and Aragon and Strahan (2012) both suggest that market liquidity can interact with funding liquidity, such joint effect can complicate the risks involved in the basis arbitrage. 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.

While default risk can be hedged to some extent in the basis trade, it is difficult to completely eliminate all other risks involved. Therefore, the seemingly profitable basis arbitrage is not risk free as standard textbook arbitrages. Instead, it is an investment like any other investments, with its own risks and rewards. Since arbitrageurs face all the risks involved in the basis trade and actively trade the cash bonds through the basis trade, these risks might affect corporate bond returns through the trading of the arbitrageurs. Given that the CDS market is many times larger than the cash bond market and that the CDS market often leads bond market in price discovery, basis risk could have big impacts on the pricing of cash corporate bonds through the activities of basis arbitrage. On the other hand, these risks could not have affected corporate bond returns before the introduction of CDS because passive buy-and-hold investors are not exposed to these risks. Instead of explicitly discussing each individual component of the risks in the basis trade, it is more important to understand the total pricing impact of these new risks on the corporate bond returns. To some extent, the compensation for new risks is reflected in the magnitude of the basis level because arbitrageurs demand discounts to enter the trade to be compensated for the risks

[10] 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.

they bear. Moreover, we can also project the basis level to the returns of corporate bonds directly by forming a new reduced-form risk factor in the spirit of Fama-French SMB and HML factors to capture the overall pricing impact of basis arbitrage since the new risks and traditional systematic risks in corporate bond returns can reinforce each other.

2. Data

This section describes the data and the construction of the basis.

2.1. CDS and Bond Data

The CDS data used in this study is on standardized ISDA contracts for physical settlement and obtained from Markit, which aggregates quotes from major CDS dealers. We focus on U.S. dollar denominated CDS contracts that are senior unsecured with modified restructuring clauses from 2001 to 2008. The daily CDS spreads 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 have a complete credit curve of CDS spreads for 6 month, 1, 2, 3, 5, 7, 10, 15, 20, and 30 year maturities for most companies.

The bond data between 2001 and 2008 is obtained from three different sources. The price information is from TRACE and NAIC, the two bond transaction databases that have been widely used in recent literature. The transaction data is further merged with the Fixed Investment Securities Database (FISD) to obtain bond characteristic information, such as issue dates, maturity dates, issue amount, and rating information. 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.

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 in early years, 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 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. Since NAIC does not report the exact time of trading, we use the last transaction price from TRACE as the closing price of the bond for each day.

When TRACE has no record of a bond's transaction, we keep the observation from NAIC if it is available.

2.2. Summary Information of the Basis

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

$$Basis_{i,t,\tau} = CDS_{i,t,\tau} - Z_{i,t,\tau}, \qquad (1)$$

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:

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

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). Robustness checks show that other measures of bond spread do not significantly affect our results.

To construct the basis, we first compute the Z-spread for each bond on each day in our dataset. We then 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 392,914 observations. The sample period is between January 2, 2001 and December 31, 2008.

[Insert Table 1 about Here]

Table 1 provides summary information of our sample of bonds and time series patterns of the basis. Panel A of Table 1 shows that our sample contains 1,978 firm-year observations and 7,116 bond-year observations (about 247 firms and 889 bonds per year). Given the growing coverage of TRACE, we observe that the number of bonds in our sample increases dramatically after 2002.

Panel B of Table 1 shows that the basis displays significant variation over time. The total sample contains 392,914 daily observations over a period of eight years. The average bond in our sample has a basis of -35 bps. The average basis is significantly negative in every single year between 2001 and 2008. The average basis is negative, ranging from -56 bps to -70 bps, during the last recession between 2001 and 2003. It is interesting to note that during the same period, both the CDS spread and the Z-spread are very wide as well. The basis widens to -102 bps during the crisis in 2008, which also sees dramatic increases in the CDS spread and the Z-spread. The average basis narrows significantly during the boom period between 2005 and 2007, a period with extremely low credit spreads as well.

3. The Basis Level, Bond Characteristics, and Future Bond Returns

In this section, we explore the relation between the basis level and individual bond characteristics and future bond returns. We first relate the basis level of each bond to its other characteristics such as rating, maturity, age, coupon, issue size, duration, and convexity. Then we demonstrate that past basis can predict future individual bond returns at 20-, 40- and 60-day horizons based on cross-sectional regression analysis. The different holding periods approximate monthly, bi-monthly, and quarterly frequency in asset pricing tests.

3.1. Basis Level and Bond Characteristics

Table 2 provides summary information on the basis level and documents the relation between the basis level and various bond characteristics. 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 10 to the lowest rating (BBB- for S&P or Baa3 for Moody's). We assign values between 2 and 9 for intermediate ratings.

[Insert Table 2 about Here]

Panel A of Table 2 shows that the average bond in our sample has a rating between A and A-, 8.5 years to maturity, 5.3 years of age, a coupon rate of 6.3%, an issue size of 0.5 billion dollars, a duration of 5.5 years, and a convexity of 59.4. The lowest basis is -371 bps and the highest is 98 bps.

To examine the relation between the basis and bond characteristics, we sort bonds into portfolios based on each of the characteristics and calculate the average basis in each portfolio. Panel B of Table 2 present the results based on rating, maturity, age, coupon, issue size, duration, and convexity, respectively.

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. For example, the basis decreases from -7 bps for AAA-rated bonds to -45 bps for BBB-rated bonds. The average basis of each rating class is statistically significantly different from zero at the 1% significance level. The standard deviation of the basis is also higher for lower-rated bonds. 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%, and the five duration groups contain bonds with duration of 0-3, 3-5, 5-7, 7-10 and more than 10 years. The basis is more negative for the bond that is older, with longer maturity, higher coupon and duration. 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 non-negligible arbitrage risk in basis trade.

The relation between the basis and convexity is largely monotonic. The five convexity groups contain bonds with convexity of 0-10, 10-30, 30-50, 50-70 and more than 70. The convexity group 1 has the least negative basis at -23 bps whereas the convexity group 5 has the most negative basis at -59 bps.

There are no distinctive patterns for the basis across the five issue size. 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 and. Bonds in the first and fifth issue size group have the most negative basis whereas bonds in the fourth issue size group have the least negative basis.

In sum, our comprehensive empirical analysis identifies a clear relation between the basis and some but not all bond characteristics: Bonds with more negative basis tend to be older and have lower rating, longer maturity, higher coupon, higher duration, and higher convexity. However, the relation between basis and issue size is not clear.

3.2. Basis Level and Future Bond Returns

In this section, we study the predictive power of the basis level for future bond returns. If we interpret the basis level as a reflection of the compensation for the risks in the basis trade, then investors should be compensated in future bond returns by arbitraging away the non-zero basis. In other words, we expect current negative basis leads to higher future bond returns.

For each bond i, we compute its k-day holding period return $HPR_{i,t,t+k}$ using the following equation,

$$HPR_{i,t,t+k} = \frac{(P_{i,t+k} + AI_{i,t+k}) + C_{i,t,t+k} - (P_{i,t} + AI_{i,t})}{(P_{i,t} + AI_{i,t})}, \tag{3}$$

when $P_{i,t+k}$ is the closest available transaction price of bond i on day $t+k$, $AI_{i,t+k}$ is the accrued interest on day $t+k$, $C_{i,t,t+k}$ is the coupon payment during the period from day t to $t+k$, $P_{i,t}$ is the closest available transaction price on day t, and $AI_{i,t}$ is the accrued interest on day t.[11]

We consider the following Fama-MacBeth regression of future individual bond excess returns on its past basis level, bond characteristics, and one liquidity measure:

$$\begin{aligned} HPR_{i,t,t+k} - r_{f,t,t+k} &= \alpha + \beta_1 BASIS_{i,t} + \beta_2 RATING_{i,t} + \beta_3 MATURITY_{i,t} + \beta_4 AGE_{i,t} \\ &+ \beta_5 COUPON_{i,t} + \beta_6 ISSUE_{i,t} + \beta_7 INDLIQ\_k_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

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 $t+k$, $BASIS_{i,t}$, $RATING_{i,t}$, $MATURITY_{i,t}$, $AGE_{i,t}$, $COUPON_{i,t}$, $ISSUE_{i,t}$, 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 are reported in brackets. The

[11] 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.

results are reported in Model 1 in Table 3. For robustness checks, we also replace age and maturity by duration ($D_{i,t}$) in Model 2 in Table 3.

[Insert Table 3 about Here]

Table 3 report the Fama-MacBeth regression results for 20-, 40- and 60-day holding period returns, respectively. Model 1 shows that the coefficients of the basis are statistically significant at the 1% significance level for 20-, 40-, and 60-day holding periods. The coefficient of the basis factor is negative, ranging from -0.0216 to -0.0223 as the holding horizon increases. This suggests that negative basis leads to higher future bond returns, consistent with our hypothesis. 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. Model 2 shows that the basis still has significant predictive power for future bond return with a negative coefficient at 40-day and 60-day holding horizon as we replace maturity and age by duration. A slightly weaker result suggests that the basis can have some interaction with duration, a measure of the total risk of bonds. Most of the significant coefficients of basis level have t-statistics ranging from 3.43 to 16.88, representing an economically and statistically significant prediction power of basis level. Overall, our results show that the basis has significant predictive power for future excess returns of individual bonds after controlling for well-known bond characteristics and liquidity measures. We also use other liquidity measures (such as number of transactions and logarithmic of trading volume for each bond from day t-k to day t) for robustness checks and the results are similar.

4. Is the Basis a New Risk Factor for Corporate Bond Returns?

In this section, we study whether the basis can provide a good measure for new arbitrage risks in affecting the returns of bond portfolios. We first construct quintile bond portfolios sorted on past basis level and examine its return patterns. This method of constructing a new risk factor is similar to the approach by Fama and French (1993) in constructing SMB and HML factors. Second, we then sort bonds into subgroups based on their bond characteristics and form a LOW minus HIGH basis portfolio within each characteristics group. We find that returns of such construction are significantly positive for most of the characteristics groups. This gives us an indication that such portfolio formation method can plausibly be a good risk proxy. Finally, we employ a new basis risk factor constructed from LOW-minus-HIGH basis portfolios on all bonds and test whether it can explain the cross-sectional returns of bond portfolios. Due to the dramatic disruptions in the corporate bond market during the current financial crisis, we conduct our asset pricing tests for two separate periods, one period before the crisis (2002 to 2006) and one during the crisis (2007 to 2008).

4.1. Formation of Quintile Basis Portfolios

We form quintile portfolios of bonds based on their past basis level and examine their subsequent returns over different holding periods. We sort bonds into five basis portfolios based on the average basis of each bond over the past 60 trading days. A bond is included in our sample only if it has more than 20 transactions during the past 60 trading days. We then compute the subsequent equal- or value-weighted k-day holding period returns of each basis portfolio on day t, $HPR_{t,t+k}$, where k = 20, 40, and 60 days. We further eliminate dates with less than five bonds traded. Our refined sample is from July 17, 2002 to December 31, 2008, with 258,514, 252,850, and 252,540 observations for 20-, 40-, and 60-day holding periods, respectively. After obtaining individual bond holding period returns, we then compute equal- and value-weighted holding period returns for the five basis portfolios. We compute value-weighted portfolio return by weighting each bond's holding period return by the ratio of its market value to the total market value of all the bonds within the portfolio. Table 4 presents the results.

[Insert Table 4 about Here]

Panel A of Table 4 reports the raw and excess holding period returns of the five equal-weighted basis portfolios. 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. The levels of the basis of the five portfolios range from -75 bps (lowest) to 18 bps (highest) within the past 60-day window. We find that the lowest basis portfolio has significantly higher raw and excess returns than the highest basis portfolio over all three holding periods. The return differentials between the two basis portfolios are statistically significant at the 1% level and amount to 28 bps, 49 bps, and 65 bps for 20-, 40-, and 60-day holding period, respectively. On an annual basis, the return differentials range from 2.69% to 3.52%, an economically significant number. The excess return of the lowest basis portfolio is positive whereas that of the highest basis portfolio is negative. This indicates that buying the lowest basis portfolio and selling the highest basis portfolio can generate positive return, consistent with industrial practices. Panel B of Table 4 reports similar results for the raw and excess holding period returns of the five value-weighted basis portfolios. The return differentials between the lowest and highest basis portfolios range from 2.19% to 2.74% on an annual basis.

4.2. Profitability of Zero-Investment Strategy and Bond Characteristics

Given that the zero-investment portfolio that longs the lowest (LOW) quintile basis portfolio and shorts the highest (HIGH) quintile portfolio based on all bonds generates significant excess returns in the previous section, we further explore whether such an investment strategy can consistently produce excess returns across different bond characteristics considered before. First, we sort all bonds into different characteristic groups. Second, within each group, we form the LOW-minus-HIGH (LMH) basis portfolio and report its equal- and value-weighted 20-, 40-, and 60-day holding period returns in Table 5.

