The Value of Creditor Control in Corporate Bonds*

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10 November 2014

Abstract: This paper analyzes the impact on corporate bond pricing of the shift of control rights from shareholders to creditors as firm credit quality declines. Specifically, we propose a new measure to demonstrate the premium in bond prices that is related to creditor control. The main insight for our methodology is that credit default swap (CDS) prices reflect the cash flows of the underlying bonds, but not the control rights. We estimate the premium in bond prices as the difference in the bond price and an equivalent synthetic bond without control rights that is constructed using CDS contracts. Empirically, we find this premium increases as firm credit quality decreases and around important credit events such as defaults, bankruptcies, and covenant violations; the increase is greatest for bonds most pivotal to changes in control. Changes in bond and CDS liquidity do not appear to drive increases in the premium.

JEL classification: G13, G33, G34

Keywords: Creditor control, Corporate bonds, Distress, Bankruptcy

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* We have benefitted from comments by participants at the Conference on Creditors and Corporate Governance in Chicago, Conference on Institutional Investors: Control, Liquidity, and Systemic Risks in Atlanta, LBS Summer Symposium 2013, Second Moore School of Business Fixed Income Conference, 20th Multinational Finance Society İzmir, the 40th European Finance Association Conference in Cambridge, 10th Annual Corporate Finance Conference at Washington University in St. Louis, 9th Annual Conference of the Financial Intermediation Research Society in Quebec City, the 2014 Western Finance Association Annual Meeting, the 2014 World Finance Conference in Venice, and seminars at Boston College, Brandeis University, Bentley University, the Board of Governors of the Federal Reserve System, Queens University, Wilfrid Laurier University, and Stockholm School of Economics. Conversations with Vikas Agarwal, Rui Albuquerque, Georgy Chabakauri, Sudheer Chava, Francesca Cornelli, Sergei Davydenko, Alex Edmans, Redouane Elkamhi, Hülya Eraslan, Işıl Erel, Vyacheslav Fos, Julian Franks, Paolo Fulghieri, Mariassunta Giannetti, Denis Gromb, Ümit Gürün, Oliver Hart, Jean Helwege, Wei Jiang, Chotibhak Jotiskasthira, Madhu Kalimipalli, Ralph Koijen, Shuqing Luo, Justin Murfin, Stewart Myers, Andrei Shleifer, Kenneth Singleton, Holger Spamann, Laura Starks, Raghu Sundaram, Yasuhiko Tanigawa, and Philip Valta contributed greatly to this paper. All errors are ours. An earlier version of this study was circulated under the title 'The Impact of Creditor Control on Corporate Bond Pricing and Liquidity'.

Over time, it has become more widely recognized that creditors play an increasingly active role in corporate governance as credit quality declines. For example, covenant violations trigger a shift in control rights to creditors, giving them the ability to intervene in managerial decisions (Chava and Roberts (2008), Roberts and Sufi (2009), Nini, Smith, and Sufi (2012)). Distressed debt investors frequently accumulate large positions in the firm's bonds in pre- and post-default periods (Hotchkiss and Mooradian (1997), Jiang, Li, and Wang (2012), and Ivashina, Iverson, and Smith (2014)). As firms become seriously distressed, creditor control can affect managerial decisions in a way that impacts the value of the debt claims, the form of a restructuring that might occur, and the distributions to creditors in the event of a restructuring. In many cases, a default leads to a change in control where the creditors become the new owners of the firm through distributions of stock in a restructuring.

While the shift in control from shareholders to creditors before and during credit events such as defaults is well established in the theoretical literature, empirical evidence showing the importance of creditors in firm governance is scarce.[1] In this paper, we take a new approach and analyze the impact of this shift in control towards creditors on the pricing of the firm's bonds. Specifically, we propose a measure of the premium in bond prices that is related to creditor control.

We estimate this premium as the difference in the bond price and an equivalent synthetic bond without control rights that is constructed using credit default swaps (CDSs). The main insight for the methodology is that CDS prices reflect the cash flows of the underlying bonds, but not the control rights.[2] Our method is similar in spirit to Kalay, Karakaş, and Pant (2014) where the control premium in equity is measured by taking the difference between the stock and the synthetic non-voting stock constructed using options. For comparison across time and companies, we measure the premium as a percentage of the bond price. The premium we introduce captures the marginal value of

[1] Shleifer and Vishny (1997) argue that both creditors and equity holders exert influence over managerial decisions as the firm value declines. Several legal scholars including Baird and Rasmussen (2006) and Ayotte and Morrison (2009) have recently made similar arguments.

[2] The unbundling of the economic (cash flow) rights and contractual control rights that has become possible through credit derivatives has also led to concerns of an "empty creditor" problem, where a debtholder obtains insurance against default but otherwise retains control rights in and outside bankruptcy – see, e.g., Hu and Black (2008), Bolton and Oehmke (2011), and Subrahmanyam, Tang, and Wang (2013).

control in a bond until the bond matures or – in the case of a payment default or bankruptcy – until the CDS contracts for that issuer settle, typically within two months following the default. Since bonds can continue to exist and trade after a CDS settlement, our measure is a lower bound for the control premium.

The premium we construct can be mapped into the CDS-bond basis examined in a number of studies starting with Longstaff, Mithal, and Neis (2005). Our measure is based on price differences (rather than the difference in CDS and bond yield spreads), which has an interpretation that corresponds more naturally to a control premium that is the subject of extensive literature on corporate control. In contrast to our work, prior studies of the determinants of the CDS-bond basis focus on whether the basis can be explained by measures of bond and CDS liquidity, as well as other non-control-related frictions such as counterparty credit risk or funding costs. We argue that beyond liquidity differences or other frictions, deviations from the no arbitrage relation between CDS and bond prices will reflect the value of control. We expect the premium to increase and to have a positive value as credit quality deteriorates, since the probability that control will shift from shareholders to creditors increases. Further, around events such as defaults where control rights are especially valuable, we expect the premium to be higher the more contentious the contest for control, particularly for bonds that are pivotal to a change in control.

Our sample consists of 2,020 publicly traded bonds of 963 U.S. companies that have both price data available from TRACE and concurrent CDS quote data available from Markit in the period from 2002 to 2012. We first examine the relationship between our premium and credit ratings. We find that the premium is close to zero for bonds of high credit quality firms, but monotonically increases as the credit rating declines for non-investment grade firms. The higher premium for lower ratings is confirmed in a panel regression, which includes numerous bond and CDS liquidity measures and bond characteristics as control variables as well as firm and time fixed effects.

We further investigate the behavior of the premium in three settings where control rights shift to creditors: defaults, bankruptcies, and covenant violations. First, we examine the premium in the time period leading up to default for 77 firms in our sample.[3] The premium monotonically increases towards the default, on average increasing to approximately 3% one year before default and over 6% by the time of default. We document several measures of bond and CDS liquidity, and show that they cannot explain the observed time series behavior of the premium. In fact, we observe that the premium starts to increase well before observed changes in liquidity. Among three CDS liquidity measures we use (number of quote providers, number of quotes across CDS maturities, and number of days with active quote changes), only the number of quote providers suggests a slight decrease in liquidity near the default, while the other two measures remain unchanged. We document the changes in four bond liquidity measures (round-trip costs, Amihud measure, volume, and number of transactions), as well as a measure of price pressure based on Feldhütter (2012). The round-trip cost and Amihud measures increase in the year leading to default – however, a decrease in bond liquidity should lead to a lower measured premium of bond over CDS implied prices. Bond volume increases for a smaller window around the default, as do the number of transactions and buying pressure. The higher level of trading activity likely reflects an active market for trading distressed securities and, consistent with Ivashina, Iverson, and Smith (2014), a concentration in ownership of debt claims around the default.

We next focus on the narrower subset of 53 defaulting firms that file for Chapter 11 bankruptcy. As we discuss in detail in Section 1.2, bondholder intervention is particularly important in the period leading up to the bankruptcy filing and early in the Chapter 11 case. We find results very similar to those for the full default sample, though of greater magnitude in the period leading to default. The behavior of the CDS and bond liquidity measures is similar to that observed for the full default sample, and again does not appear to explain the behavior of the premium.

Third, we analyze covenant violations, using the events constructed by Nini, Smith, and Sufi (2012). An advantage of analyzing covenant violations is that since firms often do not default right after a violation, the CDS contracts continue to trade both before and after the event. The influence of creditors around these events has been previously documented, and the perceived default risk of the

[3] The default subsample consists of firms that restructure both out of court and in bankruptcy.

bonds increases at this time as well (Freudenberg et al. (2011)). We find that the premium peaks around the violation quarter at 1.5%, considerably smaller than for defaults or bankruptcies (over 6%), but still significantly positive. This is not surprising given that the expected control shift with covenant violations is much smaller compared to the default and bankruptcy cases. Both CDS and bond liquidity measures are stable around the covenant violations, if not improving. This further helps to rule out the possibility that the premium is an artifact of changes in liquidity.

Collectively, these results demonstrate that the premium increases around events where control is shifted towards creditors. We then use cross-sectional analysis to show that the above documented premium increases are related to proxies for the importance of creditor control. First, prior literature has suggested that creditors' bargaining position is weaker for firms with a low proportion of fixed assets.[4] In line with the predictions of this literature, we show that the premium is higher for defaulted firms with a higher proportion of tangible assets.

Second, the behavior of the premium near default is related to the price level of the bond itself, and is lower for bonds priced near par or close to zero. The price level is a particularly useful indicator of creditors' influence on the restructuring for the following reason. When a bond is priced closer to par, the creditor is expected to be paid in full in the restructuring and thus will have little voice in the outcome of the case. When the bond is priced closer to zero at default, the creditor is sufficiently out of the money and again is expected to have little impact. However, the influence of creditors is likely greatest for mid-priced bonds. The mid-priced bonds are the expected "fulcrum" securities in the forthcoming bankruptcy process, and are where investors seeking control of the restructured firm will invest.[5] The fact that we do not find a monotonic relationship between the bond price level and the premium, and that the premium is greatest in the mid-priced group of bonds, is

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[4] Lower fixed assets have been used to proxy for higher liquidation costs (see, e.g., Davydenko and Strebulaev (2007), Bolton and Oehmke (2011), and Favara, Schroth, and Valta (2012)).

[5] The "fulcrum" security is defined as the class of debt that receives the majority of the stock of the restructured firm. Effectively, this is point in the capital structure where the firm is insolvent, i.e. no significant value is left to distribute to more junior claimants. Hotchkiss and Mooradian (1997), Jiang, Li, and Wang (2012), Li and Wang (2014), and Ivashina, Iverson, and Smith (2014) show that much activity of distressed debt investors is concentrated in the fulcrum security, where the debt investors gain controlling equity stakes in the restructured company.

consistent with the premium reflecting the control rights of those debtholders.

Third, we use ex-post characteristics of bankruptcy restructurings to further examine the premium. We find an inverse-U shaped relation between CDS auction prices and the premium, and between bond recovery rates and the premium – these results are consistent with a higher premium for the mid-priced bonds most pivotal to control. We also find the premium is significantly greater for bonds that are observed ex-post to be the fulcrum claims in the bankruptcy restructuring and for bonds that are exchanged for a greater percentage of the reorganized firm's stock.

Taken together, the results in this paper suggest that the premium of the bond price versus the CDS implied bond price increases around credit events, reflecting the shift in control rights toward creditors, and is greatest when the value of control is expected to be highest. Our results are robust to controls for both CDS and bond liquidity, as well as to other factors recently suggested to impact the CDS-bond basis such as crisis periods, funding risk, counterparty risk, haircuts (collateral quality), cheapest-to-deliver option for the CDS contract, and informational efficiency of CDSs with respect to bonds. Further technical issues regarding the CDS, such as the maturity of securities, auctions, deviation from par values, and CDS quote quality do not drive or affect our findings.

Our paper contributes to the literature on corporate governance and in particular to that on creditor rights. To our knowledge, this is the first paper to propose a measure reflecting the value of creditor control, which is well developed in the theoretical literature. This study also contributes to the CDS-bond basis literature as it proposes a new explanation for some of the empirically documented violations of the no arbitrage relation for the CDS and bond spreads. To our knowledge, we are also the first paper to document the behavior of both bond and CDS liquidity around important credit events including defaults.

The paper proceeds as follows. Section 1 outlines our methodology and discusses the valuation and exercise of bondholders' control rights. Section 2 summarizes the hypotheses we test, and describes the data and sample construction. Section 3 presents panel regressions relating the premium to credit ratings. In Section 4, we describe the behavior of the premium around three important credit events: defaults, bankruptcies, and covenant violations. Section 5 presents the cross-sectional analyses of the premium. Section 6 discusses further technical details regarding the CDSs and bonds, and validates the robustness of results. Section 7 concludes.

1. Pricing of Control Rights in Bonds

In this section, we first explain the methodology to construct the premium of bond prices over CDS implied prices. We then discuss why control is valuable to creditors, and how bondholders exercise control.

1.1. Methodology to Construct the Premium

A credit default swap is an insurance contract written on an underlying corporate bond, and is a contract between a protection buyer and protection seller. The swap runs for T years, and has value 0 when entered. The protection buyer pays a constant CDS premium until termination at time T or at the stated credit event, typically a payment default. If the credit event occurs, the protection buyer delivers the bond to the protection seller and in return receives the par value of the bond (known as physical settlement). Since 2005, CDS contracts are generally settled in cash based on an auction-determined price, in which case the protection buyer receives the difference between the par value and the market value of the bond (Helwege et al. (2009) and Du and Zhu (2012)).

Duffie (1999) shows – using an arbitrage argument – that the T-year CDS premium is equal to the spread on a T-year par floating-rate corporate bond.[6] Duffie and Liu (2001) show that spreads over default-free rates on par fixed rate bonds and par floating-rate bonds are approximately equal.[7] Thus, the T-year CDS premium is approximately equal to the T-year par fixed-rated spread over the risk-free rate, and the term structure of CDS premiums gives the term structure of par yield spreads.

[6] The arbitrage argument in Duffie (1999) relies on the bond trading at par, and the arbitrage is not exact when the bond does not trade at par. Section 6.6 shows the validity of our methodology on non-par bonds.

[7] Duffie and Liu (2001) show that the floating-rate spread is higher than fixed-rate spreads when the risk-free term structure is upward-sloping, which is typically the case. However, the difference is typically 1 basis point or less per 100 basis points of yield spread to the risk-free rate. Longstaff, Mithal, and Neis (2005) provide similar evidence.

For a given firm on a given day, we extract a fixed-rate par yield curve from CDS premiums at different maturities. If CDS premiums are missing at some maturities, we linearly interpolate; if the missing CDS premium has a maturity higher (lower) than the highest (lowest) maturity for which CDS data are available, we set the CDS premium equal to the premium at the highest (lowest) maturity for which a quote is available.[8]

From the term structure of par yield spreads, we calculate a term structure of par yields by adding the term structure of swap rates to the term structure of par yield spreads. We use swap rates because Duffie (1999), Hull, Predescu, and White (2004), and Feldhütter and Lando (2008) show that swap rates are better proxies for risk-free rates than Treasury yields. We then bootstrap a zero coupon curve from the par rate curve, and use the zero coupon curve to discount the promised cash flows of the bond. This produces our CDS implied bond price.

Throughout this paper, we define the *premium* of bonds versus CDSs as follows:

$$Premium = \frac{Bond\ price - CDS\ implied\ bond\ price}{Bond\ price} \qquad (1)$$

Absent liquidity differences or other frictions, *premium* in Equation 1 would reflect the value of control for bondholders, because the bond conveys control rights while the CDS does not.

A number of papers look at pricing differences between the corporate bond and CDS markets by comparing the 5-year CDS premium to the yield spread on an artificial 5-year bond (see, e.g., Hull, Predescu, and White (2004), Blanco, Brennan, and Marsh (2005), and Zhu (2006)). The yield spread on the artificial bond is typically found by interpolating the yield spreads of bonds with maturities straddling 5 years. For bonds close to par, this approach is reasonably accurate; but for bonds far below par, the approach generates a significant bias as discussed in Nashikkar, Subrahmanyam, and Mahanti (2011). Our approach, which is closest to that of Han and Zhou (2011), avoids this bias by pricing the cash flows of the bond directly. This method is similar to the "Par

[8] In Section 6.8.2, we describe an alternative approach, as in Nelson and Siegel (1987), to calculate missing CDS premiums and find our results to be very similar with this alternative approach.

Equivalent CDS" methodology developed by J.P. Morgan and used also by Fontana (2010), Nashikkar, Subrahmanyam, and Mahanti (2011), and Bai and Collin-Dufresne (2013). A difference is that we use the CDS implied bond price while the Par Equivalent CDS methodology is used to find the bond implied CDS spread. Using prices permits easier interpretation with regards to the value of control rights, which is the main focus of this paper.

1.2. Creditor Control Rights

1.2.1. Why Are (Creditor) Control Rights Valuable?

Control shifts to creditors as the firm becomes distressed, particularly when the firm is closer to default or bankruptcy. In fact, Aghion and Bolton (1986, p. 6) view bankruptcy as "…a mechanism of transmission of control from the entrepreneur to the investor (debt-holder) when "things start going bad"." Accordingly, a firm does not have to reach a default in order for control to shift to creditors. From a legal perspective, the fiduciary responsibility of the board shifts to creditors as soon as the firm is in the "zone of insolvency" (Branch (2000), Altman and Hotchkiss (2005), and Becker and Strömberg (2012)). Even if the firm is farther from insolvency, cash flow shortfalls such that a firm violates a covenant or misses a scheduled debt payment would trigger control rights for bondholders.

A natural question that arises is why control should be priced in any security (equity or debt). Theoretically, two key ingredients are needed for control to matter to an investor in a particular security, as emphasized in Aghion and Bolton (1986, 1992). The first is incompleteness of the investment contracts. The second is a difference in investors' objective functions – this could be differences in private benefits, beliefs (expectations), risk-aversions, reputational concerns, etc.[9] In other words, potential conflicts or disagreements among investors about how to run the firm in a world with incomplete contracts make control valuable. The value of control depends on the probability of a disagreement situation arising and its economic significance, as discussed in Zingales (1995). Both the probability and the economic significance of the event, and hence the value of

[9] The literature typically models/interprets the value of control through private benefits of control. Aghion and Bolton (1986 and 1992) show that, from a theoretical modeling perspective, there is a one-to-one mapping between modeling the value of control through private benefits or through differences in beliefs.

control, are time varying.

In equity markets, the idea of estimating the control premium by looking at two securities/portfolios with identical cash flows but differences in control rights is not new. For instance, Zingales (1994, 1995) and Nenova (2003) study the price difference between voting and non-voting shares; Barclay and Holderness (1989) and Dyck and Zingales (2004) look at the difference between the price in block trades and the post-announcement share price; and Kalay, Karakaş, and Pant (2014) study the stock price minus the price of an options portfolio replicating the cash flows of the stock.[10] All of these studies document that the control premium in equities has a positive value, and interpret the control premium as a lower bound for private benefits of control.