[Insert Table 5 about Here]

Panel A of Table 5 reports the holding period returns of the LMH basis portfolio for each year of our sample. Since we delete those dates with less than five different bond transactions, our sample shrinks to the period between July 21, 2002 and December 31, 2008. The result shows that the LMH strategy is significantly profitable for 28 out of 30 tested portfolios (for 2 different weighting schemes and 3 different holding horizons) from 2002 to 2006, suggesting that the basis trade can be profitable under normal market conditions when the negative basis usually converges over time. However, the strategy becomes less profitable in 2007 and even loses money in 2008 when the crisis worsens (i.e., 9 out of 12 portfolios are significantly negative). This result is consistent with Figure 2, which shows that the negative basis widens even further in 2008 from very negative levels at the beginning of the crisis. Therefore, the tightening of credit and unwinding of basis trade positions during the crisis can lead to big losses in the basis trade that is conventionally profitable in normal times.

Panel B of Table 5 shows that the LMH strategy is significantly profitable for all rating groups. The profit is the highest for AA-rated bonds (with equal-weighted return of 0.80%, 1.41%, and 1.69% for 20-, 40-, and 60-day horizons, respectively). This result suggests that the profitability of LMH strategy is not concentrated on few rating classes within investment grades, consistent with the prevailing wisdom that any investment grade bond can be a potential target for basis arbitrage. Panel C shows that the LMH strategy is most profitable for bonds with shortest and longest maturities. But it actually loses money for bonds with 5 to 10 years of maturity. The diminished arbitrage profits could be due to the fact that these medium term bonds are the most liquid and efficient segment of the corporate bond market as the CDS of similar maturities are mostly actively traded around 5 years-to-maturity.

Panel D shows that the LMH portfolio is profitable for all age groups. The most profitable age group of bonds is between seven to ten years. Panel E shows that the LMH strategy is most profitable for bonds with the highest coupons. Panel F shows that the LMH strategy generates highest return for the smallest issue size. Similar to the results for maturity, Panel G shows that the LMH strategy is most profitable for bonds with shortest and longest durations. Finally, Panel H shows that the strategy is profitable for the smallest and biggest convexity groups.

In sum, the return of the LMH portfolio is time varying and is not monotonically related to conventional bond characteristics. The return of the LMH portfolio is lowest in 2007 and 2008. More important, the return of the LMH portfolio is highest for AA-rated bond portfolios, lowest for liquid bond portfolios with medium time to maturity, duration and convexity, intermediate level of coupons, and large issue size. These results suggest that it is difficult to reduce the basis measure to any single source of risk. Instead, we can use such an investment strategy to proxy for different risks involved in the basis arbitrage trade, which could include counterparty risk, funding risk, collateral risk, liquidity risk, and residual default risk among others.

4.3. The Basis as a New Risk Factor for Corporate Bond Returns

In this section, we test explicitly whether the LMH basis factor, constructed as return differential between the LOW and HIGH basis portfolios formed from all available investment grade bonds, plays the role of a new risk factor for corporate bond returns. Due to the dramatic disruptions to all major financial markets during the crisis, we conduct our analysis in two separate periods, one for normal market conditions before the crisis between 2002 and 2006, and another during the crisis between 2007 and 2008. Since we consider daily portfolio returns, we can still perform a robust sub-period study for the 2007 and 2008 financial crisis.

4.3.1. Results Before the Financial Crisis (2002-2006)

Following Gebhardt, Hvidkjaer, and Swaminathan (2005), we form twenty bond portfolios sorted on rating (AAA, AA, A, and BBB) and maturity (1-3, 3-5, 5-7, 7-10, and more than 10 years) and use their 20-, 40-, and 60-day value-weighted holding period returns to conduct our asset pricing tests. Accordingly, we construct the new basis risk factors over corresponding holding horizons. In particular, the three basis risk factors, *BASIS_20*, *BASIS_40*, and *BASIS_60*, are represented by the 20-, 40-, and 60-day holding period returns of the LMH portfolio constructed based on past 60-day average basis.

We perform the following rolling regression for each of the twenty rating-maturity bond portfolio q to obtain the betas of the all the factors over the past 180 trading days,

$$\begin{aligned}&HPR_{q,t-k,t} - r_{f,t-k,t} = \alpha_{q,k} + \beta_{b,q,k} BASIS\_k_t + \beta_{m,q,k} MKT\_k_t + \beta_{size,q,k} SMB\_k_t \\ &+\beta_{bm,q,k} HML\_k_t + \beta_{def,q,k} DEF\_k_t + \beta_{term,q,k} TERM\_k_t + \beta_{l,q,k} LIQ\_k_t \\ &+\beta_{amh,q,k} AMH\_k_t + \varepsilon_{q,k,t},\end{aligned} \tag{5}$$

where $HPR_{q,t\text{-}k,t}$ is the k-day holding period return of the bond portfolio q formed on four credit rating classes and five maturity groups ($q=1,2,\ldots,20$) from day t-k to t, $BASIS\_k_t$ is the k-day holding period return of the basis factor 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 measured from day t-k to day t. $\beta_{b,q,k}$ is the beta for the basis risk factor for portfolio q for time horizon k, $\beta_{m,q,k}$ is the market beta, $\beta_{size,q,k}$ is the size beta, $\beta_{bm,q,k}$ is the BM beta, $\beta_{def,q,k}$ is the default beta, $\beta_{term,q,k}$ is the term beta, $\beta_{l,q,k}$ is liquidity beta, and $\beta_{amh,q,k}$ is the Amihud liquidity beta. We follow the procedures in Lin, Wang and Wu (2011) to construct the Amihud (2002) liquidity measure for the corporate bond market. In addition, we demean all these risk factors to interpret the second step estimates as risk premiums. For robustness checks, we also construct Pastor and Stambaugh (2003) liquidity risk measure (PS) as an alterative liquidity risk measure as shown in Lin, Wang and Wu (2011).

After obtaining the estimated betas from equation (5), we run the following Fama-Macbeth regression to obtain estimates of the risk premium for each of the risk factors:

$$\begin{aligned} HPR_{q,t,t+k} - r_{f,t,t+k} &= \gamma_0 \alpha_{q,k} + \gamma_b \beta_{b,q,k} + \gamma_m \beta_{m,q,k} + \gamma_{size} \beta_{size,q,k} \\ &+ \gamma_{bm} \beta_{bm,q,k} + \gamma_{def} \beta_{def,q,k} + \gamma_{term} \beta_{term,q,k} + \gamma_l \beta_{l,q,k} + \gamma_{amh} \beta_{amh,q,k} + \delta_{q,k}, \end{aligned} \tag{6}$$

where $HPR_{q,t,t+k}$ represents the realized return of bond portfolio q from day t to $t+k$ and is a proxy for the expected return on day t till day $t+k$ (where q =1,2,…,20, and k =20, 40, or 60), all the betas with the hat sign are the estimated betas for various risk factors for portfolio q for the time horizon k from the first-stage time series regression from day $t-180$ to t. Hence, the regression results from equation (6) report the risk premiums of eight systematic risk factors, which are denoted by γs.

Table 6 reports the empirical results of our asset pricing tests. Panel A of Table 6 shows that the three basis risk factors are highly positively correlated with *MKT, HML, DEF, TERM, and AMH* (with correlation coefficient above 0.10). The correlation coefficients tend to increase as holding horizons increase. On the other hand, the basis factors are less correlated with the liquidity factor, *SMB*, and *PS*. Panel B shows the summary statistics of all the risk factors and the basis factors in percentage terms. There is no extreme outlier in the risk factors.

[Insert Table 6 about Here]

Panel C of Table 6 reports the Fama-MacBeth regression results for the asset pricing test from 2002 to 2006. Model 1 and Model 2 show the results of seven-factor asset pricing model without the basis factor. Consistent with the literature, we find that *MKT*, *SMB*, *DEF*, and *TERM* carry significant positive risk premiums. *LIQ* and *AMH* (and *PS*) carry significant risk premiums in 20-day and 40-day horizons respectively. The adjusted R^2s of the seven factor model range from 48% to 65%. The abnormal returns (the intercept) are slightly negative for the 40-day (value-weighted) and 60-day (both equal- and value-weighted) horizons, ranging from -7 to -14 bps. After including the basis risk factor in Model 3 and Model 4, we find that the basis risk premium is significantly positive during this time period. The basis risk premiums range from 1.48% to 4.30% on an annual basis. On average, the basis risk carries an annual basis risk premium of 2.87% on average across different time horizons. Moreover, the new basis risk factor continues to be significant in the presence of other existing systematic risk factors across all time horizons. This result confirms our conjecture that the basis risk factor represents new sources of risk that are independent of the existing systematic risk factors. We will further verify the source of the basis risk in relation to the new risks arisen from basis arbitrage in the following sections.

4.3.2. Results During the Financial Crisis (2007-2008)

In this section, we report the results for the asset pricing tests during the current financial crisis between 2007 and 2008. Model 1 and Model 2 show that the existing systematic risk factors such as *MKT*, *HML*, and *DEF* carry significantly negative risk premiums during the financial crisis. The adjusted R^2s range from 50% to 59%. Model 3 and Model 4 show that the basis risk premium is also significantly negative, ranging from -2.45% to -7.00% on an annual basis (about -5.17% on average). The negative risk premiums for existing systematic risk factors imply that the financially-constrained bond investors are willing to take huge price discounts to cash out from the credit market even though they know that the expected return in the long-run can be positive if they can hold on to their investments. Since standard asset pricing theory requires systematic risk factors to earn positive risk premium, we interpret the negative risk premium as a result of the failure of the market self-adjusting mechanism during the extreme turmoil of the current financial crisis.

In summary, our results provide novel evidence that the basis risk is a new risk factor for the expected corporate bond returns even after controlling for well-known risk factors documented by Fama and French (1993), Gebhardt, Hvidkjaer and Swaminathan (2005), and Lin, Wang and Wu (2011). In the next section, we test more directly whether the basis risk factor is related to the new risks arisen from basis trade.

5. What is the Basis Risk Factor?

In this section, we show that the basis risk factor is a convenient empirical proxy for the new risks in basis trade. First, we show that it is directly related to the new risks, such as funding liquidity, counterparty risk, and collateral risk documented in the recent literature after controlling for existing systematic risk factors. For example, Brunnermeier and Pedersen (2009) establish a theoretical link between funding liquidity and market liquidity and suggest that the shortage of speculators' capital can drive liquidity risk premium. Gârleanu and Pedersen (2011) argue that margin requirements for trading securities can affect a security's required rate of return in addition to the usual beta risks. The funding liquidity crisis (such as the one in 2007-2008) can lead to the possibility of the basis trade. They define basis in a general way as the price gap between securities with identical cash flows but different margins. They show that the required return on a high-margin security such as corporate bond is greater than that of a low-margin security with the same cash flow such as a CDS. Fontana (2009) shows that funding liquidity dried up during the 2007-2008 crisis. Moreover, Fontaine and Garcia (2009) also argue that funding liquidity can potentially be an important missing aggregate risk factor that commands a risk premium. Moreover, Arora, Gandhim, and Longstaff (2012) show that counterparty risk is priced in CDS market. Bai and Collin-Dufresne (2013) try to explain the basis level by their constructs of funding liquidity measure, counterparty risk measure, liquidity, and collateral risk measure and find that these proxies can explain the basis level up to 50% in time series and less than 25% in cross-sectional test.

Second, we run a horse race between the basis risk factor and the empirical measures of above-mentioned new risks and show that basis risk factor is more consistently priced than the other empirical measures separately and jointly. This shows that basis risk factor is a superior empirical risk proxy than other proxies. Lastly, we demonstrate that the basis risk and other new sources of risks are not consistently priced in speculative grade bonds, which should be less affected by the basis risk since they are not widely used in the basis trade.

5.1. The Relation between the Basis Risk Factor and the Existing Risk Factors

In addition to the traditional seven systematic risk factors, we construct three empirical risk factors to proxy for the new risks involved in CDS and basis trade, such as funding liquidity, counterparty risk and collateral risk. First, funding liquidity is proxied by TED spread, which is the difference between 3-month uncollateralized LIBOR rate minus 3-month T-bill rate. Second, counterparty risk is proxied by FINRET, which is the value-weighted excess return of all investment bank equities from CRSP with SIC code 6211. Third, aggregate collateral risk is proxied by VIX, which is the S&P500 option implied volatility from CBOE. We run a time series regression for the basis risk factor against the existing systematic risk factors as well as the three new risk factors. The results are reported in Table 7.

[Insert Table 7 about Here]

Specification (1), (2) and (3) in Table 7 include each of three new risks one at a time, and specification (4) include all the new risks. We test the relationship for 20-, 40-, and 60-day horizons. The basis factor is significantly related to *HML*, *TERM*, *LIQ*, *TED*, and *VIX* at 20-day when each new risk is included separately. In 40-day and 60-day horizon, *HML*, *TERM*, *LIQ*, and *VIX* continue to be significantly related to the basis factor. When all the old and new risk factors are included, risk factors *TERM* and *VIX* are consistently and significantly related to the basis risk factor across three holding horizons. This result suggests that the basis risk factor is related to the uncertainty in term structure (i.e., *TERM*) and in the aggregate collateral risk related to macroeconomic situation (i.e. VIX). It is very likely that these considerations reflect the uncertainty in obtaining funding and collateral in the basis trade. Although empirically, the basis risk factor is not closely related to the counterparty risk proxied by FINRET, it can plausibly be due to the fact that basis trade involves not only investment banks, but also hedge funds and other types of speculators. Hence, the FINRET may not be a good empirical proxy to measure the true counterparty risk involved.