In debt markets, given that the necessary components of the theory of control rights are also present, the control premium will be reflected in bond prices as well. Empirically, we frequently observe disagreement as to the preferred outcome of a restructuring. Relatedly, we observe that debt investors differing both in their beliefs and objectives often compete for control.

Specific examples from our sample illustrate these points. For instance, in the 2005 bankruptcy filing of Delphi Corp., at least three groups, each led by one or more hedge funds, pursued competing investment proposals for the firm. Another example is the 2008 bankruptcy filing of the Tribune Company (as described by Harner (2011, p. 188)): "The litigation in Tribune Co.'s Chapter 11 case illustrates a control contest among debtholders that is becoming more commonplace as investors invoke debt-based takeover strategies. Four different debtholder groups have proposed a plan of reorganization for the company. Each plan proposes a different capital structure for the reorganized company." In these cases and others in our sample, at least one investor purchases the

[10] Contracts that separately allocate cash flow rights and control rights are employed in a number of contexts. Dual-class shares in the equity market, particularly in technology firms such as Google, are argued to allow founders/entrepreneurs "brimming with self-belief" to raise capital and run their firms as they like without suffering from the market's short-termism (http://www.economist.com/node/18988938). Aghion and Bolton (1992) discuss the optimality of issuing non-voting (dual-class) shares versus a debt contract, while Dewatriponte and Tirole (1994) show the optimality of state contingent shifts of control from equity to debt investors. Kaplan and Strömberg (2003) describe the allocation of cash flow versus control rights in venture capital contracts.

(expected) fulcrum securities with the goal of owning the company after the restructuring by exchanging these securities for equity.

Particular investors may also gain private benefits in the form of (pecuniary or non-pecuniary) rents from keeping (or not keeping) the firm as a going concern. For example, prior to CIT Group's 2009 bankruptcy, certain bondholders provided a $3 billion loan at a high interest rate of 10.5%. According to analysts "some bondholders end up better than others with this structure".[11] Bondholders also may use control of one tranche of debt to benefit positions they hold in other tranches or in the same firm's equity. Hotchkiss, Smith and Strömberg (2014) describe cases where an equity owner (backed by a private equity sponsor) also owns portions of the firm's debt; Manconi and Massa (2009) document and analyze the joint ownership of equity and bonds of the same company.

1.2.2. How Do Bondholders Exercise Control Rights?

There are several ways in which creditors can exercise control over firm decisions. The variety and intensity of these mechanisms depend on how distressed the firm is.

To begin, even when firms are not near distress, certain "corporate actions" – such as changes to financings, pledges of collateral, asset sales, or acquisitions (as specified and interpreted from the bond indenture) – can require the "consent" of a specified percentage of bondholders. If the firm violates these consent requirements, bondholders can accelerate payment of the debt. Hence, the threat of acceleration provides bondholders with a voice in what actions the firm can take, or, with the ability to negotiate a change in the terms of the debt (such as increasing the coupon) that improves the value of the bond in exchange for consenting to these actions. Interestingly, Kahan and Rock (2009) document many cases of non-distressed firms where bondholders engage in negotiations with management to improve the value of their position. They further provide examples where

[11] http://www.thisismoney.co.uk/money/article-1200921/3bn-bondholder-loan-saves-CIT-Group-bankruptcy.html. See also Franks and Nyborg (1996, p. 1166): "Control rights raise particular problems when creditors have different incentives to keep the firm as a going concern … the different incentives arise from the possession of private benefits by particular creditors; such benefits are only preserved when the debtor firm is maintained as a going concern."

bondholders accumulate a large enough position to engage the firm, or form groups such that their combined stake is pivotal in gaining consent for actions such as changes to a credit agreement or significant asset sales.[12]

Most typically, a decline in firm value will create incentive for creditors to exercise their control rights. Nini, Sufi, and Smith (2011) show the positive impact of lenders on firm governance and value when firms are near covenant violations. Denis and Wang (2014) further show a high incidence of loan renegotiation even absent a covenant default, indicating that even outside of default states, creditors have strong control rights over the borrower's operating and financial policies and do not remain silent on managerial decision making. The bonds in our sample are almost entirely the senior unsecured debt of the firm; as such, the risk of a cash flow shortfall or missed payment extends to the bonds upon a loan covenant default (Freudenberg et al. (2011)).

As firms approach distress, negotiations with creditors can enable a firm to avoid a default, or to implement an out of court restructuring rather than filing for bankruptcy. Bondholders can form 'ad hoc' committees, which are "informal groups of sophisticated investors who pool resources to advance their common interests in out-of-court restructurings and bankruptcy cases" (Wilton and Wright (2011, p. 1)). Rosenberg et al. (2008, p. 283) note: "It is also common for groups of bondholders or other creditors to assemble and confer with the debtor before a bankruptcy petition is filed." Consent for a pre-packaged bankruptcy would be an extreme example of negotiations with bondholders prior to any default which fully determine the terms of a restructuring.

Closer to or in default, control arguably matters the most. If a firm does file for Chapter 11, critical decisions – to which creditors can object – are made in the first days of the case, which impact how the operations of the firm as well as the balance sheet will be restructured. Such decisions involve financing, asset sales, rejection of contracts such as leases, formation of creditor committees

[12] An example of this type of bondholder activism is for Beazer Homes, which is in our sample. The filing of the firm's 10Q for June 30, 2007 was delayed due to a restatement of its financials. A bondholder group argued that this was an event of default under the indenture. The company offered a cash payment to a "majority" of bondholders in exchange for their consent to waive such a default. The company later became more seriously distressed and completed an out of court restructuring in 2009.

(and the non-public information afforded to members of those committees), valuation of the firm, initial terms of a plan of reorganization, and requests to grant certain claims different priority than they would otherwise be treated under the Bankruptcy Code.[13] Hence, bond investors can exercise substantial influence over both out of court and bankruptcy restructurings, and the corresponding decisions that are made in advance or to avoid such events.

The potential influence of bondholders also increases as firms become distressed because the holdings of public bonds can become quite concentrated. An investor (or group of investors) which accumulates a significant stake in the bonds can control the outcome of an out of court restructuring – for example, by not participating in a distressed exchange such that the offering would fail or would not sufficiently reduce the firm's debt burden.[14] The bond investors' consent is also frequently needed for the firm to take other restructuring actions, including restructuring other liabilities or asset sales (as described above). This makes the large bondholder pivotal in determining whether an out of court restructuring can succeed. Empirically, Hotchkiss and Mooradian (1997) demonstrate that bond investors frequently purchase just over the "1/3 threshold" in a class of debt – a position sufficient to block any bankruptcy restructuring plan – often well in advance (or in the absence of) a subsequent bankruptcy.

It is important to recognize that it is the ownership of the bond itself that enables an investor to exercise the control rights. For example, to participate in negotiations preceding a debt restructuring, the bondholder must make legal representations of her ownership of the bond. Without such representations, an investor owning a minimal stake could attempt to block a restructuring by falsely claiming that she owns a large percentage of the outstanding bonds. A holder of a derivatives position cannot represent ownership and hence cannot exercise such control rights.

[13] The example of Lehman Brothers, sold just five days after its September 15, 2008 Chapter 11 filing, shows how the provisions of the Bankruptcy Code can be used to expedite asset sales. The auction for Lehman's CDS followed on October 10, 2008.

[14] Gertner and Scharfstein (1991) model, and Asquith, Gertner, and Scharfstein (1994) empirically examine such exchange offers and show that a small investor may be better off by 'holding out' and not exchanging their debt. The authors suggest that large debtholders can negotiate directly with the firm to ensure the success of the offer. They also show that an investor can be made worse off if they do not exchange. Notably, for many of the distressed exchanges in our sample, less than 100% of the bonds are exchanged – in these cases, a portion of the original bonds (and the corresponding CDS) remain outstanding after the exchange.

2. Testable Hypotheses and Data

This section first develops the hypotheses we test, based on our discussion of control rights of debtholders. We then describe the data used and the liquidity measures constructed for bonds and CDSs. We also describe the construction of our default, bankruptcy, and covenant violation subsamples, and the behavior of our premium measure for these samples.

2.1. Testable Hypotheses

As noted earlier, the magnitude of the premium depends on the likelihood and economic significance of a shift to creditor control. We expect the premium to be positive when creditor control rights are valuable. The premium should increase as credit quality deteriorates, since a lower credit rating reflects a higher probability of default.

We further examine the time series behavior of *premium* as firms approach key events where creditor control becomes important. In describing the time series behavior, it is important to recognize (as we discuss above) that the influence of creditors can be important well before an actual event of default; for example, more seriously distressed firms typically attempt to negotiate an out of court agreement with creditors when a default is likely.[15] Davydenko, Strebulaev, and Zhao (2012) further show that although information about the firm's financial condition is already incorporated into security prices, there remains uncertainty as to whether and when the firm will file for bankruptcy up until the filing date, with creditor behavior likely influencing the filing decision. Therefore, we expect the magnitude of our premium to increase significantly as firms move closer to a covenant violation, default, or bankruptcy filing. The increase should be greater for defaults/bankruptcies, where control fully shifts to creditors, in comparison to covenant violations.

Cross-sectionally, we expect additional proxies for the importance of creditor control to be related to the premium. For instance, several recent papers, including Garlappi, Shu, and Yan (2007), Bolton and Oehmke (2011), and Favara, Schroth, and Valta (2012), argue that creditors' bargaining

[15] Gilson, John, and Lang (1990) and others document the frequencies with which firms successfully reach agreements to restructure debt out of court.

position is weaker for firms with a low proportion of fixed assets. This implies that bonds of defaulting firms with more tangible assets are expected to have a higher premium. Lastly and foremost, control rights become most important in distressed restructurings, particularly for bonds that are pivotal to a change in control. Therefore, bonds that are the expected "fulcrum" security in a subsequent restructuring should exhibit the greatest increase in the premium.

2.2. Corporate Bond Data and Liquidity Measures

Corporate bond transactions data are obtained from Financial Industry Regulatory Authority's (FINRA) Trade Reporting and Compliance Engine (TRACE). Since July 1, 2002, all dealers have been required to report their secondary over-the-counter corporate bond transactions through TRACE. Public dissemination of collected information was phased in over time, depending on bond issue sizes and rating (the timeline of dissemination changes is described in Goldstein and Hotchkiss (2008)). Only as of January 2006 are all non-144A bond transactions disseminated.[16] The publicly disseminated data are available through Wharton Research Data Services (WRDS) and are used in a number of papers including Dick-Nielsen, Feldhütter, and Lando (2012), and Bao, Pan, and Wang (2011).

Through FINRA it is also possible to obtain historical transactions information not previously disseminated. The historical data are richer than the WRDS data in three aspects. First, the data contain all transactions in non-144A bonds since July 2002, so the data set for the earlier years of TRACE is significantly larger than the WRDS data set. This is important because it allows us to look at a broader set of lower rated companies which includes more defaulting firms. Second, the data have buy/sell indicators for all transactions, not just after October 2008 as in the WRDS data set. Third, trade volumes are not capped. Having buy-sell indicators and uncapped trade volumes help us measure bond liquidity more accurately. FINRA provides the enhanced historical data with an 18

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[16] Rule 144A allows for private resale of certain restricted securities to qualified institutional buyers. According to TRACE Fact Book 2011, the percent of rule 144A transactions relative to all transactions is 2.0% in investment grade bonds and 8.4% in speculative grade bonds. Also, transactions reported on or through an exchange are not included in TRACE.

month lag, so we append to this data the publicly disseminated data from WRDS for the June 15 2011 to June 2012 period. Erroneous trades are filtered out as described in Dick-Nielsen (2009).

We use four measures of bond liquidity which have been well documented in prior studies using the TRACE data. The first is the total trade volume in the two-week window ending on the current day (*volume*). The second is the number trades within the same two-week window (*number of transactions*). Third, we use round-trip trading costs. For days with at least one investor buy price and one investor sell price, the *round-trip cost* is defined as follows:

$$Round\text{-}trip\ cost = \frac{Average\ investor\ buy\ price - Average\ investor\ sell\ \ price}{Average\ investor\ buy\ price} \qquad (2)$$

Our measure of round-trip costs is the median of daily round-trip costs within a two-week window. Our fourth measure of bond liquidity is price impact (Amihud (2002)). The price impact of a trade is defined as the absolute return for this trade relative to the previous trade divided by the transaction volume of this trade. For each two-week window, we calculate the *Amihud* price impact as the average price impact of all trades within that window. For all liquidity measures, we include only trades with a transaction volume of $100,000 or more.[17]

In addition to the bond liquidity measures above, we use Feldhütter (2012)'s price pressure measure. Feldhütter shows that the price difference between small trades and large trades at a given point in time identifies the number of sellers relative to the number of buyers.[18] We define a small trade as one with a volume of $50,000 or less while a large trade is one with a volume of $100,000 or more. For any day where there is both a small and large trade, we define price pressure on that day as the average large price minus average small price. In percentage, we define *price pressure* on that day as follows:

[17] This largely eliminates retail trading (see, Goldstein, Hotchkiss, and Sirri (2007)).
[18] Feldhütter (2012) shows that a high price difference between small trades and large trades identifies a high number of sellers relative to buyers, but one can also show that a low price difference identifies a low number of sellers relative to buyers.

$$Price\ pressure = \frac{Average\ large\ price - Average\ small\ price}{Average\ large\ price} \qquad (3)$$

When price pressure is positive, there is buying pressure in the bond; a negative price pressure implies selling pressure in the bond. In the two-week window, we calculate price pressure as the median over daily price pressure values.

2.3. CDS Data and Liquidity Measures

Daily CDS quotes are obtained from Markit Group Limited. Markit receives data from more than 50 global banks, and each contributor provides pricing data from its books of record and from feeds to automated trading systems. Data from individual banks are aggregated into composite quotes after filtering out outliers and stale data, and a quote is published only if at least three contributors provide data. These data are frequently used both by market participants for daily marking-to-market and in academic research. Markit provides CDS quotes for maturities 6 months and 1, 2, 3, 4, 5, 7, 10, 15, 20, and 30 years.[19]

We use three different measures of CDS liquidity. The first is the daily number of data contributors to Markit's composite quote for the five-year CDS contract (*market depth*). This measure is used by most prior literature examining CDS liquidity (see, e.g., Qiu and Yu (2012)), and a greater number of contributors implies higher liquidity. Second, to measure the liquidity across the term structure of CDS premiums, we use the number of CDS quotes on a given day across different maturities (*number of cross-sectional quotes*). If there are CDS premiums missing for some maturities, this would indicate low liquidity across the maturity curve. The maximum possible number of quotes is 11. Third, we measure liquidity as the number of days in the previous two weeks where the five-year CDS premium differs from the current five-year CDS premium (*number of active days*). This measure captures the extent to which prices are stale, and a higher number implies higher

[19] Quotes are also provided at different "doc clauses," which define for a given CDS contract the type of events triggering payment on the CDS. We use the "no restructuring (XR)" quotes, under which out of court restructurings do not trigger settlement of the CDS for our sample; our calculated premium will be lowest using these quotes compared to those with other restructuring clauses. See also Section 6.8.2 for further discussion of the impact of CDS quote quality on our premium measure.

liquidity.

2.4. Sample Description

2.4.1. Full Sample of Reference Bonds

For our calculations of the premium of bond versus CDS implied prices, we merge the CDS and TRACE data by matching the company (the "reference entity" for the CDS) with the corresponding bonds (the "reference obligations") of that company. Reference entities and the Cusip identifier of the matching reference obligations are provided in the Markit RED database. This ensures us that the bond matched to a given CDS quote is in fact a deliverable bond for that CDS contract, and matches the CDS identifiers to 2,268 TRACE bonds. Of these, data is sufficient to calculate the premium for 2,020 bonds of 963 issuing companies, as described in Panel A of Table 1. Note that while there may be more than one reference bond per company, multiple bonds of the same firm frequently do not trade during the same time periods and are most always of the same seniority. We exclude agency, perpetual, and asset-backed bonds, and further exclude the first two weeks of trading for newly issued bonds.

(~Insert Table 1 about here~)

The median rating of bonds in the full sample is 9 (BBB); offering amounts are relatively large (median $700 million). The median bond in our sample has a price of 103, coupon of 6.6%, and time to maturity of six years. By focusing on bonds of entities with CDS contracts, as well as restricting our analysis to bonds that are reference obligations, our sample does not include some smaller and less actively traded bonds.[20] Bonds have on average 68 trades (median 44 trades) over two-week periods, excluding smaller trades as described above; average *volume* over two-week windows is almost $145 million (median $69.5 million). CDS liquidity is similar to that reported in other recent studies; the mean (6.8) and median (6.0) *market depth* indicating the number of CDS quote providers are the same as reported by Qui and Yu (2012). The two additional measures enable

[20] Das, Kalimipalli, and Nayak (2014) report that CDS trading is more likely to be introduced for older, larger, better rated, and more profitable firms.

us to consider the robustness of our time series and cross-sectional results to measurement of CDS liquidity.

Premium for the full sample has a median of -0.312%, but has significant variation. Our results are comparable with those in the sizeable literature on the CDS-bond basis, since there is a close and positive relation between the size of the basis and the size of the control premium. In other words, one can state results on the basis from prior literature in terms of our premium measure or vice versa. The characteristics of our median full sample bond imply that for every 1 basis point change in the yield, the bond price changes by approximately 5 basis points; therefore, a 5 basis point difference in the CDS-bond basis translates into a 25 basis point (0.25%) difference in the bond price.[21] Thus, the magnitude of the premium is consistent with the CDS-bond basis documented in, for example, Longstaff, Mithal, and Neis (2005) of -8.4 basis points, which translates into a premium of approximately -0.42%. See Section 6.1 for further comparison of our premium to prior estimates of the CDS-bond basis. Our objective, however, is to consider the time series and cross-sectional variation in *premium* as it relates to proxies for the importance of creditor control.

2.4.2. Credit Event Subsamples

We rely on a number of sources to determine whether bond issuers in our sample experience credit events during the sample period.[22] First, we use Moody's default database to identify defaults and bankruptcies. We verify default dates, types, and restructuring information from a number of news sources including CCH Capital Changes Reporter, Lexis-Nexis, The Deal Pipeline, and also from bankruptcy documents in Pacer. We also identify all TRACE bonds that at some point are rated "D" by S&P or Moody's, and verify that these bonds have been identified by our other sources.

We identify 199 bonds (9.9% of the full sample) of 77 firms that default during our sample period, shown in Table 1 Panel B (default subsample). Table 1 Panel C shows characteristics of the

[21] The price, coupon, and time to maturity of the median bond in the full sample (Table 1 Panel A) imply a modified duration of 4.80; hence a 1 basis point change in the yield-to-maturity of the bond approximately translates into a 5 basis point change in the bond price.
[22] We use the term "credit event" to refer to a default, bankruptcy, or covenant violation, which do not all contractually trigger settlement of the CDS.

subset of 130 defaulting bonds (6.4% of the full sample) of 53 firms that file for Chapter 11 (bankruptcy subsample). The Chapter 11 filings occur on average 11 days (maximum 147 days) following the initial default, while the remaining defaulted firms successfully restructure out of court. We include only the first default event for any bond/issuer.