5.2. Horse-race of the Basis Factor with the Proxies of New Risks

In this section, we compare the basis risk factor with the old and new risk factors and test whether the basis factor can survive the horse-race. If it does, it shows that the basis risk factor is a superior proxy of new risks. Panel A and Panel B in Table 8 report the results for 2002-2006 and 2007-2008 periods respectively.

[Insert Table 8 about Here]

Model 5 in Panel A of Table 8 includes TED spread and shows that across all three time horizons the basis risk premium continues to be statistically significant ranging from 1.94% to 3.62% for the 2002-2006 period. Model 6 in Panel A includes FINRET and shows a similar result as before. The basis risk premium carries a significant premium ranging from 1.76% to 4.75% in 2002-2006. Model 7 includes VIX and shows a slightly higher basis risk premium, from 1.90% to 3.67%. Finally, Model 8 includes all three new risk factors together with the basis risk factor. The basis risk factor survives still across all time horizons, and carries an average risk premium of 2.37%. There is also some indication that the basis risk factor is the most dominant risk factor in 40-day horizon as the three new risks are jointly insignificant.

Panel B of Table 8 shows that the basis risk factor continues to carry a significant negative risk premium about -4.63% during the crisis period on average. The non-zero basis risk premium is strongest in the 60-day horizon whereas it is not significant in the 20-day horizon. Moreover, we find that both the direct proxy of funding liquidity and the counterparty risk carries significant negative risk premiums during the crisis period. This result indicates that basis risk reflects the arbitrage risk conveniently and not completely. During the crisis period, the arbitrage risk can last for a long time as price discovery can be very slow (i.e., Duffie, 2010) and more direct proxies for funding liquidity and the counterparty risk can capture risk-return relationship in the bond returns as arbitrage activities are frozen during the crisis since the terms and availability of financing deteriorate significantly. This dramatically reduces the demand for the basis trade. Moreover, many levered players in the trade have been forced to unwind their positions due to the tightening of credit. As a result, the basis widens and becomes hugely negative in the height of the crisis. As shown in Figure 2, the basis of investment grade index in late 2008 is about -250 basis points. Many banks and hedge funds, such as Deutsche Bank, Merrill Lynch, and Citadel, have lost billions of dollars due to the blow up of the basis trade.

The widening of the basis has also created serious disruptions in the credit market even for investors who have not invested in CDS. For example, traditional investors in cash bonds suffer huge losses as well due to the unwinding of the basis trade. As a result, investment-grade corporate credit spreads, such as CDX.IG index rose from 50 bps in early 2007 to about 250 bps by the end of 2008. The spread of even the safest tranche, such as CDX.IG super senior tranche, widens to about 100 bps from 5 bps. Figure 3 provides time series plots of BAA and AAA credit spreads and their difference, as well as the LIBOR-OIS spread between 2001 and 2008. The LIBOR-OIS spread is the difference between LIBOR and the overnight indexed swap rate and measures the counterparty risk in the financial system. The difference between BAA and AAA spreads increases from 100bps to 330 bps from January 2007 to December 2008. The LIBOR-OIS spread shoots up from about 10 bps to more than 80 bps in early July 2007 and increases further to more than 360 bps in October 2008, before settling back to about 10bps in August 2010.

On the other hand, the potential cash-rich investors are reluctant to step in to bring the price back to its fundamental value. They also enter into a massive fear as they are not sure whether the market might collapse and they might lose all their investments. The joint effects of deleveraging by the financial-constrained arbitrageurs and fearful investors make the prices of corporate bonds deviate significantly from their equilibrium values for a prolonged period and arbitrageurs fail to step in to bring the price back to equilibrium. Only when the government steps in to restore the confidence in the financial system, the bond market starts to revert back to its equilibrium level.

Overall, our results show that the basis risk outperforms some direct measures of new risks such as funding liquidity, counterparty risk and collateral risk. It represents these new risks better in normal periods when arbitrage activities are normal than in crisis periods when arbitrage activities are less active due to limits-to-arbitrage. This is the first study, as far as we know, that shows clearly how corporate bond market can be affected by the introduction of credit derivatives and the associated arbitrage activities.

5.3. Speculative Grade Bonds

According to Deutsche Bank (2009), arbitrageurs tend to favor investment grade bonds over speculative grade bonds when conducting the basis trade. As a result, we do not expect the basis risk to play an important role for pricing speculative grade bonds.

Table 9 repeats our asset pricing tests for high-yield bonds. There are altogether twenty bond portfolios with five maturity groups as defined before and four rating classes (BB, B, CCC, and CC-C). Panels A and B report the results for the normal and crisis periods respectively. Similar to before, we include the three new risks to compete with the basis risk factor. As expected, the basis risk premium is indifferent from zero during the normal period in Table 9. The basis risk premium is statistically significantly negative for 40-day holding horizon during the crisis period, but is indifferent from zero for 20- and 60-day horizons.

[Insert Table 9 about Here]

Overall, the results for high yield bonds are much weaker than that for investment grade bonds. The basis risk premiums are zero between 2002 and 2006. They are occasionally significantly negative between 2007 and 2008 but much less so than that for investment grade bonds. Other new risks such as counterparty risk and collateral risk carry significant risk premiums for the 20-day horizon during the normal period, similar to investment grade bonds. But the results are more mixed across other holding horizons. During the financial crisis, these new risks can have positive or negative risk premiums at different time horizons as well. These results indicate that bonds that are not widely used in the basis trade are not affected by the basis risk. The other new risks can also affect speculative bonds, but plausibly through different channels other than basis arbitrage and therefore the risk premiums are not consistently negative or positive.

We also conduct extensive robustness checks on the alterative empirical proxies of funding liquidity, counterparty risk and uncertainty measures. For example, we use LIBOR minus OIS and LIBOR minus REPO to replace TED spread. We also construct the sensitivity measure of the investment bank equity returns with respect to the interest rate change to capture the counterparty risk of the financial intermediaries. We also employ alternative basis measures by using adjusted Z-spread and asset swap spread. Lastly, we also test the results on the alternative twenty bond portfolios formed on duration and ratings. The prevailing results are largely consistent with our conjecture. The results are available upon requests.

6. Conclusion

In this paper, we have identified a new risk factor, the basis factor, for pricing corporate bonds. In contrast to traditional fundamental corporate bond risk factors, the basis factor affects corporate bond returns only after the introduction of CDS and the associated CDS-Bond basis arbitrage trade. The basis factor, constructed as the return differential between LOW and HIGH quintile basis portfolios, is priced in the cross section of investment grade bonds with an annual risk premium of about 3% in normal periods. Our result shows that the introduction of CDS has fundamentally changed the pricing of cash corporate bonds. It also highlights the inter-connections of global financial markets. Just like foreign speculators can affect emerging market equity returns as documented in Bekaert and Harvey (2000), arbitrageurs in credit derivatives can affect the pricing of cash corporate bonds through their trading activities. Hopefully these effects can be incorporated more explicitly into future asset pricing theories.

References:

Acharya, Viral V., and Johnson Timothy C., 2007. Insider Trading in Credit Derivatives, *Journal of Financial Economics*, 84, 110-141.

Alexopoulou, Ioana, Andersson, Magnus, and Georgescu, Oana Maria, 2009, An Empirical Study on the Decoupling Movements between Corporate Bond and CDS Spreads. ECB Working Paper No. 1085.

Amihud, Yakov, 2002, Illiquidity and Stock Returns: Cross-Section and Time Series Effects, *Journal of Financial Markets* 5, 31-56.

Aragon, George O., and Philip E. Strahan, 2012, Hedge Funds as Liquidity Providers: Evidence from the Lehman Bankruptcy, *Journal of Financial Economics* 103, 570-587.

Arora, Navneet, Priyank Gandhi, and Francis A. Longstaff, 2012, Counterparty Credit Risk and the Credit Swap Market, *Journal of Financial Economics* 103, 280-293.

Bai, Jennie and Pierre Collin-Dufresne, 2013, The CDS-Bond Basis, AFA 2013 San Diego Meetings Paper.

Bao, Jack, Jun Pan, and Jiang Wang, 2011, The Illiquidity of Corporate Bonds, *Journal of Finance* 66, 911-946.

Bekaert, Geert and Campbell Harvey, 2000, Foreign Speculators and Emerging Markets, *Journal of Finance* 55, 565-613.

BIS Credit Risk Transfer Statistics, 2010, Bank of International Settlements.

Blanco, Robert, Simon Brennan, and Ian Marsh, 2005, An Empirical Analysis of the Dynamic Relationship between Investment Grade Bonds and Credit Default Swaps, *Journal of Finance* 60, 2255-2281.

Board of Governors of the Federal Reserve System, 2009, The Supervisory Capital Assessment Program: Overview of Results.

Bolton, Patrick and Martin Oehmke, 2011, Credit Default Swaps and the Empty Creditor Problem, *Review of Financial Studies* 24, 2617-2655.

Brunnermeier, Markus K. and Lasse Heje Pedersen, 2009, Market Liquidity and Funding Liquidity, *Review of Financial Studies* 22, 2201-2238.

Campbell, John Y., and Glen B. Taksler, 2003, Equity Volatility and Corporate Bond yields, *Journal of Finance* 58, 2321-2349.

Chen, Long, David Lesmond, and Jason Wei, 2007, Corporate Yield Spreads and Bond Liquidity, *Journal of Finance* 62, 119-149.

Choudhry, Moorad, 2006, The Credit Default Swap Basis, Bloomberg Press, New York.

Collin-Dufresne, Pierre, Robert Goldstein, and Spencer Martin, 2001, The Determinants of Credit Spread Changes, *Journal of Finance* 56, 2177--2207.

D'Arcy, Stephen, James McNichols, and Xinyan Zhao, 2009, A Primer on Credit Derivatives, Working paper, University of Illinois.

D. E. Shaw Group, 2009, The Basis Monster That Ate Wall Street, Market Insights 1, 1-9.

Deutsche Bank, 2009, CDS-Bond Basis Update, Quantitative Credit Strategy, Global Markets Research.

De Wit, Jan, 2006, Exploring the CDS-Bond Basis, Working paper, National Bank of Belgium.

Dick-Nielsen, Jens, Peter Feldhütter, and David Lando, 2012, Corporate Bond Liquidity before and After the Onset of the Subprime Crisis, *Journal of Financial Economics* 103, 471-492.

Duarte, Jefferson, Francis Longstaff, and Fan Yu, 2007, Risk and Return in Fixed-Income Arbitrage: Nickels in Front of a Steamroller? *Review of Financial Studies* 20, 769-811.

Duffie, Darrell, 2010, Presidential Address: Asset Pricing Dynamics with Slow-Moving Capital, *Journal of Finance* 65, 1237-1267.

Edwards, Amy K., Lawrence E. Harris, and Michael S. Piwowar, 2007, Corporate Bond Market Transaction Costs and Transparency, *Journal of Finance*, 62(3), pp. 1421-1451.

Elton, Edwin, Martin Gruber, Deepak Agrawal, and Christopher Mann, 2001, Explaining the Rate Spread on Corporate Bonds, *Journal of Finance* 56, 247-277.

Ericsson, Jan and Olivier Renault, 2006, Liquidity and Credit Risk, *Journal of Finance* 61, 2219-2250.

Fama, Eugene and Kenneth French, 1993, Common Risk Factors in the Returns of Stocks and Bonds, *Journal of Financial Economics* 33, 3-56.

Fama, Eugene and James MacBeth, 1973, Risk, Return and Equilibrium: Empirical Tests, *Journal of Political Economy* 81, 607-636.

Fontaine, Jean-Sébastien and René Garcia, 2009, Bond Liquidity Premia, Working paper, Université de Montréal.

Fontana, Alessandro, 2009, The Persistent Negative CDS-Bond Basis during the 2008/09 Financial Crisis, Working paper, Ca'Foscari University of Venice.

Friewald, Nils, Rainer Jankowitsch, and Marti G. Subrahmanyam, 2012, Illiquidity or Credit Deterioration: A Study of Liquidity in the US Corporate Bond Market during Financial Crisis, *Journal of Financial Economics* 105, 18-36.

Gârleanu, Nicolae and Lasse Heje Pedersen, 2011, Margin-Base Asset Pricing and Deviations from the Law of One Price, *Review of Financial Studies* 24, 1980-2022.

Gebhardt, William, Soeren Hvidkjaer, and Bhaskaran Swaminathan, 2005, The Cross-section of expected corporate bond returns: Betas or characteristics? *Journal of Financial Economics* 75, 85-114.

Goldstein, M., E. Hotchkiss and E. Sirri, 2007, Transparency and Liquidity: A Controlled Experiment on Corporate Bonds, *Review of Financial Studies*, 235-273.