Based on the fact that these firms become distressed during the sample period, it is not surprising that the credit ratings are lower, coupons are higher, and prices are on average lower for the defaulting bonds. Bond characteristics appear otherwise similar to the full sample. Interestingly, bond *volume* and *number of transactions* are higher and price impact (*Amihud*) is similar, though spreads widen, for the defaulting group, while the CDS liquidity measures appear similar to the full sample. Notably, the median *premium* increases from -0.312% for the full sample (Panel A) to 0.795% for the default subsample (Panel B) to 1.088% for the bankruptcy sample (Panel C). Although the statistics in Table 1 pool observations for non-distressed and distressed time periods, the magnitude substantially increases and becomes positive for the subsamples where creditor involvement in a restructuring in fact becomes very important.

Finally, we match our dataset of bond issuers to the covenant violations dataset of Nini, Smith, and Sufi (2012). While the covenant violation data is only available for firms with financial data available on Compustat, this covers the vast proportion of our sample of bond issuers with both TRACE and CDS data available. Characteristics of the covenant violation subsample are shown in Panel D of Table 1. As would be expected, the bonds are lower rated (median rating of 13, which corresponds to BB-). Bond and CDS liquidity measures are comparable to those of the full sample. The median *premium* for the covenant violation subsample is positive (0.018%) and greater than that of the full sample (-0.312%), but is considerably smaller than that observed for the default and bankruptcy subsamples. We examine the time series behavior of the premium relative to the credit events, as well as that of the liquidity measures, in detail in Section 4 below.

3. Relation of *Premium* to Credit Ratings

Our measured premium will be higher the greater the probability that control will shift to creditors. To investigate this hypothesis, we first plot the *premium* versus firms' credit ratings in Figure 1.

(~Insert Figure 1 about here~)

Figure 1 shows that the mean and median *premium* is close to zero for firms with a rating of BB or higher, while it is positive for the firms with a rating of B or lower. More importantly, we observe that the premium increases as the credit rating of the firm deteriorates. This is in line with the hypothesis that the value of control is higher as the probability of creditor intervention is higher.

To examine the relationship between the premium and rating more rigorously, Table 2 reports panel regressions of *premium* on credit ratings and control variables. We control for the bond and CDS liquidity measures described in the previous sections. We also control for bond characteristics including whether the bond is callable, the seniority of the bond, coupon rate, the offering amount of the bond, bond age, and the time-to-maturity.[23] Standard errors are clustered at the firm level.

Regression 1 is run for the full sample using both year-month and firm fixed effects, and strongly shows that the premium increases as rating deteriorates, confirming the description in Figure 1. Since time fixed effects will reduce the role of the liquidity measures, we repeat the same regression without year-month fixed effects in Regression 2. The results are consistent with the prior literature documenting a negative basis during the financial crisis, and the constant is more strongly negative. Most importantly, the coefficient for *rating* remains strongly significant. Excluding firm fixed effects in Regression 3, the coefficient for *rating* increases slightly (0.707 versus 0.614). Thus,

[23] Using a comprehensive sample bonds included on TRACE, Feldhütter and Schaefer (2014, Tables 5 and IA.12) show that over three quarters of non-investment grade bonds are callable. It is therefore important, when studying lower credit quality bonds, and in particular bonds near default, that we include these bonds in our analysis. Our results relating credit ratings to premium are unchanged when we exclude callable bonds. For our tests of bonds closer to default, the embedded options are substantially out of the money, particularly if there is a call premium, and therefore will have no measurable impact on bond prices.

the relationship we document holds both in the cross-section and within firm. Finally, when we include only pre-crisis observations (prior to 2008) in Regression 4, we find that the relation between credit rating and the premium is similar in terms of the magnitude of the coefficient.[24]

(~Insert Table 2 about here~)

Based on the non-linear relation between *premium* and *rating* observed in Figure 1, we also include squared rating in the Regression 5. Consistent with Figure 1, the coefficient for the *squared rating* is positive (0.025) and significant at the 5% level (t-stat=2.31), whereas the coefficient for the *rating* is positive but not significant.

Our results relating the premium to credit rating are robust to the inclusion of the bond and CDS liquidity measures. From a theoretical perspective, it is unclear how lower CDS liquidity should relate to the premium. Bongaerts, De Jong, and Driessen (2011) show that a decline in CDS liquidity does not necessarily increase the basis (i.e., increase our premium). In the regressions with year-month fixed effects, *market depth* is negatively related to *premium* while the *number of cross-sectional quotes* is positively related. The relationship between *premium* and *rating* is unchanged when we also include quality measures for CDS quotes (see Section 6.8.2 for a detailed discussion of the CDS quote quality measures). Prior literature more consistently shows that lower bond liquidity is associated with a lower basis (and so a lower premium); as we would therefore expect, measures of bond trading activity are positively related to the premium and *roundtrip costs* are negatively related to the premium. The coefficient for the Amihud measure is insignificant when firm and year-month fixed effects are included, but is sensitive to the inclusion of time fixed effects (Regression 2) and the time period included (Regression 4).

[24] Since sovereign bonds do not reflect any control premium, we would not – absent other frictions – expect to see an increase in the bond price minus CDS implied price when sovereigns are in distress. Bonnet (2012) examines sovereign bases during the sovereign debt crisis 2010-2011 and finds that "…in normal circumstances, the CDS spread on sovereign issuers is wider than the spreads on their bonds. When their creditworthiness as perceived by the market deteriorates, the basis can change sign" (p.15). This shows that the bond price does not systematically increase relative to the CDS implied price for sovereigns in distress.

4. Behavior of Premium and Liquidity Measures around Credit Events

In this section, we examine the behavior of the premium, and of CDS and bond liquidity measures, around the credit events: defaults, bankruptcies, and covenant violations.

4.1. Defaults

Figure 2 plots the median of *premium* observations for defaulted bonds on a quarterly basis (Panel A) in the five year period leading to default, where quarter -1 is the time period ending at the day prior to the default date. As clearly observed in the figure, the premium substantially increases as the firms get closer to default and peaks close to the default date. We also plot the weekly medians (Panel B) which illustrates the further increase in *premium* in the shorter window starting one year prior to default.

(~Insert Figure 2 about here~)

Table 3 shows the behavior of *premium* leading to default, showing both the economic and statistical significance of the quarterly medians. In the quarter ending on the day prior to the default date (quarter -1), *premium* reaches 6.3%. It is also critical to consider to what extent changes in the liquidity of the CDSs or bonds might explain this behavior. Table 3 reports the three CDS liquidity measures. Among these measures, only *market depth* gets slightly worse as firms get close to default whereas other measures stay relatively flat. Market depth gradually drops from over 8 to 6 over the 2-3 years before default, though market depth is also lower in the fifth year before default suggesting other factors affecting this measure of liquidity. The overall pattern of relatively stable CDS liquidity makes it unlikely that the increased premium, which begins well before the default date, is caused by lower CDS liquidity.

(~Insert Table 3 about here~)

Table 3 also reports the bond liquidity and price pressure measures in the quarters leading to default. Liquidity worsens around the default date based on the *round-trip costs* and *Amihud* measures. For example, median round-trip costs increase from a high of approximately 0.3% of the bond price in years 3 through 5 prior to default to 0.787% in the last quarter before default. Price impact (*Amihud*) also peaks at the last quarter before default. However, lower bond liquidity – and hence lower bond prices – would lead to a lower, rather than higher, premium, and would bias against us finding an increase in *premium* towards the default date. *Volume* and *number of transactions* increase close to the default date. As measures of improved liquidity, these could imply a higher premium; however, Dick-Nielsen, Feldhütter, and Lando (2012) empirically find that volume and number of transactions are only weakly priced in bond yield spreads as compared to the Amihud and round-trip cost measures, consistent with the theoretical predictions in Johnson (2008). However, higher volume and number of transactions would imply better price discovery and hence the no arbitrage relation would be expected to hold better. Further, they may reflect increased demand and the transfer of securities to investors for whom control rights become more important; this is consistent with increased turnover and concentration of claims of bankrupt firms as documented by Ivashina, Iverson, and Smith (2014) and others. Consistent with this interpretation, *price pressure* increases at the quarter prior to the default date. An active market for the bonds, frequently involving specialized distressed debt investors, would contribute to our finding that control is valuable and reflected in the premium. Both Figure 2 and Table 3 also show that the premium begins to rise prior to the increase in trading activity.

Although we can only observe CDS quotes up to the date of a default, and so *premium* is only observable to that point, the interest in bond ownership continues as reflected in the post-default bond liquidity measures. Bond *volume* and *number of transactions* remain high in the quarter beginning at the default date (Quarter 1), declining to pre-default levels over the subsequent quarters; *price pressure* further demonstrates interest in buying the defaulted debt. At the same time, there is an increase in trading costs as reflected in *round-trip costs* and *Amihud*. The behavior of bond liquidity around default documented by our paper is consistent with descriptions of activity by investors which take an active role in the distressed restructurings.

4.2. Bankruptcies

We repeat the analysis for the behavior of *premium* for the subset of cases where the defaulted firm enters Chapter 11 bankruptcy in Figure 3. Results are qualitatively similar. One important point to note is that the *premium* based on weekly medians is higher than is observed for the entire default subsample, and that much of the increase relative to the non-bankruptcy cases occurs in the final month prior to default. This is consistent with the view that near bankruptcy, control rights shift to creditors, giving them an important influence on the restructuring outcome. Further, in bankruptcy it is likely that the creditors will emerge as the new owners of the restructured firm by exchanging their debt claims for a controlling equity stake.