Hull, John, Mirela Predescu, and Alan White, 2004, Relationship Between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements, *Journal of Banking and Finance* 28, 2789-2811.

JP Morgan, 2006, Credit Derivative Handbook, Corporate Quantitative Research.

Liu, Xuewen, and Antonio S. Mello, 2011, The Fragile Capital Structure of Hedge Funds and the Limits to Arbitrage, *Journal of Financial Economics* 102, 491-506.

Lin, Hai, Junbo Wang, and Chunchi Wu, 2011, Liquidity Risk and the Cross-Section of Expected Corporate Bond Returns, *Journal of Financial Economics* 99, 628-650.

Mitchell, Mark and Todd Pulvino, 2001, Characteristics of Risk and Return in Risk Arbitrage, *Journal of Finance* 56, 2135-2176.

Mitchell, Mark and Todd Pulvino, 2012, Arbitrage Crashes and the Speed of Capital, *Journal of Financial Economics* 104, 469-490.

Nashikkar, Amrut, Marti G. Subrahmanyam, and Sriketan Mahanti, 2011, Liquidity and Arbitrage in the Market for Credit Risk, *Journal of Financial and Quantitative Analysis* 46, 627-656.

Newey, Whitney and Kenneth West, 1987, A Simple, Positive Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 703-708.

Norden, Lars and Martin Weber, 2004, The Comovement of Credit Default Swap, Bond and Stock Markets: An Empirical Analysis, CFS Working paper, University of Mannheim, Germany.

Oehmke, Martin and Adam Zawadowski, 2013a, Synthetic or Real? The Equilibrium Effects of Credit Default Swaps on Bond Markets, Working Paper, Columbia University.

Oehmke, Martin, and Adam Zawadowski, 2013b, The Anatomy of The CDS Market, Working Paper, Columbia University.

Pástor, Ľuboš, and Stambaugh, Robert F., 2003, Liquidity Risk and Expected Stock Returns, *Journal of Political Economy* 111, 642-685.

Rajan, Arvind, Glen McDermott, and Ratul Roy, 2007, The Structured Credit Handbook. John Wiley & Sons, Inc.

Schultz, P., 2001, Corporate Bond Trading Costs: A Peek Behind the Curtain, *Journal of Finance* 56, 677-698.

Shleifer, Andrei and Robert W. Vishny, 1997, The Limits to Arbitrage, *Journal of Finance* 52, 35-55.

Tang, Dragon Yongjun and Yan Hong, 2007, Liquidity and Credit Default Swap Spreads, Working paper, University of South Carolina.

Trapp, Monika, 2009, Trading the Bond-CDS Basis - The Role of Credit Risk and Liquidity, CFR Working paper No. 09-16, University of Cologne.

Table 1. Time Series Patterns of the CDS-Bond Basis

The table reports a summary of the sample and time series patterns of the basis. Panel A reports the number of firms and bonds in each year in our sample. The basis is defined as the difference between CDS spread and Z-spread on the same bond and is reported in percentage terms. Panel B reports the total number of daily observations, mean, standard deviation, median, skewness and kurtosis of CDS spread, Z-spread, and the basis for each year. All the spreads and the basis are in percentage terms. The sample period is from January 2001 to December 2008.

Panel A: The Number of Firms and Bonds by Year

	2001	2002	2003	2004	2005	2006	2007	2008	Total
Firm	145	200	238	263	288	283	278	269	**1,978**
Bond	531	770	889	970	1,026	986	947	865	**7,116**

Panel B: CDS Spread, Z-Spread, and CDS-Bond Basis by Year

Year		2001	2002	2003	2004	2005	2006	2007	2008	Average
N		4,232	9,662	40,439	57,185	79,223	76,046	63,412	62,715	49,114
CDS Spread	MEAN	0.99	1.31	0.54	0.41	0.43	0.38	0.44	1.33	0.60
	STD	0.79	1.35	0.61	0.40	0.42	0.34	0.43	1.52	0.62
	MED	0.76	0.84	0.36	0.31	0.33	0.29	0.33	0.87	0.42
	SKEW	2.76	3.04	3.86	3.70	4.01	2.66	3.13	5.35	3.72
	KURT	14.98	13.58	19.34	20.16	28.26	14.67	19.77	53.57	25.70
Z-Spread	MEAN	1.69	2.06	1.10	0.72	0.51	0.45	0.64	2.35	0.96
	STD	1.02	1.58	0.93	0.68	0.58	0.50	0.60	1.81	0.84
	MED	1.53	1.61	0.94	0.61	0.39	0.35	0.52	1.91	0.78
	SKEW	1.11	2.17	1.63	1.29	1.79	1.43	1.70	3.49	1.89
	KURT	3.44	7.89	4.38	2.69	5.78	3.49	6.61	28.39	8.51
CDS-Bond Basis	MEAN	-0.70	-0.75	-0.56	-0.31	-0.08	-0.08	-0.19	-1.02	-0.35
	STD	0.90	0.81	0.60	0.48	0.36	0.33	0.39	0.86	0.50
	MED	-0.44	-0.56	-0.50	-0.24	-0.01	-0.03	-0.12	-0.89	-0.27
	SKEW	-0.93	-1.06	-1.27	-1.70	-2.29	-2.33	-1.79	-0.78	-1.74
	KURT	0.42	1.07	3.17	6.39	12.27	13.63	7.65	0.57	7.72

Table 2. The CDS-Bond Basis and Bond Characteristics

The table reports the relation between the basis and various bond characteristics, such as rating, maturity, age, coupon, size, duration and convexity. Panel A reports summary information of the basis and bond characteristics. Bond ratings are categorized from 1 to 10 for all investment grade bonds (S&P ratings AAA to BBB-). We use the S&P ratings whenever available, followed by Moody's (Aaa to Baa3) 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 B reports the mean and standard deviation of CDS spread, Z-spread, and the bond characteristics broken down in groups, including ratings, maturity, age, coupon, issue size, duration and convexity. 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. The sample period is from January 2001 to December 2008.

Panel A: Summary Information of the Basis and Bond Characteristics

	N	MEAN	STD	MIN	MAX	MED	SKEW	KURT
CDS-Bond Basis	392,914	-0.35	0.64	-3.71	0.98	-0.17	-1.91	4.99
Rating	392,914	6.80	2.21	1.00	10.00	7.00	-0.39	-0.46
Maturity	392,914	8.51	7.62	1.00	30.00	5.76	1.36	0.72
Age	392,914	5.25	3.95	0.00	47.90	4.38	1.12	1.76
Coupon	392,914	6.25	1.35	0.25	11.75	6.40	-0.28	0.20
Issue Size	392,914	13.10	12.88	8.57	14.91	12.77	2.56	9.14
Duration	392,914	5.55	3.43	0.91	15.01	4.75	0.75	-0.46
Convexity	392,914	59.43	73.96	1.30	336.54	27.42	1.60	1.43

Panel B: CDS Spread, Z-Spread, and the Basis by Bond Characteristics Groups

Characteristics	Groups	N	CDS Spread		Z-Spread		CDS-Bond Basis	
			MEAN	STD	MEAN	STD	MEAN	STD
Ratings	AAA	9,441	0.16	0.17	0.23	0.54	-0.07	0.46
	AA	45,155	0.32	0.51	0.49	0.79	-0.16	0.51
	A	172,022	0.45	0.74	0.78	1.07	-0.33	0.60
	BBB	166,296	0.86	0.94	1.31	1.29	-0.45	0.69
Maturity	1	92,690	0.31	0.79	0.53	1.15	-0.22	0.66
	2	80,772	0.51	0.84	0.75	1.17	-0.24	0.61
	3	57,108	0.62	0.79	0.90	1.08	-0.29	0.56
	4	70,675	0.79	0.83	1.18	1.16	-0.40	0.62
	5	91,669	0.83	0.79	1.43	1.09	-0.60	0.62
Age	1	136,966	0.67	0.88	0.93	1.21	-0.27	0.59
	2	80,530	0.55	0.79	0.84	1.09	-0.29	0.57
	3	61,910	0.57	0.78	0.95	1.14	-0.38	0.63
	4	66,072	0.50	0.72	0.89	1.09	-0.40	0.68
	5	47,436	0.69	0.93	1.32	1.33	-0.63	0.73
Coupon	1	95,535	0.47	0.79	0.59	1.07	-0.12	0.52
	2	93,878	0.61	0.84	0.93	1.20	-0.32	0.63
	3	83,010	0.64	0.78	1.06	1.12	-0.42	0.62
	4	73,766	0.69	0.86	1.19	1.17	-0.50	0.64
	5	46,725	0.67	0.92	1.21	1.26	-0.55	0.72
Issue Size	1	72,228	0.58	0.89	1.01	1.22	-0.43	0.67
	2	55,707	0.54	0.79	0.89	1.14	-0.35	0.63
	3	103,146	0.60	0.78	0.93	1.13	-0.32	0.63
	4	65,704	0.54	0.71	0.80	1.06	-0.27	0.61
	5	96,129	0.70	0.93	1.09	1.28	-0.39	0.63
Duration	1	108,834	0.35	0.82	0.58	1.18	-0.23	0.66
	2	97,950	0.55	0.86	0.80	1.16	-0.25	0.58
	3	78,683	0.79	0.92	1.19	1.25	-0.40	0.63
	4	44,472	0.81	0.81	1.29	1.17	-0.49	0.68
	5	62,975	0.75	0.52	1.34	0.82	-0.58	0.54
Convexity	1	101,415	0.33	0.80	0.56	1.16	-0.23	0.66
	2	104,083	0.54	0.85	0.79	1.16	-0.25	0.59
	3	55,031	0.75	0.91	1.13	1.25	-0.39	0.63
	4	40,650	0.76	0.72	1.12	1.02	-0.36	0.59
	5	91,735	0.81	0.74	1.40	1.05	-0.59	0.61

Table 3. The CDS-Bond Basis and Future Individual Bond Returns

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 INDLIQ_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. 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 2001 to December 2008.

	k=20		k=40		k=60	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
BASIS	-0.0206***	-0.0099	-0.0314***	-0.0282***	-0.0201***	-0.0223***
	[-6.10]	[-0.62]	[-3.43]	[-5.66]	[-6.40]	[-16.33]
RATING	0.0008	0.0011	-0.0014	0.0004	-0.0008	-0.0020*
	[0.68]	[0.59]	[-0.45]	[0.18]	[-1.05]	[-1.63]
MATURITY	0.0021		-0.0011		0.0093	
	[1.13]		[-1.19]		[0.91]	
AGE	0.0043		0.0051		0.0088	
	[1.60]		[0.97]		[0.87]	
DURATION		0.0004		0.0008		-0.0001
		[0.56]		[0.84]		[-0.21]
COUPON	-0.1498	-0.1673	-0.4686	-0.0026	0.0264	-0.2192**
	[-0.81]	[-1.24]	[-1.49]	[-0.01]	[0.18]	[-2.46]
ISSUE SIZE	-0.0005	0.0029	0.0397	0.0003	-0.0007	0.0030***
	[-0.20]	[1.36]	[1.02]	[0.28]	[-0.19]	[3.16]
INDLIQ_K	-0.0476	0.0458	0.0651	0.0016	-0.0055	0.0077
	[-1.04]	[1.60]	[0.88]	[0.20]	[-0.41]	[0.71]
INTERCEPT	-0.0307	-0.0597*	-0.5253	-0.0134	-0.0811	-0.0284**
	[-1.12]	[-1.73]	[1.02]	[-0.61]	[-0.69]	[-2.02]
N	343,491	343,491	337,437	337,437	332,707	332,707
$\mathbf{R^2}$	24.92	25.39	30.42	30.53	33.02	34.28

Table 4. Returns of the Quintile Basis Portfolios

The table 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 2008. The quintile portfolios are sorted from the lowest (quintile 1) to the highest (quintile 5) basis. For each quintile, we compute the holding period returns for k = 20-, 40- and 60-day horizons. All portfolios are rebalanced daily and are equal-weighted (in Panel A) or value-weighted (in Panel B) 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. There are 258,514, 252,850, and 252,540 observations for 20 day, 40 day, and 60 day HPR, respectively. 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. There are about 35 bonds in each quintile portfolio. The t-statistics are reported in square bracket. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A: Equal-Weighted Quintile Portfolios Sorted on CDS-Bond Basis

Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-0.75	0.4244	0.2382	0.7961	0.4205	1.0452	0.4771
2	-0.42	0.3513	0.1651	0.5914	0.2158	0.836	0.268
3	-0.26	0.28	0.0938	0.5134	0.1379	0.6979	0.1299
4	-0.10	0.3398	0.1536	0.6335	0.2579	0.8784	0.3103
5	0.18	0.1428	-0.0433	0.3104	-0.0651	0.3996	-0.1684
1 – 5		0.2815***		0.4857***		0.6455***	
		[6.74]		[8.32]		[9.69]	

Panel B: Value-Weighted Quintile Portfolios Sorted on CDS-Bond Basis

Rank	**Basis**	**k=20**		**k=40**		**k=60**	
		Raw	**Excess**	**Raw**	**Excess**	**Raw**	**Excess**
1	-0.72	0.3586	0.1725	0.7273	0.3517	0.9771	0.4091
2	-0.42	0.3119	0.1258	0.5586	0.1831	0.7899	0.2219
3	-0.26	0.2623	0.0761	0.4539	0.0783	0.6197	0.0516
4	-0.10	0.314	0.1278	0.5908	0.2152	0.8182	0.2502
5	0.12	0.1398	-0.0463	0.3227	-0.0528	0.4509	-0.117
1 – 5		0.2188***		0.4045***		0.5262***	
		[5.06]		[6.59]		[7.59]	

Table 5. The Basis Risk Factor and Bond Characteristics

The table reports the relation between the basis risk factor and bond characteristics, such as rating, maturity, age, coupon, issue size, duration, and convexity. We first sort bonds into the characteristics groups. Then we construct a zero-investment basis portfolio by using the bonds in each characteristic group. We name this portfolio as LOW-minus-HIGH (LMH) portfolio because we long the LOW (quintile 1) basis portfolio and short the HIGH (quintile 5) basis portfolio by sorting the bonds within each characteristic group based on their past 60-day average basis. We report the profits of this LMH strategy by year in Panel A, by rating in Panel B, by maturity in Panel C, by age in Panel D, by coupon in Panel E, and by issue size in Panel F, by duration in Panel G, and by convexity in Panel H. We report both equal- and value-weighted HPR of the LMH portfolio. Definitions of the bond characteristics groups are the same as that in Table 2. Basis and returns are in percentage terms. The t-statistics are reported in square bracket. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively. The sample period is from July 2002 to December 2008 as we delete the trading days with less than five bond transactions. From Panel A through Panel F, there are 258,514, 252,850, and 252,540 observations for 20 day, 40 day, and 60 day HPR, respectively.

	k=20		**k=40**		**k=60**	
	EW	**VW**	**EW**	**VW**	**EW**	**VW**
			Panel A: Year			
2002	0.1157	0.1329	0.6561*	0.7292**	1.1591***	1.2140***
	[0.52]	[0.62]	[1.94]	[2.21]	[3.43]	[3.73]
2003	0.6110***	0.5581***	1.2927***	1.2157***	1.7473***	1.6369***
	[5.60]	[4.87]	[7.88]	[6.91]	[9.36]	[8.03]
2004	0.6085***	0.5963***	1.2535***	1.2378***	1.8132***	1.7542***
	[7.65]	[7.40]	[9.71]	[9.37]	[11.13]	[10.54]
2005	0.5794***	0.5190***	0.6868***	0.6313***	0.8570***	0.8002***
	[9.69]	[7.79]	[9.02]	[7.47]	[10.26]	[8.37]
2006	0.1810***	0.1120**	0.2848***	0.1559**	0.4277***	0.2730***
	[4.11]	[2.26]	[4.55]	[2.16]	[5.67]	[3.15]
2007	0.0188	-0.1361***	-0.081	-0.3440***	-0.2965***	-0.8342***
	[0.40]	[-2.64]	[-1.57]	[-5.23]	[-5.03]	[-8.44]
2008	-0.3043	-0.3737*	-0.8682***	-0.8852***	-1.4920***	-1.3224***
	[-1.57]	[-1.86]	[-3.59]	[-3.44]	[-5.73]	[-5.33]
			Panel B: Ratings			
AAA	0.2289***	0.2216***	0.4258***	0.4225***	0.6021***	0.5897***
	[2.93]	[2.85]	[4.80]	[4.78]	[6.64]	[6.54]
AA	0.7957***	0.6385***	1.4147***	1.1463***	1.6894***	1.2886***
	[8.86]	[7.81]	[12.25]	[10.73]	[13.91]	[11.91]
A	0.2624***	0.2588***	0.3124***	0.3342***	0.4272***	0.406***
	[5.74]	[5.77]	[5.21]	[5.67]	[6.23]	[6.05]
BBB	0.3002***	0.1695***	0.4991***	0.3122***	0.7023***	0.4383***
	[5.43]	[3.03]	[6.99]	[4.04]	[8.34]	[4.85]

Panel C: Maturity						
1	0.4195***	0.2837***	0.5827***	0.3130***	0.4273***	0.2059***
	[8.82]	[7.67]	[10.43]	[7.40]	[10.18]	[5.54]
2	0.2940***	0.3028***	0.4341***	0.4946***	0.6174***	0.6568***
	[6.03]	[5.29]	[7.02]	[6.89]	[9.47]	[8.48]
3	-0.1419*	-0.1556**	-0.2960***	-0.2553***	-0.1854*	-0.1403
	[-1.76]	[-2.06]	[-2.73]	[-2.64]	[-1.69]	[-1.46]
4	0.0706	0.0104	0.0065	-0.0788	-0.1687**	-0.2784***
	[1.44]	[0.18]	[0.10]	[-1.14]	[-2.37]	[-3.53]
5	0.4553***	0.5063***	0.7668***	0.8802***	1.1403***	1.1820***
	[5.46]	[7.05]	[7.59]	[9.93]	[9.83]	[11.41]
Panel D: Age						
1	0.1935***	0.1123**	0.2935***	0.1895***	0.3921***	0.2742***
	[4.10]	[2.31]	[4.61]	[2.88]	[5.16]	[3.55]
2	0.2411***	0.2807***	0.3044***	0.3931***	0.4484***	0.4874***
	[3.89]	[5.16]	[3.66]	[5.33]	[5.09]	[5.85]
3	0.1221**	0.1299**	0.2230***	0.2590***	0.3747***	0.4129***
	[2.52]	[2.41]	[3.84]	[3.82]	[5.62]	[5.76]
4	0.6576***	0.4930***	0.9431***	0.7351***	1.1050***	0.8665***
	[8.97]	[7.53]	[10.25]	[8.53]	[10.43]	[8.87]
5	0.2430***	0.1476*	0.4285***	0.2670***	0.6357***	0.4232***
	[2.84]	[1.81]	[4.52]	[2.78]	[5.36]	[3.55]
Panel E: Coupon						
1	0.1501***	0.1735***	0.1411**	0.1649***	0.1646**	0.2180***
	[3.23]	[3.77]	[2.19]	[2.75]	[2.40]	[3.39]
2	0.1321***	0.0867**	0.1264**	0.02	0.2088***	0.0225
	[3.06]	[2.14]	[2.32]	[0.39]	[3.41]	[0.38]
3	0.1191**	0.0261	0.2579***	0.0497	0.4471***	0.139
	[2.01]	[0.42]	[3.53]	[0.60]	[5.42]	[1.52]
4	0.2353***	0.0035	0.3357***	0.0186	0.3671***	-0.0508
	[3.25]	[0.05]	[3.60]	[0.18]	[3.05]	[-0.41]
5	0.8093***	0.8501***	1.4169***	1.3688***	1.5893***	1.4975***
	[7.64]	[7.53]	[12.17]	[10.49]	[12.63]	[10.83]

			Panel F: Issue Size			
1	0.5399***	0.5514***	0.7633***	0.7713***	1.0944***	1.0831***
	[3.82]	[3.95]	[5.42]	[5.57]	[7.24]	[7.32]
2	0.2803***	0.2715***	0.2118**	0.2272***	0.054	0.0949
	[3.96]	[4.31]	[2.49]	[2.88]	[0.54]	[1.02]
3	0.2171***	0.1991***	0.2887***	0.2556***	0.4824***	0.4256***
	[3.27]	[3.24]	[3.59]	[3.27]	[5.41]	[4.83]
4	0.3319***	0.2988***	0.4479***	0.4171***	0.4528***	0.4441***
	[7.68]	[7.28]	[8.17]	[8.05]	[7.12]	[7.34]
5	0.1731***	0.1465***	0.3150***	0.2852***	0.4590***	0.4090***
	[3.38]	[2.96]	[4.52]	[4.20]	[5.75]	[5.24]
			Panel G: Duration			
1	0.4156***	0.2914***	0.5582***	0.3286***	0.4867***	0.2853***
	[9.93]	[8.74]	[11.96]	[8.90]	[13.57]	[9.07]
2	0.1290**	0.1767***	0.1461*	0.2265***	0.3464***	0.3963***
	[2.17]	[2.88]	[1.81]	[2.83]	[4.50]	[4.99]
3	0.0558	0.0461	-0.1156**	-0.1218*	-0.2570***	-0.3034***
	[1.14]	[0.88]	[-1.97]	[-1.87]	[-3.68]	[-4.33]
4	0.4020***	0.3670***	0.5770***	0.5186***	0.5610***	0.2733*
	[4.11]	[3.97]	[4.75]	[4.46]	[3.80]	[1.88]
5	0.4570***	0.3497***	0.9769***	0.8048***	1.5890***	1.3392***
	[6.11]	[4.86]	[10.45]	[9.17]	[16.44]	[14.27]
			Panel H: Convexity			
1	0.4099***	0.2795***	0.5796***	0.3404***	0.4784***	0.2666***
	[9.15]	[8.00]	[11.56]	[8.66]	[12.81]	[8.15]
2	0.1437**	0.1707***	0.2030***	0.2615***	0.3897***	0.4266***
	[2.58]	[2.93]	[2.77]	[3.57]	[5.13]	[5.48]
3	0.1680***	0.1482**	0.0524	0.0336	-0.1558*	-0.1496
	[3.10]	[2.22]	[0.75]	[0.38]	[-1.75]	[-1.44]
4	0.021	0.0723	-0.0074	0.0173	-0.1334*	-0.1957***
	[0.39]	[1.37]	[-0.13]	[0.29]	[-1.96]	[-2.86]
5	0.4925***	0.5202***	0.7413***	0.8476***	1.1764***	1.2270***
	[6.06]	[7.22]	[7.51]	[9.68]	[10.44]	[11.97]

Table 6. Asset Pricing Tests with the Basis Risk Factor

The table reports asset pricing tests using the basis factor as a new risk factor. Panel A reports correlations between the basis factors and other systematic risk factors over the same time horizons. The existing risk factors are MKT_k, SMB_k, HML_k, TERM_k, DEF_k, LIQ_k, AMH_k, and PS_k. We compute the value of these risk factors for a time horizon of k (where k = 20, 40, and 60, respectively). 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 (= 20, 40, or 60) represents the number of days used to calculate the price impact relative to the volume. PS_k is the Pastor-Stambaugh (2003) bond market liquidity risk factor. We demeaned all risk factors. All factors except for LIQ_k factors are in percentage terms. We construct three basis factors (BASIS_k, where *k* = 20, 40, 60) by forming the LMH portfolio as specified in Table 4 and use the LMH's HPR from day *t-k* to *t* for the value-weighted portfolios of test assets. We use all the systematic risk factors from day *t-k* to t to price the twenty portfolios for their future returns from day *t* to *t+k* (where *k* = 20, 40, and 60, respectively) as a proxy for the expected returns of the portfolios. Panel B reports summary statistics of the basis risk factors, which are all in percentage terms. Panel C and D report regressions of twenty rating/maturity portfolios for sub-period 2002-2006 and 2007-2008, respectively. When estimating the betas, we employ the standard Fama-MacBeth procedure with a 180-day rolling window. The standard errors are Newey-West standard errors. An ***, **, and * denotes significance at the 1%, 5%, and 10% level, respectively.