(~Insert Figure 3 about here~)

Table 4 shows that in the year prior to the year of default (quarters -8 to -5) the premium has already increased significantly and remains high in the year ending at default. Table 4 also shows the behavior of the CDS and bond liquidity measures as the firms near bankruptcy. Similar to the full default group, there is some decline in *market depth* for the CDS, but the other two measures of CDS liquidity appear stable. Bond *volume* and *number of transactions* rise just prior to default reflecting increased trading activity (also observed in buying pressure (*price pressure*)), while there is a rise in *round-trip costs* and price impact (*Amihud*). As above, *premium* rises prior to the liquidity changes, and an increase in illiquidity for the bonds would bias against our finding an increase in the premium.

(~Insert Table 4 about here~)

Relative to the entire default subsample, the trading activity and price pressure reported in Table 4 demonstrate an even greater interest in buying bonds of firms which ultimately file for bankruptcy. These bonds continue to trade until the settlement of a reorganization plan, when shares in the restructured firm are typically distributed to the post-default owners of the bonds.

At the time of settlement of the CDS contract following a default, one would expect our measured premium to return to zero. This is because the bond (in the case of physical delivery) or the value of the bond (in the case of cash delivery) will be delivered to settle the contract, either of which will reflect the value of the control rights at that point. However, as described in Section 1.2, distressed debt investors seeking active involvement in the restructuring would invest in the bonds and not the CDS alone, and if control is valuable our premium will remain positive until the CDS settlement. Possession of the bond is important in influencing the restructuring well before settlement of the CDS. None of the out of court restructurings in our sample triggers settlement of the CDS, and therefore in these cases the CDS holder does not receive the bond or its cash value. For the bankruptcies in our sample, auctions to determine settlement of the CDS occur on average 48 days after the bankruptcy filing.

4.3. Covenant Violations

Creditors have also been shown to exert important influence on the firm around covenant violations, as documented by Nini, Smith, and Sufi (2012), yet covenant violations will not trigger settlement of the CDS. We analyze the behavior of the premium and liquidity measures around "new" covenant violations (where the firm has not violated a covenant in the recent past), as defined in the appendix of Nini, Smith, and Sufi (2012) using quarterly 10-Qs and annual 10-Ks.

(~Insert Figure 4 about here~)

Figure 4 plots *premium* with respect to the covenant violation quarter, where quarter -1 is the quarter containing the reported covenant violation. The sample firms generally do not default immediately after the covenant violations, enabling us to observe our premium both before and after the event. The premium increases towards the violation quarter, peaks around 1.5%, and subsequently drops. This is again consistent with the hypothesis that the control is valuable around events where control is shifted to the creditors. Another important point to note is that the magnitude of the premium is much lower than that observed near defaults or bankruptcy. While creditors gain important influence when a covenant is tripped, the shift toward creditor interests is not as extreme as in a default or bankruptcy, where control is fully shifted to creditors. Still, firms which violate a covenant have a greater probability of a subsequent shift in control towards the more junior claimants. It is important to note that while the covenants that are violated are for bank loans, which are generally senior to the bonds we examine, the likelihood of a restructuring that involves all creditors of the firm increases at this point.[25]

Table 5 provides statistics for the premium and liquidity measures. Since these events do not trigger payments for the CDS, we report the 8 quarters both before and after the covenant violation quarter (quarter 1). The premium peaks shortly after the covenant violation quarter at 1.471% which is strongly statistically significant.[26] Importantly, we observe little change in the CDS and bond liquidity measures over this period. Therefore, a change in CDS liquidity is unlikely to explain the behavior of the premium around the covenant violation date.

(~Insert Table 5 about here~)

4.4. Multivariate Analysis of Premium near Credit Events

Table 6 confirms the relationships shown above for the credit event subsamples, allowing us to include year-quarter fixed effects and firm fixed effects. The dependent variable is daily observations of *premium* in the period leading up to default (Regressions 1 and 2), bankruptcy (Regressions 3 and 4), and covenant violation (Regressions 5 and 6). The variable *event period* indicates observations in the quarter prior to the event date. This allows us to compare the premium in the final quarter before the event relative to that in both a longer window beginning five years prior, and a shorter window beginning one year prior. In all specifications, we find a positive coefficient for

[25] Freudenberg et al. (2011) show that bond default probabilities increase subsequent to covenant violations. Davydenko (2013) further shows that senior lenders sometimes block scheduled payments on more junior bonds upon a loan covenant violation. Failure to comply with the terms of a credit agreement can further trigger a covenant default on the bonds: in our sample, Spectrum Brands provides such an example, where bondholders argued that a negotiated change in borrowing under a loan credit agreement violated limitations on indebtedness specified in the bond indenture. Around covenant violations, one would also expect the value of control rights to be priced in traded loans; however, sufficient data to examine such effects either in loan prices or loan CDSs do not exist.

[26] As demonstrated by Nini, Smith, and Sufi (2012), actions by creditors around covenant violations can lead to increases in firm value. This means the gains to bondholders at that time are not necessarily a redistribution of value away from equity holders – correspondingly, we would not clearly predict a simultaneous decline in the value of equity or its control premium.

the *event period*, indicating an increase in premium leading up to the event dates. Results are invariant to including additional bond characteristics as controls. The impact of CDS liquidity is unclear, and is dependent on the measure of liquidity. The impact of bond *volume* has the expected sign but is not significant using the shorter control period, while price impact (*Amihud*) appears more important in explaining *premium* relative to the shorter control window.

Most importantly, the statistical significance of the *event period* indicator shows that our univariate findings that the premium increases near the event are robust to the inclusion of controls including CDS and bond liquidity measures, and time fixed effects. The regression specifications further show that these results hold within firm. Coefficient and significance of the event period indicator in regressions 1 through 4 are also insensitive to the exclusion of the month preceding default (not reported for brevity). The final trading month contributes to the premium significantly based on Panel B of Figures 2 and 3, so these results further show the robustness of our findings to changes in liquidity closest to the default.

(~Insert Table 6 about here~)

Given the nature of the covenant violation event, it is not surprising that the event period indicator is significant only in Regression 6 using a shorter control period window (in comparison to Regression 5) containing the three quarters prior to the quarter of the violation [-1yr, -0.25yr]. Notably, this coefficient of 1.145 for the covenant violation subsample is strongly significant. As we would expect, the magnitude of the coefficient for *event period* is greater for the default subsample (Regression 2 coefficient of 4.120) and particularly for the bankruptcy subsample (Regression 4 coefficient of 4.977).

5. Cross-Section Analyses

In this section, we use cross-section analyses to further examine how the premium we document is related to creditor control.

5.1. Proxies for Creditor Bargaining Power: Tangibility

As discussed in Section 2.1, creditors' bargaining position is weaker for firms with a low proportion of fixed assets. This implies that defaulting firms with more tangible assets should have higher premiums.

We test this hypothesis in Table 7 by regressing *premium* on the *tangibility* of the firm for the default subsample. We measure *tangibility* as property, plant, and equipment (net) divided by total assets, using data from Compustat for the corresponding quarter. Concurrent premium observations are calculated taking the median of all daily observations in the same quarter. Regressions include all quarters in the five year period prior to default. Both regressions include month fixed effects, and Regression 2 also includes firm fixed effects. The results in both specifications confirm that the higher the measured tangibility of the firm, the higher is our measured premium, consistent with prior theory that these are cases where creditors have greater influence.[27]

(~Insert Table 7 about here~)

5.2. Bond Prices

An important proxy to capture the importance of a particular bond to gaining control of the defaulting firm is to determine whether it is potentially the "fulcrum" security. The fulcrum claims reflect the point of insolvency of the firm and so depend on an estimate of the firm value, which is often debated amongst groups of claimants (Gilson, Hotchkiss, and Ruback (2000)).[28] Eberhart and Sweeney (1992) confirm that bond prices at the bankruptcy filing are unbiased predictors of the value

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[27] Bai and Collin-Dufresne (2013) and Kim, Li and Zhang (2014) use tangible assets as one of several measures to build a collateral quality index, and suggest that better collateral quality leads to lower haircuts in the repo market and to smaller arbitrage frictions. Note that if arbitrage frictions are significant, higher tangibility (i.e. smaller haircut) would lead to a tighter relation between the CDS and bond price, and therefore a smaller premium – this biases against our finding of a higher premium for higher tangibility.

[28] Note that alternative measures of the claims structure may not reflect this pivotal point in the capital structure. For example, a high ratio of bank to total debt claims may not indicate a strong bargaining position for banks when the firm value is higher than the amount of bank claims; in this case, more junior claimants have greater bargaining power and are likely to receive equity in exchange for their claims. Ownership information for public bonds would potentially be helpful in discerning cases where an investor holds a large stake in a claim pivotal to a change in control. However, unlike public equity holdings which require disclosure by all owners of more than 5% of outstanding shares, public bond holders are not required to systematically disclose their holdings.

of the ultimate settlement. Therefore, the best way to capture the likelihood that the bond will in fact be the fulcrum security is to examine the bond price at filing. If the bond price is closer to par, then it is likely it will be unimpaired in the restructuring, will receive a distribution close to the value of its claim, and will not vote in the bankruptcy process. If the bond price is closer to zero right before the default, it is likely that it would be wiped out and hence also will not vote or significantly influence the bankruptcy process. Therefore, bonds farther from these extremes will have a higher likelihood of being the fulcrum security, and we expect our premium to be higher for these bonds.

To test this hypothesis, we split our default subsample into three parts: ones with high, medium and low bond prices just prior to the default. Specifically, we calculate the median bond price for any bond in the last 30 days before default and split the bonds according to a bond price 1) higher than \$70, 2) between \$40 and \$70, and 3) less than \$40. Figure 5, Panel A plots the evolution of bond prices as firms near default for these three groups. Panel B plots *premium*, and shows that the increase close to the default date occurs predominantly for medium priced group. This result is consistent with our hypothesis that bonds which are expected to become the fulcrum security have a higher measured premium.