Panel A: Factor Correlations

	MKT_20	SMB_20	HML_20	DEF_20	TERM_20	LIQ_20	AMH_20	PS_20
BASIS_20	0.16***	0.08**	0.23***	0.12***	0.41***	0.05**	0.18***	0.05**
	MKT_40	SMB_40	HML_40	DEF_40	TERM_40	LIQ_40	AMH_40	PS_40
BASIS_40	0.30***	0.11***	0.23***	0.23***	0.45***	0.09***	0.18***	0.24***
	MKT_60	SMB_60	HML_60	DEF_60	TERM_60	LIQ_60	AMH_60	PS_60
BASIS_60	0.36***	0.10***	0.18***	0.31***	0.38***	0.17***	0.13***	0.17***

Panel B. Summary Statistics of Risk Factors

	N	MEAN	STD	MIN	MAX
BASIS_20	1541	0.21	1.68	-11.02	10.93
MKT_20	2236	-0.19	4.87	-32.76	19.56
SMB_20	2236	0.31	2.26	-8.92	7.26
HML_20	2236	0.48	2.50	-10.74	12.95
DEF_20	2236	-0.20	2.00	-15.83	5.47
TERM_20	2236	-1.27	2.89	-10.55	15.66
LIQ_20	2236	2.02	0.68	0.68	3.67
AMH_20	2196	0.00	1.00	-8.94	5.59
PS_20	1768	0.00	0.18	-1.09	1.56
BASIS_40	1522	0.39	2.33	-10.51	27.84
MKT_40	2216	-0.41	7.10	-46.88	19.24
SMB_40	2216	0.60	3.20	-10.31	9.53
HML_40	2216	0.95	3.77	-14.18	20.18
DEF_40	2216	-0.40	3.06	-21.83	7.79
TERM_40	2216	-2.67	4.18	-15.30	21.43
LIQ_40	2216	2.02	0.64	0.87	3.51
AMH_40	2136	0.00	1.00	-7.82	3.23
PS_40	1921	0.00	0.20	-1.27	0.76
BASIS_60	1505	0.52	2.69	-17.13	26.37
MKT_60	2196	-0.49	8.48	-53.90	20.24
SMB_60	2196	0.92	3.91	-12.27	12.51
HML_60	2196	1.38	4.40	-12.36	23.29
DEF_60	2196	-0.59	3.96	-23.26	7.79
TERM_60	2196	-4.13	4.97	-16.33	18.17
LIQ_60	2196	2.03	0.62	0.95	3.49
AMH_60	2076	0.00	1.00	-6.55	2.17
PS_60	2049	0.00	0.09	-0.76	0.20

Panel C: Pre-crisis Period: 2002-2006

	k=20				k=40				k=60			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Intercept	-0.0001	-0.0004	0.0005*	0.0003	-0.0009**	-0.0007*	-0.0010***	-0.0008**	-0.0014***	-0.0012***	-0.0014***	-0.0010**
	[-0.47]	[-1.36]	[1.65]	[0.96]	[-2.41]	[-1.79]	[-2.73]	[-1.99]	[-3.35]	[-2.83]	[-3.09]	[-2.40]
BASIS_k			0.3434***	0.3101***			0.4021***	0.5398***			0.4074**	0.3563**
			[4.19]	[3.82]			[3.19]	[4.41]			[2.46]	[2.11]
MKT_k	0.8911***	0.9235***	0.6393*	0.7986**	0.4964	0.9183**	0.4473	0.9249**	1.5329***	1.5320***	1.8012***	1.6068***
	[2.67]	[2.71]	[1.93]	[2.35]	[1.31]	[2.39]	[1.17]	[2.44]	[3.18]	[3.00]	[3.59]	[3.13]
SMB_k	0.8904***	0.6573***	0.9297***	0.8060***	0.7010**	0.7876***	0.6319**	0.8344***	-0.2747	0.1675	-0.1141	0.3177
	[3.56]	[2.66]	[3.61]	[3.08]	[2.35]	[2.87]	[2.15]	[3.04]	[-0.98]	[0.53]	[-0.40]	[0.95]
HML_k	0.2622	0.4281**	-0.1388	0.0826	0.1240	0.4999**	0.0599	0.5518**	0.9392***	1.0735***	0.7258***	0.7348***
	[1.37]	[2.28]	[-0.72]	[0.43]	[0.63]	[2.55]	[0.27]	[2.37]	[4.00]	[4.83]	[3.14]	[3.16]
DEF_k	0.2179***	0.2333***	0.1386	0.2166**	0.2409***	0.2147**	0.2587***	0.2261**	0.2280**	0.2126**	0.2162**	0.2402**
	[2.77]	[2.67]	[1.53]	[2.49]	[2.79]	[2.37]	[2.68]	[2.28]	[2.08]	[2.04]	[2.02]	[2.17]
TERM_k	0.0607	0.1034	-0.0776	-0.0814	0.2954	0.2756	0.2466	0.1299	0.3175	0.3899	0.3093	0.3875
	[0.37]	[0.60]	[-0.46]	[-0.47]	[1.23]	[1.12]	[0.97]	[0.5]	[1.13]	[1.43]	[1.10]	[1.41]
LIQ_k	0.1557***	0.0405	0.1269*	0.0666	0.0018	0.0522	0.0089	0.0508	-0.0199	-0.0162	-0.0126	-0.0076
	[2.83]	[0.72]	[1.75]	[1.09]	[0.06]	[1.46]	[0.24]	[1.36]	[-0.79]	[-0.66]	[-0.50]	[-0.31]
AMH_k	-0.1860		-0.2288		-0.1940**		-0.0833		0.0145		0.0224	
	[-1.43]		[-1.55]		[-1.97]		[-0.84]		[0.10]		[0.14]	
PS_k		0.0100		0.0128		0.0810***		0.0508*		-0.0003		0.0040
		[0.55]		[0.70]		[3.50]		[1.91]		[-0.05]		[0.56]
N	27,133	27,133	27,133	27,133	26,865	26,865	26,865	26,865	26,568	26,568	26,568	26,568
R^2	0.4995	0.4837	0.5114	0.496	0.5696	0.5732	0.5877	0.5862	0.6474	0.6530	0.6564	0.6594

Panel D: Crisis Period: 2007-2008

	k=20				k=40				k=60			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Intercept	0.0017	0.0010	0.0019	0.0038**	0.0021	0.0038**	0.0011	0.0004	0.0014	0.0033***	0.0012	0.0030***
	[1.59]	[0.81]	[1.38]	[2.39]	[1.33]	[2.50]	[0.63]	[0.23]	[0.93]	[2.63]	[0.79]	[2.59]
BASIS_k			-0.4605	-0.1959			-1.1202***	-0.9690***			-0.9009*	-1.4408***
			[-1.42]	[-0.63]			[-3.17]	[-2.98]			[-1.94]	[-3.52]
MKT_k	-4.0705***	-3.9148***	-3.0556***	-3.6194***	-3.4784***	-4.7253***	-3.3215***	-3.5656***	-4.3248***	-4.2714***	-3.8620***	-4.4035***
	[-4.03]	[-3.95]	[-3.47]	[-3.76]	[-3.74]	[-5.48]	[-4.05]	[-4.12]	[-4.56]	[-4.96]	[-4.03]	[-4.72]
SMB_k	2.0357***	1.3772**	1.4994***	0.8027	2.6760***	1.7842***	3.2132***	2.4129***	2.0039**	1.2572*	2.4012***	1.5752**
	[2.71]	[2.00]	[2.76]	[1.36]	[3.95]	[2.72]	[5.00]	[3.45]	[2.37]	[1.66]	[3.12]	[2.11]
HML_k	-1.2575**	-1.4003**	-0.7405	-1.1355**	-1.2158	-1.6198**	-1.3914*	-1.1606*	-2.7276***	-1.5854**	-1.8329**	-1.7871**
	[-2.27]	[-2.34]	[-1.30]	[-2.02]	[-1.61]	[-2.02]	[-1.84]	[-1.72]	[-3.98]	[-2.09]	[-2.54]	[-2.29]
DEF_k	-1.3087***	-1.3624***	-1.4398***	-1.8336***	-1.6605***	-1.7301***	-2.5431***	-2.4904***	-3.9740***	-4.1098***	-3.9405***	-3.7994***
	[-4.12]	[-4.13]	[-3.71]	[-4.6]	[-3.43]	[-3.45]	[-5.37]	[-4.68]	[-8.75]	[-8.21]	[-8.15]	[-8.41]
TERM_k	0.5290	0.7086	0.0560	0.3167	-0.6025	-0.6021	0.3305	0.1176	-0.0638	0.1530	0.0376	-0.1259
	[1.20]	[1.61]	[0.12]	[0.70]	[-1.34]	[-1.35]	[0.68]	[0.28]	[-0.12]	[0.26]	[0.07]	[-0.21]
LIQ_k	-0.0578	-0.0843	-0.0940	-0.1000	-0.0833	-0.0355	-0.1229**	-0.0949*	0.0849	-0.0164	0.0748	-0.0609
	[-0.58]	[-0.87]	[-1.02]	[-1.06]	[-1.58]	[-0.62]	[-2.08]	[-1.67]	[1.19]	[-0.26]	[1.04]	[-0.90]
AMH_k	0.0230		0.1633		-0.4516		-0.5200		0.7675		0.7530	
	[0.05]		[0.29]		[-1.27]		[-1.37]		[0.95]		[1.03]	
PS_k		0.0909		-0.1316		0.2557**		0.3916***		0.0222		-0.0059
		[0.83]		[-1.20]		[2.06]		[2.59]		[0.51]		[-0.16]
N	27,133	27,133	27,133	27,133	26,865	26,865	26,865	26,865	26,568	26,568	26,568	26,568
R^2	0.5042	0.5069	0.5445	0.5594	0.5060	0.5111	0.5975	0.5743	0.5797	0.5904	0.5983	0.5949

Table 7. The Basis Risk Factor versus Other Risk Factors

The table reports the regression analysis between value-weighted basis risk factor BASIS_k and the systematic risk factors, such as MKT_k, SMB_k, HML_k, TERM_k, DEF_k, LIQ_k, AMH_k, TED_k, FINRET_k, and VIX_k, and k = 20, 40, and 60. The rest of the risk factors are defined in Table 6. TED_k is the average of 3-month uncollateralized LIBOR rate minus 3-month T-bill rate from day *t-k* to *t*, FINRET_k is the cumulative excess return of value-weighted financial firms' equity returns from day *t-k* to *t*, VIX_k is the average of SP500 option volatility from day *t-k* to *t*. The standard errors are Newey-West standard errors. The sample period is from 2002 to 2008. An ***, **, and * denotes significance at the 1%, 5%, and 10% level.

	k=20				k=40				k=60			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.04	-0.02	-0.02	-0.00	0.02	-0.06	-0.06	0.01	0.04	-0.07	-0.06	0.04
	[0.39]	[-0.17]	[-0.18]	[-0.04]	[0.12]	[-0.28]	[-0.31]	[0.06]	[0.16]	[-0.29]	[-0.25]	[0.18]
MKT_k	0.03	0.08	0.03	0.04	0.08**	0.04	0.04	-0.05	0.07*	0.09	0.03	-0.01
	[1.10]	[1.30]	[0.81]	[0.59]	[2.51]	[0.50]	[1.16]	[-0.64]	[1.77]	[1.01]	[0.62]	[-0.16]
SMB_k	-0.02	-0.00	-0.02	-0.02	-0.05	-0.04	-0.03	-0.06	-0.05	-0.04	-0.03	-0.05
	[-0.37]	[-0.06]	[-0.56]	[-0.53]	[-1.05]	[-0.92]	[-0.69]	[-1.23]	[-0.93]	[-0.65]	[-0.57]	[-0.89]
HML_k	0.14**	0.16**	0.07	0.08	0.11**	0.13**	0.06	0.03	0.08	0.10	0.04	0.02
	[2.00]	[2.26]	[0.97]	[0.99]	[2.18]	[2.10]	[1.07]	[0.45]	[1.34]	[1.55]	[0.69]	[0.3]
DEF_k	0.02	0.06	0.08	0.05	-0.06	0.04	0.07	0.03	0.02	0.12	0.16	0.08
	[0.14]	[0.45]	[0.55]	[0.36]	[-0.38]	[0.32]	[0.51]	[0.18]	[0.16]	[1.06]	[1.57]	[0.55]
TERM_k	0.27***	0.27***	0.34***	0.33***	0.31***	0.31***	0.37***	0.38***	0.32***	0.33***	0.37***	0.36***
	[4.43]	[3.74]	[7.97]	[7.23]	[5.05]	[4.27]	[7.98]	[7.41]	[5.52]	[5.58]	[7.85]	[6.89]
LIQ_k	0.29**	0.44***	0.01	0.01	0.56**	0.78***	0.16	-0.01	0.88**	1.19***	0.46	0.17
	[2.01]	[3.29]	[0.07]	[0.05]	[1.99]	[2.97]	[0.55]	[-0.02]	[2.04]	[3.19]	[0.93]	[0.37]
AMH_k	-0.07	-0.03	-0.12	-0.13	0.11	0.20	-0.12	-0.10	0.11	0.18	-0.15	-0.20
	[-0.63]	[-0.27]	[-1.41]	[-1.53]	[0.92]	[1.55]	[-0.78]	[-0.77]	[0.50]	[0.76]	[-0.58]	[-0.89]
TED_k	-0.61*			-0.17	-0.98			-0.71	-1.34			-1.20
	[-1.90]			[-0.66]	[-1.48]			[-1.07]	[-1.37]			[-1.20]
FINRET_k		-0.03		-0.01		0.03		0.07		-0.01		0.03
		[-0.80]		[-0.21]		[0.59]		[1.49]		[-0.29]		[0.67]
VIX_k			-0.07***	-0.06***			-0.11***	-0.11***			-0.13**	-0.13**
			[-3.91]	[-3.74]			[-2.69]	[-2.81]			[-1.99]	[-2.40]
N	1536	1536	1536	1536	1522	1522	1522	1522	1505	1505	1505	1505
R^2	0.3031	0.2816	0.3519	0.3531	0.4322	0.4107	0.4554	0.4792	0.4733	0.4507	0.4795	0.4983

Table 8. Horse-race of the Basis Risk Factor versus Other New Risk Factors

The table reports asset pricing tests for alternative explanations. The risk factors BASIS_k, MKT_k, SMB_k, HML_k, TERM_k, DEF_k, LIQ_k, and AMH_k are defined in Table 6 where *k* = 20, 40 and 60. TED_k, FINRET_k and VIX_k are defined in Table 7. Panel A reports the results from 2002 to 2006. Panel B reports the results from 2007 to 2008. The standard errors are Newey-West standard errors. The sample period is from 2002 to 2008. An ***, **, and * denotes significance at the 1%, 5%, and 10% level.

Panel A: Pre-crisis Period: 2002-2006

	k=20				k=40				k=60			
	Model 5	**Model 6**	**Model 7**	**Model 8**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Intercept	0.0008**	0.0004	0.0006*	0.0004	-0.0006	-0.0012***	-0.0006*	-0.0003	-0.0007	-0.0012***	-0.0009**	-0.0005
	[2.57]	[1.19]	[1.96]	[1.32]	[-1.62]	[-3.27]	[-1.75]	[-0.87]	[-1.48]	[-2.65]	[-2.14]	[-1.02]
BASIS_k	0.2899***	0.3800***	0.2939***	0.2784***	0.4043***	0.2821**	0.4108***	0.2416*	0.4652***	0.4559***	0.4021**	0.5137***
	[3.35]	[4.62]	[3.57]	[2.95]	[3.21]	[2.13]	[3.12]	[1.77]	[2.72]	[2.80]	[2.44]	[2.99]
MKT_k	0.5907	0.7654**	0.8841**	0.7183*	0.3753	0.5424	0.5383	0.8754*	1.8665***	2.2717***	1.7424***	1.8664***
	[1.62]	[2.38]	[2.57]	[1.75]	[0.94]	[1.36]	[1.35]	[1.74]	[3.67]	[4.33]	[3.35]	[3.04]
SMB_k	0.8843***	0.8399***	0.9861***	1.2191***	0.5724*	0.3682	0.5507*	0.3425	-0.3875	0.1863	-0.1780	-0.1176
	[3.33]	[3.38]	[3.74]	[3.84]	[1.83]	[1.17]	[1.72]	[0.88]	[-1.24]	[0.61]	[-0.56]	[-0.33]
HML_k	-0.2569	-0.0496	-0.3563*	-0.2969	0.1753	0.0228	0.0663	0.4970	0.6889**	0.2538	0.5242**	0.0855
	[-1.25]	[-0.23]	[-1.76]	[-1.22]	[0.75]	[0.10]	[0.26]	[1.54]	[2.48]	[0.90]	[2.02]	[0.29]
DEF_k	0.1982**	0.1515*	0.1211	0.1261	0.2743***	0.1688*	0.2373**	0.3050***	0.1978*	0.2299**	0.2074**	0.0975
	[2.02]	[1.87]	[1.24]	[1.36]	[2.62]	[1.67]	[2.36]	[2.69]	[1.73]	[2.09]	[1.97]	[0.82]
TERM_k	-0.1132	-0.0862	-0.0601	0.0315	0.1512	0.4231*	0.1677	0.1286	0.1703	0.2053	0.2813	0.2046
	[-0.65]	[-0.51]	[-0.36]	[0.18]	[0.61]	[1.66]	[0.67]	[0.51]	[0.59]	[0.71]	[0.98]	[0.69]
LIQ_k	0.0929	0.1668**	0.1233	0.1845***	0.0468	-0.0157	0.0605	0.1082**	0.0331	-0.0051	0.0044	0.0740**
	[1.24]	[2.52]	[1.54]	[2.91]	[1.20]	[-0.43]	[1.59]	[2.32]	[1.10]	[-0.20]	[0.17]	[2.30]
AMH_k	-0.2031	-0.3095**	-0.1762	-0.4779**	-0.0787	0.0514	-0.0914	-0.0263	-0.1148	0.0374	-0.0607	-0.2107
	[-1.21]	[-2.27]	[-1.04]	[-2.53]	[-0.79]	[0.41]	[-0.87]	[-0.21]	[-0.71]	[0.19]	[-0.38]	[-1.27]
TED_k	0.0051			-0.0078	0.0048			-0.0006	0.0090**			0.0107***
	[0.49]			[-0.91]	[0.88]			[-0.07]	[2.40]			[2.88]
FINRET_k		0.9432		1.5678**		1.3807**		1.1702		3.7739***		3.7208***
		[1.60]		[2.54]		[2.20]		[1.25]		[5.33]		[4.25]
VIX_k			-0.0737	-0.4757			0.0544	-0.0206			-0.2376	-0.4847**
			[-0.26]	[-1.34]			[0.26]	[-0.09]			[-1.11]	[-2.07]
N	27,133	27,133	27,133	27,133	26,865	26,865	26,865	26,865	26,568	26,568	26,568	26,568
R^2	0.5374	0.5382	0.5280	0.5735	0.6010	0.6020	0.6069	0.6408	0.6643	0.6783	0.6795	0.7034

Panel B: Crisis Period: 2007-2008

	k=20				k=40				k=60			
	Model 5	**Model 6**	**Model 7**	**Model 8**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Intercept	0.0010	0.0009	0.0015	0.0012	0.0019	-0.0023	0.0012	0.0008	0.0012	0.0012	0.0020*	0.0028**
	[0.79]	[0.79]	[0.99]	[0.82]	[1.02]	[-1.20]	[0.60]	[0.44]	[0.96]	[0.84]	[1.91]	[2.51]
BASIS_k	-0.4846	-0.3782	-0.3626	-0.2177	-1.1632***	-0.9373***	-0.8696***	-0.3996	-0.8526**	-0.7909*	-1.0133**	-1.2970***
	[-1.62]	[-1.04]	[-1.08]	[-0.59]	[-3.29]	[-2.71]	[-2.69]	[-1.25]	[-2.01]	[-1.71]	[-2.20]	[-2.78]
MKT_k	-2.9635***	-3.3634***	-2.6955***	-4.4167***	-3.0005***	-4.1981***	-2.5855**	-3.7435***	-2.4581**	-4.7613***	-3.8692***	-4.9116***
	[-2.99]	[-3.11]	[-2.73]	[-3.43]	[-3.67]	[-4.73]	[-2.54]	[-3.15]	[-2.38]	[-4.39]	[-3.82]	[-3.24]
SMB_k	1.0729*	0.7295	1.1718	-0.0994	0.6701	2.2699***	3.6125***	1.7278*	-0.9761	1.1188	1.3282*	-1.3884
	[1.87]	[1.32]	[1.59]	[-0.13]	[0.84]	[3.10]	[4.48]	[1.88]	[-1.13]	[1.54]	[1.73]	[-1.61]
HML_k	-1.2411**	-0.7539	-1.0810	-1.7939*	-2.5242***	-2.0667**	-1.4819	-2.1483**	-1.9487***	-1.9286***	-3.8807***	-3.7955***
	[-2.21]	[-1.21]	[-1.57]	[-1.9]	[-2.64]	[-2.15]	[-1.57]	[-2.01]	[-2.92]	[-3.02]	[-3.74]	[-4.15]
DEF_k	-1.3340***	-1.3306***	-1.3540***	-1.5565***	-2.5884***	-2.0545***	-2.9056***	-2.8630***	-3.9508***	-3.3767***	-3.4181***	-3.4268***
	[-3.58]	[-3.22]	[-3.84]	[-3.84]	[-5.38]	[-4.55]	[-5.58]	[-5.11]	[-9.03]	[-7.54]	[-8.67]	[-7.77]
TERM_k	0.4546	0.1771	0.1843	0.7009	0.1341	0.3038	0.4786	0.8730*	0.0307	-0.2055	-0.2724	-0.3658
	[0.96]	[0.36]	[0.37]	[1.36]	[0.27]	[0.62]	[1.04]	[1.83]	[0.06]	[-0.40]	[-0.44]	[-0.62]
LIQ_k	-0.1045	-0.0600	-0.2474***	-0.2340**	-0.1151**	-0.1515***	-0.0926	-0.1449**	0.0378	0.0355	-0.0115	-0.1905**
	[-1.24]	[-0.65]	[-2.69]	[-2.29]	[-2.01]	[-2.64]	[-1.49]	[-2.29]	[0.51]	[0.53]	[-0.17]	[-2.23]
AMH_k	-0.2360	-0.9494	-0.5627	-1.3943*	-0.9542***	0.0320	0.3233	-0.4876	0.4929	-0.1121	0.5365	-0.6449
	[-0.43]	[-1.20]	[-0.87]	[-1.77]	[-3.11]	[0.07]	[0.53]	[-0.99]	[0.65]	[-0.20]	[0.80]	[-0.86]
TED_k	-0.3630***		-1.5343	-0.2668*	-0.1973**		-2.2889**	0.0254	-0.1843**		0.1451	-0.1673**
	[-2.67]		[-1.50]	[-1.74]	[-2.44]		[-2.58]	[0.19]	[-2.43]		[0.20]	[-2.02]
FRET_k		-9.8572***		-12.715***		-14.660***		-15.303***		-16.277***		-15.436***
		[-3.51]		[-3.71]		[-5.25]		[-5.37]		[-5.26]		[-3.89]
VIX_k			-1.5343	-0.7575			-2.2889**	-0.7825			0.1451	0.4465
			[-1.50]	[-0.73]			[-2.58]	[-0.87]			[0.20]	[0.49]
N	27,133	27,133	27,133	27,133	26,865	26,865	26,865	26,865	26,568	26,568	26,568	26,568
R^2	0.5830	0.5750	0.5693	0.6209	0.6197	0.6152	0.6237	0.6650	0.6302	0.6237	0.6197	0.6678

Table 9. The Pricing of Basis Risk Factor in High-Yield Bonds

The table reports asset pricing tests for high-yield corporate bond portfolios. The risk factors BASIS_k, MKT_k, SMB_k, HML_k, TERM_k, DEF_k, LIQ_k, AMH_k and PS_k are defined in Table 6 where *k* = 20, 40 and 60. TED_k, FINRET_k and VIX_k are defined in Table 7. Panel A reports the results from 2002 to 2006. Panel B reports the results from 2007 to 2008. The standard errors are Newey-West standard errors. The sample period is from 2002 to 2008. An ***, **, and * denotes significance at the 1%, 5%, and 10% level.

Panel A: Pre-crisis Period: 2002-2006

	k=20				k=40				k=60			
	Model 3	**Model 4**	**Model 8**	**Model 9**	**Model 3**	**Model 4**	**Model 8**	**Model 9**	**Model 3**	**Model 4**	**Model 8**	**Model 9**
Intercept	-0.0498*	-0.0176	-0.0001	0.2757	0.0110	-0.0100	0.0823	0.0242	-0.0054	0.0080	0.0129**	-0.0031
	[-1.66]	[-1.05]	[0.00]	[0.91]	[1.59]	[-0.39]	[1.10]	[1.24]	[-0.10]	[0.29]	[2.14]	[-0.17]
BASIS_k	0.5999	0.1954	-1.3069	7.4559	-0.4356	-1.3549	-3.4577	-3.4078	8.1726	-3.3114	-0.2024	3.9532
	[0.41]	[0.16]	[-0.37]	[1.01]	[-0.55]	[-1.00]	[-1.30]	[-1.15]	[1.25]	[-1.08]	[-0.21]	[0.72]
MKT_k	6.4542***	3.0165	7.0576	-3.9636	-1.4769	-2.8491	-7.5529	-17.083	-2.4383	-11.407	0.7702	2.0254
	[3.04]	[1.15]	[1.33]	[-0.42]	[-0.95]	[-0.62]	[-0.88]	[-0.91]	[-0.47]	[-1.59]	[1.10]	[1.49]
SMB_k	3.4432	-0.1438	0.7543	-4.3976	-0.5374	-3.8894	-16.548	0.6426	-3.7245	-0.1941	0.0800	0.6708
	[0.80]	[-0.08]	[0.28]	[-0.57]	[-0.36]	[-1.25]	[-0.99]	[0.81]	[-1.06]	[-0.22]	[0.10]	[0.95]
HML_k	5.8361	0.1125	2.8877*	-10.693	2.1717*	-2.2614	0.7064	1.1990***	1.0547*	0.8963	-1.5768	1.5275
	[0.98]	[0.16]	[1.71]	[-0.9]	[1.90]	[-0.52]	[0.79]	[2.93]	[1.70]	[1.38]	[-1.40]	[1.33]
DEF_k	1.1407	0.8800	3.5009	-7.7214	-0.1368	1.4904	-0.1037	-0.3023	-0.3377**	-0.7036***	-0.2797	-0.8756***
	[1.01]	[1.17]	[1.02]	[-1.14]	[-1.10]	[0.90]	[-0.38]	[-1.17]	[-1.97]	[-3.16]	[-0.86]	[-2.72]
TERM_k	-0.4165*	-0.0745	-0.1424	-0.1090	0.0738	-1.6919	-0.0924	1.3197**	0.1796	-0.8748**	-1.0166	1.9844**
	[-1.66]	[-0.25]	[-0.17]	[-0.21]	[0.17]	[-0.77]	[-0.13]	[2.42]	[0.25]	[-2.04]	[-0.90]	[2.29]
LIQ_k	0.0168	-0.0475	-0.0794	-0.1477	0.0762	0.0166	0.0738	0.0490	0.0849***	0.0516*	0.2898***	0.0755
	[0.36]	[-0.90]	[-1.06]	[-1.26]	[1.27]	[0.40]	[0.94]	[0.71]	[4.10]	[1.67]	[2.88]	[1.14]
AMH_k	-0.1100		0.1987		0.7335**		0.4794		1.0432***		1.3126***	
	[-0.90]		[0.99]		[2.44]		[1.42]		[4.94]		[3.06]	
PS_k		-0.0365		-0.0023		0.2633***		0.1348**		-0.0279		-0.0434*
		[-1.07]		[-0.04]		[4.48]		[2.56]		[-1.59]		[-1.66]
TED_k			0.0117	0.0324***			0.0266**	0.0140			-0.0252***	-0.0043
			[1.32]	[2.67]			[2.32]	[1.20]			[-2.89]	[-0.52]
FINRET_k			1.3005**	2.3703***			0.7437	1.3806**			3.2258**	2.5879*
			[2.02]	[2.77]			[0.95]	[2.01]			[2.32]	[1.90]
VIX_k			-0.1664	-0.4575***			0.1468	0.2098			-0.3061***	-0.2767***
			[-1.10]	[-3.57]			[1.22]	[1.62]			[-3.46]	[-2.99]
N	16,024	16,024	16,024	16,024	15,763	15,763	15,763	15,763	15,503	15,503	15,503	15,503
R^2	0.5388	0.5545	0.6579	0.6577	0.5685	0.5303	0.6486	0.6507	0.6483	0.6485	0.7051	0.7046