(~Insert Figure 5 about here~)

5.3. Bankruptcy Characteristics

We also hypothesize that in the cross-section, we will observe a higher premium in cases where the chances of control contests and the potential benefits from those contests are higher. The regressions shown in Table 8 support this hypothesis by using hand-collected data on the ultimate outcomes of the bankruptcy cases in our default sample. The dependent variable is the increase in the premium towards the bankruptcy date, which controls for firm level factors that might affect the premium. For each bond, we calculate the difference in the average premium in the quarter prior to default versus the average premium in an earlier window ([-5yr, 0.25yr]). The regressions include one bond of each bankrupt firm, selecting the bond with the lowest average daily trading volume in the five year window (biasing us toward a lower premium given the bond's liquidity) – results are robust to selecting bonds with the highest trading volume.

(~Insert Table 8 about here~)

We regress the change in the premium on the following independent variables and their squares: i) the *recovery rate* to the specific bond, calculated using the post-default trading prices as in as Jankowitsch, Nagler and Subrahmanyam (2014) (Specification 1), and ii) the *auction price* for the bankruptcy cases where the CDS is settled through an auction (Specification 2). We find a strongly significant inverse-U shaped relation of both *recovery rate* and *auction price* to *premium,* despite the decreased sample size due to data availability on bankruptcy outcomes. This confirms the results in Section 5.2 that the mid-priced bonds are most likely to be pivotal to control and thus have a higher premium.

Table 8 also relates the premium to two outcome variables measured at the resolution of the bankruptcy case: (iii) a dummy indicating the bond is the "*fulcrum*" security in the reorganization (Specification 3), and (iv) the percentage of the reorganized company's stock distributed to the bond creditor's class (Specification 4). These measures are perhaps noisier indicators of bonds key to creditors' control at the time of default, given the average time in Chapter 11 for the sample firms is 1.5 years. Nevertheless, we find the increase in *premium* to be positively and significantly correlated with these variables. Thus, in the cross-section of bankruptcy cases, the premium is higher for bonds which are pivotal in obtaining control in the restructuring.

6. Further Issues

In this section, we discuss further issues specific to the CDS and bond valuation, and validate the robustness of our results, particularly the behavior and magnitude of the premium prior to default and across ratings. For brevity, we do not formally report all results in this section.

6.1. CDS-Bond Basis

The pattern we document for *premium* is consistent with the CDS-bond basis reported in the existing literature that uses a range of different sample periods, firms, and basis calculation methods. For the period before the subprime crisis, this literature finds that the basis for investment grade bonds is close to zero, and importantly the basis for lower grade bonds is positive. To illustrate this comparison, Figure 6 plots the median of *premium* across ratings for the sample period July 2002-July 2007, along with pre-crisis results from other papers that report the basis across ratings. To make our results comparable for this plot, we group rating notches (e.g., A+, A, and A- are grouped into one category of A). It is imperative to note that, unlike our paper, prior literature does not consider the effect of creditor control on the pricing of bonds and CDSs, and accordingly pays limited attention to the lowest credit quality bonds for which the creditor control matters the most.

(~Insert Figure 6 about here~)

Several papers document that the CDS-bond basis becomes negative for many bonds during the financial crisis of 2008-2009 (see, e.g., Nashikkar, Subrahmanyam, and Mahanti (2011), Augustin (2012), Bai and Collin-Dufresne (2013), Choi and Shachar (2014), and Junge and Trolle (2014)). Figure 7 plots *premium* versus rating for three sample sub-periods (pre-, mid- and post-crisis) and demonstrates that the behavior of *premium* is consistent with the negative basis for some bonds during the mid-crisis period. Nevertheless, even during the crisis, we observe a highly positive premium in bonds rated CCC or worse. This suggests that although there may be more noise in our measure when market frictions become significant, these frictions do not crowd out the effects of creditor control on the premium, even under a crisis as severe as that of 2008-2009.

(~Insert Figure 7 about here~)

6.2. "Limits to Arbitrage"

In attempting to explain why the CDS-bond basis was negative during the 2008-2009 crisis, the papers mentioned above in Section 6.1 find evidence consistent with "limits to arbitrage" theories. These papers show that frictions including bond trading liquidity risk, funding risk, counterparty risk, and haircuts (collateral quality) play a role in explaining price differences between CDSs and bonds between September 2008 and September 2009. There are two main reasons why such frictions are unlikely to explain our results. First, in the crisis period, the bond is cheap relative to the CDS: hence, limits to arbitrage causes opposite effects to our finding that the bond becomes more expensive. However, as Figure 7 illustrates, the premium is positive for the lowest rated bonds even when market frictions become significant during the crisis period.

Second, Bai and Collin-Dufresne (2013) find that these frictions do not have any economic significance before or after the one-year period during the crisis. Kim, Li, and Zhang (2014) also show that CDS-bond arbitrage worked well prior to the crisis. If non-control-related frictions were driving the relationship between the premium and ratings, we would expect the *premium* to be strongly related to ratings during the crisis, but to have a much weaker relationship with ratings before the crisis. Figure 7 and Table 2 (Regression 4) show that the increase in *premium* with deteriorating ratings is striking in the period before the crisis. Moreover, when we repeat our analyses using only defaults prior to 2008, we find that our results are robust to this choice of time period. This pre-crisis behavior of *premium* provides convincing evidence that frictions are not driving our results.

In addition to the observations made above, we account for potential frictions in our analysis by including firm and time fixed effects, and time varying bond and CDS liquidity measures in regressions, where appropriate. Further, we discuss below each of the frictions suggested to affect the CDS-bond basis.

Liquidity risk: We have shown in our main analysis that bond and CDS liquidity measures cannot explain the behavior of our premium measure. The level of liquidity and liquidity risk is highly correlated in the equity market (Acharya and Pedersen (2005)) and in the bond market (Bai and Collin-Dufresne (2013)). To the extent that this correlation extends to the CDS market, our measures of the level of liquidity also control largely for liquidity risk. Furthermore, Dick-Nielsen, Feldhütter, and Lando (2012), Acharya, Amihud, and Bharath (2013), and Bai and Collin-Dufresne

(2013) find that illiquidity risk is not significant outside crises. Since our results hold in the pre-crisis period it is unlikely that liquidity risk drives our premium.

Funding risk: For an arbitrageur entering a CDS-bond arbitrage trade, a risk is that bond and CDS prices diverge further at the same time as funding costs widen. Bai and Collin-Dufresne (2013) use the Libor-OIS spread as a proxy for funding costs. While the Libor-OIS spread widened during the crisis with an average spread of 74 basis points during July 2007-December 2009, the spread was only 10 basis points during November 2003-July 2007.[29] Thus, funding costs are quite small (especially relative to the magnitude of *premium*) in a period where we find strong results, making it implausible that these costs drive our results.

Counterparty risk: One might be worried that counterparty credit risk impacts CDS premiums, leading to a lower CDS implied price relative to the bond and therefore a positive premium.[30] For this to be the case, counterparty credit risk has to impact CDS premiums significantly and the impact has to be in the direction of increasing CDS premiums. Arora, Gandhi, and Longstaff (2012) exclusively focus on the impact of counterparty credit risk on CDS premiums and find that the effect is "vanishingly" small. The small but statistically significant effect they find is that the higher the dealer's credit risk, the lower is the price that the dealer can charge for selling credit protection. This finding is opposite to what would be necessary to explain our results. Furthermore, we show in Table 2 and Figure 7 that our results are strong in the pre-crisis period. Since counterparty credit risk was much smaller before the crisis, this result further supports the conclusion that counterparty credit risk is unlikely to affect our results in any significant way.

Haircuts (collateral quality): To short a bond, an arbitrageur needs to buy bonds which are funded via the repo market using the same bonds as collateral. The haircut imposed on that transaction reduces the amount of leverage available to the arbitrageur. If haircuts are high, this could lead to an expensive bond and a positive premium. Gorton and Metrick (2012) show that haircuts reached 45% by the end of 2008. However, they also show that haircuts were 0% before the crisis –

[29] OIS data are available in Datastream only from November 2003.
[30] Note that counterparty credit risk refers to the risk that one of the counterparties to the CDS contract defaults; it is separate from the risk that the firm on which the CDS contract is written defaults.

therefore haircuts could not be driving our results.

6.3. Cheapest-to-Deliver

In the case of a credit event, the insurance seller has the option to deliver any bonds in a basket of bonds within the same seniority class (see, e.g., Jankowitsch, Pullirsch, and Veza (2008)). Throughout this paper, we use only reference bonds for the calculation of the premium to ensure the correct matching of deliverable bonds to CDS quotes. However, if there are other deliverable bonds and some bonds are more expensive than others, the premium we calculate might partially reflect a cheapest-to-deliver option priced into the CDS contract. To make sure that a potential cheapest-to-deliver option does not significantly influence our results, we repeat our analysis for the default and bankruptcy subsamples using bonds that we verify are the lowest priced bond of a given issuer. Specifically, we expand our sample to include all bonds on TRACE for the defaulting issuers (not only reference bonds), and determine which are in fact the lowest priced. In cases of bankruptcies with CDS auctions, we also verify prices from listings of bonds deliverable in the auctions. We then calculate the median price in a given quarter using only lowest priced bonds. Our results are qualitatively unchanged for this modified bond sample.