Panel B: Crisis Period: 2007-2008

	k=20				k=40				k=60			
	Model 3	**Model 4**	**Model 8**	**Model 9**	**Model 3**	**Model 4**	**Model 8**	**Model 9**	**Model 3**	**Model 4**	**Model 8**	**Model 9**
Intercept	0.0014	0.0002	0.0001	0.0044	-0.0055	-0.0046	-0.0051	-0.0023	-0.0118*	-0.0104	0.0069*	-0.0038
	[0.33]	[0.06]	[0.03]	[0.99]	[-1.10]	[-1.01]	[-1.23]	[-0.57]	[-1.91]	[-1.60]	[1.67]	[-0.65]
BASIS_k	-0.2022	-0.0843	0.8083	-0.1062	-0.8402	-1.4854**	-1.6868**	-2.1330***	0.5620	0.9909	1.6176*	-0.7958
	[-0.47]	[-0.18]	[1.48]	[-0.22]	[-1.54]	[-2.45]	[-2.24]	[-2.63]	[0.89]	[1.17]	[1.76]	[-0.68]
MKT_k	-0.1788	0.3944	-4.6648***	-3.2770**	-2.2676**	-2.0342*	0.3239	-2.3877	-2.8915**	-2.3620**	-3.7492**	-5.7323***
	[-0.28]	[0.50]	[-3.69]	[-2.12]	[-2.36]	[-1.91]	[0.17]	[-1.44]	[-2.22]	[-2.00]	[-2.58]	[-3.86]
SMB_k	-0.5250	-0.3859	-0.3017	-0.7092	0.9265	0.7383	0.1795	-1.1692	-0.3823	0.7056	-4.4418***	0.5151
	[-1.20]	[-0.86]	[-0.40]	[-0.81]	[1.30]	[0.98]	[0.14]	[-1.31]	[-0.54]	[1.01]	[-3.58]	[0.36]
HML_k	0.0341	0.3377	-0.4767	0.2619	-0.7249	-1.4314**	-1.7615*	-1.4062	-0.5430	-0.2312	-1.7248**	-0.4901
	[0.04]	[0.35]	[-0.48]	[0.24]	[-0.99]	[-2.02]	[-1.91]	[-1.58]	[-0.78]	[-0.34]	[-2.05]	[-0.43]
DEF_k	-2.2950***	-1.9882***	-1.5931**	-2.6666***	-0.8459*	-1.0153**	-0.5316	-1.2622*	-4.1389***	-4.4508***	-4.0302***	-2.9305***
	[-3.88]	[-3.22]	[-2.50]	[-3.76]	[-1.70]	[-2.04]	[-0.60]	[-1.76]	[-6.92]	[-7.00]	[-7.28]	[-3.83]
TERM_k	-0.1402	-0.4075	1.6511	0.0657	-0.8820	-0.6836	-0.1802	-1.4353	0.4841	-1.3040	-4.2394**	-5.6133***
	[-0.15]	[-0.43]	[1.23]	[0.04]	[-0.84]	[-0.69]	[-0.09]	[-0.88]	[0.51]	[-1.65]	[-2.25]	[-3.33]
LIQ_k	-0.5080***	-0.4291***	-0.2236	-0.5322***	-0.2138***	-0.2240***	-0.2938**	-0.0882	-0.1144**	-0.1608***	-0.0948	-0.0458
	[-4.68]	[-3.70]	[-1.58]	[-3.51]	[-2.82]	[-3.44]	[-2.29]	[-0.93]	[-2.08]	[-3.41]	[-1.32]	[-0.70]
AMH_k	-0.4681		0.8870*		-0.2695		0.0251		-0.8506*		-1.6434**	
	[-1.17]		[1.66]		[-0.55]		[0.03]		[-1.87]		[-2.00]	
PS_k		-0.1740*		-0.1991		-0.2785**		0.0304		0.1011***		0.0515
		[-1.77]		[-0.86]		[-2.13]		[0.17]		[2.70]		[0.92]
TED_k			0.2805**	0.6957***			0.2968*	0.0576			-0.0811	-0.1480**
			[2.09]	[3.67]			[1.66]	[0.37]			[-1.24]	[-2.06]
FRET_k			-3.5072	-1.3459			9.5154*	3.7923			-11.416***	-13.314**
			[-1.32]	[-0.44]			[1.95]	[0.88]			[-3.02]	[-2.17]
VIX_k			4.2139***	7.6179***			4.3500***	2.1995***			-0.2090	0.7846
			[2.85]	[4.19]			[4.28]	[2.86]			[-0.40]	[1.53]
N	16,024	16,024	16,024	16,024	15,763	15,763	15,763	15,763	15,503	15,503	15,503	15,503
R^2	0.3223	0.3486	0.3486	0.3617	0.4011	0.3964	0.4419	0.4540	0.3186	0.3661	0.4529	0.4652

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.

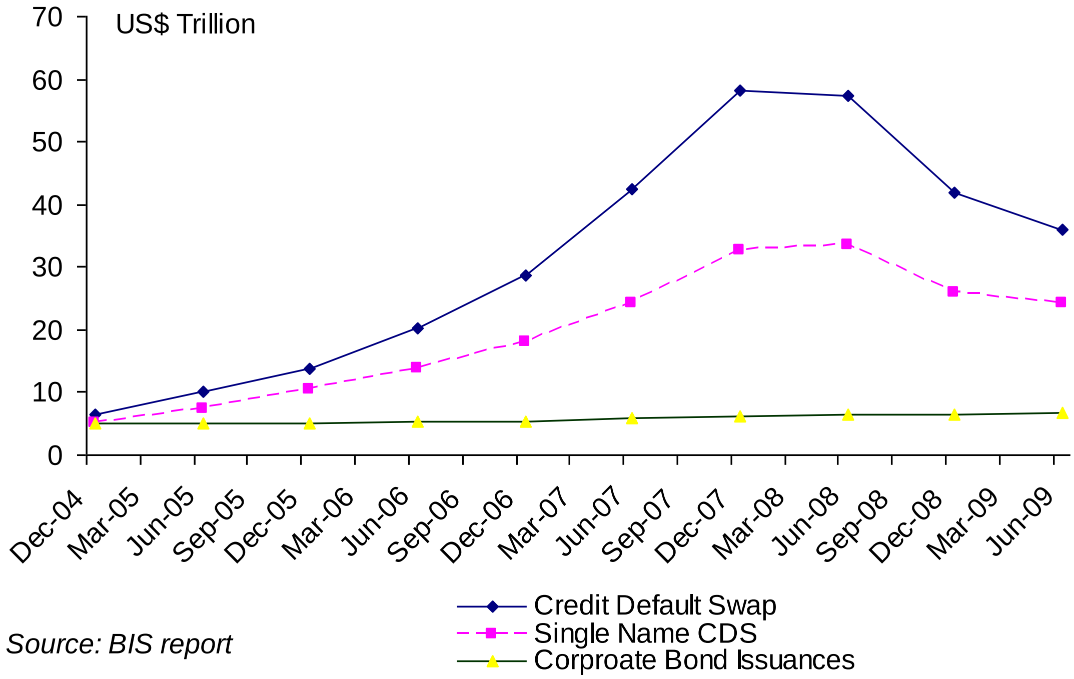
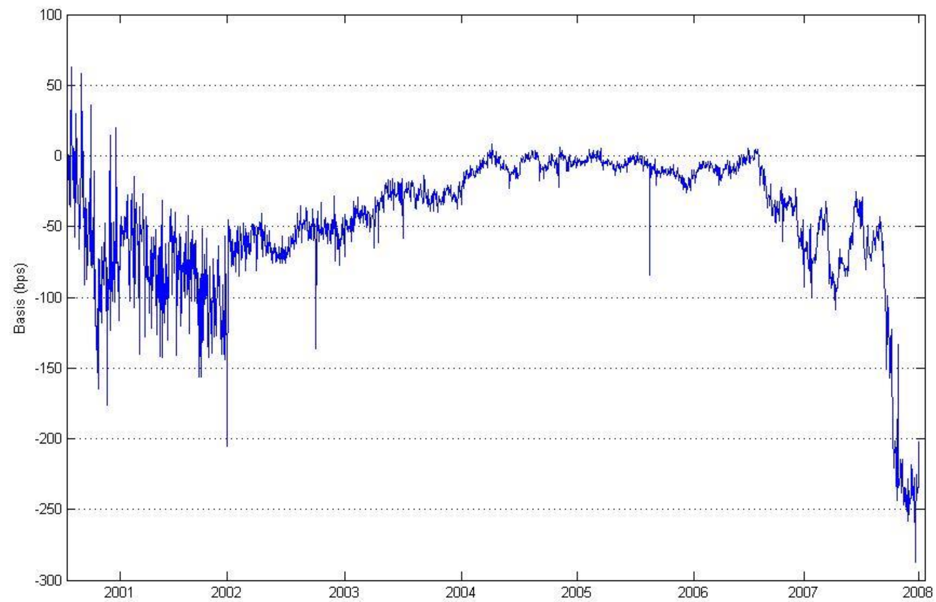


Figure 2: Equal- and Value-Weighted Investment Grade CDS-Bond Basis Indices

This figure provides time series plots of equal- and value-weighted CDS-Bond basis indices constructed from our sample of investment grade 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 contains the equal-weighted basis index, and Panel B contains the value-weighted index.

Panel A: Equal-weighted Basis Index



Panel B: Value-weighted Basis Index

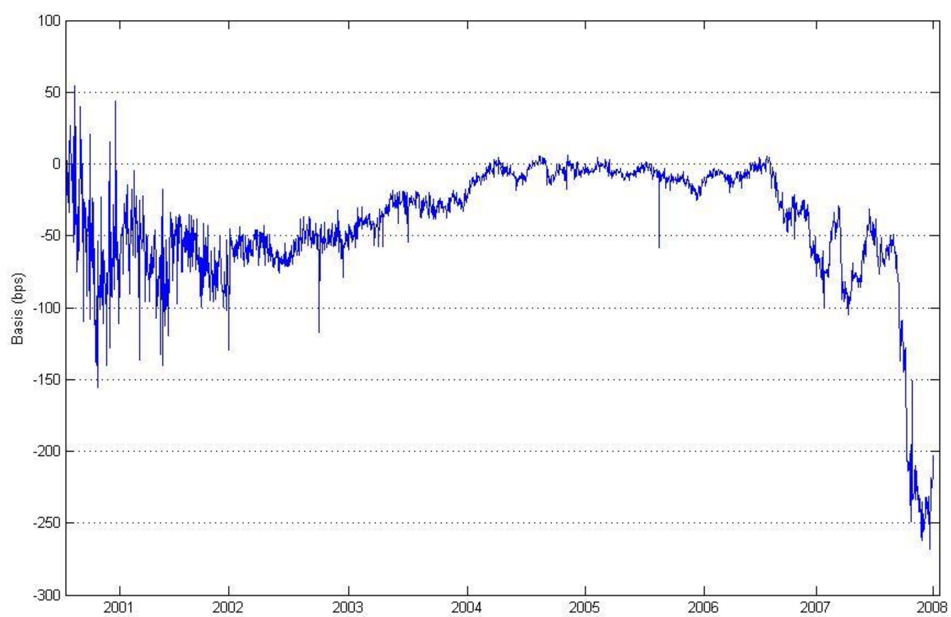


Figure 3: The Corporate Bond Spread and LIBOR-OIS Spread from 2001 to 2008

This figure provides time series plots of corporate bond yields and LIBOR-OIS spread from 2001 to 2008. The left Y-axis is in percentage point for AAA and BAA bond yields in solid lines. The right Y-axis is in percentage point for BAA-AAA spread and LIBOR-OIS spread in solid lines with asterisks. LIBOR-OIS spread is the difference between 3-month LIBOR and the overnight indexed swap rate. The data sources are from the Federal Reserve Bank of St Louis and Bloomberg.