6.4. Auctions

After 2005, the settlements of the CDS credit events are processed through auctions. Recent work shows some (local) inefficiency and biases in the final bond price in the auctions (see, e.g., Chernov, Gorbenko, and Makarov (2013), Gupta and Sundaram (2012), and Du and Zhu (2012)).[31] These papers find that the final bond price might be either above or below the fair bond price because of strategic bidding on the part of participants holding CDS. However, the differences in prices are modest and the effect would be short-lived. Still, we consider that to the extent market participants were aware of these potential biases in the auctions ex-ante, CDS prices might have been affected. To address the concern that these biases may significantly influence our results, we rerun our analyses

[31] Our sample includes each of the 26 auctions studied by Chernov, Gorbenko, and Makarov (2013).

including only default events occurring before the first auction was introduced on June 14, 2005, and find very similar results.

6.5. Maturity

Many studies of the CDS-bond basis focus on bonds/CDSs with a maturity close to five years. Mainly this is done because the 5-year CDS contract is the most liquid. One might worry that our results are influenced by either short or long maturity bonds where the CDS pricing is less liquid. To address this concern, we follow the approach in Bai and Collin-Dufresne (2013) and restrict our sample to transactions in bonds that have a maturity between 3 and 7.5 years on the day of the transaction. We find that our results hold in this subsample.

6.6. Par Value

In the calculation of the CDS-implied bond price, we use the arbitrage argument in Duffie (1999) which relies on the bond trading at par. As pointed out by Fontana (2010) among others, the arbitrage is not exact when the bond does not trade at par. Since bonds close to default are likely to trade well below par, this raises the concern that the control premium we find becomes biased as the bond trades further away from par, and this might cause an increase in the premium close to default. There are four reasons why we rule out this concern. First, Fontana (2010) shows that the error created by applying the Duffie arbitrage argument to bonds well below par is at best modest. Second, according to Fontana (2010), to the extent that the bias is non-negligible, the error works against us finding a larger premium close to default (see Table 8 in Fontana (2010)). Third, the approximate arbitrage argument in Duffie (1999) can be avoided using the "arbitrage-free" approach in Fontana (2010) and Bai and Collin-Dufresne (2013) to calculate the CDS implied bond price.[32] Using the alternative approach, they find results consistent with the pattern we document: the basis increases and becomes strongly positive as credit quality deteriorates (see Figure 6). Fourth, the cross-sectional

[32] The drawback of using the "arbitrage-free" approach is that a constant recovery rate is assumed and if the assumed constant recovery rate is incorrect there is an error introduced (see Bai and Collin-Dufresne (2013) for more on this error). Therefore it is not clear which method is preferred.

results for ex-ante bond prices (Section 5.2) and ex-post auction prices (Section 5.3) suggest a non-linear relation between the bond prices deviating from par values and the control premium. This further alleviates the concerns regarding the results being driven by the deviation from par value for bond prices.

6.7. Information Efficiency

Blanco, Brennan, and Marsch (2005) and others find that the CDS market incorporates information into prices faster than the bond market. If this is the case, our control premium could be a manifestation of the differential information efficiency between CDS and bond markets: as bond prices drop close to default, the corporate bond market reacts slower resulting in a positive control premium. To rule out this possibility, we give the bond market a head start of one day and calculate the control premium at day t using the CDS price at day t-1 and the bond price at day t. We find almost identical results with this setup. Results lagging CDS prices several days are also very similar. This shows that our findings are not driven by differential information efficiency between CDS and bond markets.

6.8. CDS Quote Quality

6.8.1. Quote Based CDS Liquidity Measures

As in almost all the related literature, our measures of CDS liquidity are calculated from quote data rather than transactions data (see, e.g., Qiu and Yu (2012), Bai and Collin-Dufresne (2013), and Junge and Trolle (2014)). Responding to the financial crisis, in July 2010 the Depository Trust & Clearing Corporation (DTCC) began releasing weekly trading activity for the most liquid single name CDSs. Our sample includes 18 bonds (issued by 11 different firms) defaulting after July 2010 for which we can compare our CDS liquidity measures to the weekly trading activity from DTCC (Section IV in Trade Information Warehouse Reports).

(~Insert Figure 8 about here~)

For these bonds, Figure 8 shows that both market depth and the number of cross-sectional quotes follow the same pattern as the DTCC trading activity – an increase in liquidity in the period leading up to default and a drop towards their earlier level in the final two weeks before default. It is harder to compare the number of days with active quote changes because it is already at its maximum of 10 (for the two week window over which it is calculated) and hence shows little variation. While data from DTCC are limited to a small subsample, our quote-based liquidity measures appear well aligned with the transactions data for these bonds.

6.8.2. Premium Calculation and CDS Quote Quality Measures

In the calculation of *premium*, we use CDS premiums to derive a term structure of par yield spreads. If quotes for some CDS premiums are missing, we use linear interpolation to obtain those missing CDS premiums, as explained in Section 1.1. There are two potential concerns regarding the calculations. First, our results might be sensitive to our interpolation approach. Second, there is no weighting of the CDS premiums for different maturities on a given day and arguably the quality differs across quoted CDS premiums. To address both concerns, we use a different interpolation procedure where we weight the quotes across maturity. The procedure is as follows.

We require that there is a 5-year CDS premium and if there are no premiums at other maturities, we set the CDS premium equal to the 5-year CDS premium at all maturities. If there are two CDS premiums, we use a linear function to calculate premiums at other maturities. If there are more than two premiums, we follow the Nelson-Siegel estimation procedure (see, Nelson and Siegel (1987)) to calculate a term structure and weight each premium with its quote quality. Specifically, we assume that the CDS premium is given as:

$$CDS(m) = \beta_0 + \beta_1 * \frac{1-\exp(-m/\tau)}{m/\tau} + \beta_2 * [\frac{1-\exp(-m/\tau)}{m/\tau} - \exp(-m/\tau)],$$

where m is maturity, while β_0, β_1, β_2, and τ are parameters. The parameters are estimated on a daily basis for each firm by minimizing the mean squared errors between actual and model CDS premiums. A measure of quote quality of a CDS premium is the "CompositeLevel" variable given by

Markit, and we translate this quote quality using a ranking of 4=CcyGrp, 3=DocAdj, 2=Entity Tier, 1=Thin, and 0=Missing.[33] A higher-ranking number implies a better quote quality. In the Nelson-Siegel estimation, we weight each CDS quote with the quote quality. If estimation leads to a negative CDS premium at any maturity, we set the premium to zero at this maturity.

Our results remain very similar with this approach, and hence we use the simpler approach in the main text.

6.9. Shorting Costs

For the default subsample, we find a substantial premium close to the default event. An interesting question is to what extent this premium is reflected in bond shorting costs.

When lending a bond, certain creditor control rights (such as voting in certain corporate actions) are conveyed to the borrower of a bond. Thus we expect an increase in premium to be reflected in higher shorting costs as well. To our knowledge, the only paper that provides empirical evidence on shorting costs for corporate bonds close to default is Asquith et al. (2013).[34] Using a dataset from a major lender, they document shorting costs for corporate bonds in a sample period that overlaps with ours. Their Table 5 presents the 35 corporate bonds in their sample with the highest borrowing costs, and 22 of these bonds are either close to or in default (i.e., rated CCC or D), showing that bond shorting costs increase as the firms get close to default. The premium documented in this paper provides an underlying economic rationale for the increase in shorting costs.

The average borrowing cost in Asquith et al. (2013) is approximately 200bps at default (their Figure 4), but this is an annualized figure. The value of having a repo specialness of 200bps for one-and-a-half months – about the average time until settlement of CDS in our sample – is 200bps x (1.5/12) = 25bps. Therefore the impact of a shorting cost of 200bps for this time would be 0.25% of the bond price, which is below the increase in the premium we find. There are at least three reasons

[33] See "Markit.com User Guide CDS and Bonds", February 2013, for an explanation of Markit's data cleaning codes. The guide is available from the authors upon request.
[34] Nashikkar and Pedersen (2007) examine the determinants of corporate bond shorting costs for a sample that includes both investment grade and speculative grade bonds.

why observed shorting costs may not appear large enough to match the documented premium. First, as explained in Asquith et al. (2013) bond loans are "on demand" meaning that the lender of the security may “recall” it at any time – this is particularly likely precisely when there is a loss from unwinding the trade (e.g., around events important to exercising control such as negotiations of a restructuring or the formation of a creditor committee). This is supported by the evidence in Aggarwal, Saffi and Sturgess (2012) for equities lending markets, showing that "the recall is most pronounced for contentious events." This implies that the lender of the bond de facto retains the control rights. Second, consistent with the evidence mentioned above, conversations with market participants revealed to us that bonds are generally not lent out before situations where control is particularly important. This implies that we may not observe lending fees in those situations where the premium is large and shorting costs are expected to be highest. Third, certain control rights specific to bankruptcy are not conveyed to a borrower.[35]

If shorting costs are indeed lower than the control premium near default, it may seem that one can short the bond and sell protection to profit from high control premium (the proposed trade has to be initiated before default because the CDS stops trading at default). However, the profitability of this trade is uncertain. First, at the time of trade, default is not certain (Duffie and Lando (2001) and Davydenko, Strebulaev, and Zhao (2012)). Second, to short the bond, one needs to borrow and short-sell it, and this short-selling has to be in place until the bond and CDS prices have converged. As explained above the loans are "on demand", and a bond lender is likely to recall the bond precisely when there is a loss from unwinding the trade (e.g., around events important to exercising control such as negotiations of a restructuring or the formation of a creditor committee).

[35] For instance, upon a bankruptcy filing, the U.S. trustee appoints a creditors’ committee based on creditors’ holdings (11 U.S.C. § 1102). The committee consults with the debtor, investigates the debtor's conduct and operation of the business, and participates in formulating a plan (11 U.S.C. § 1103). A borrower could not be appointed to a creditors committee.

7. Conclusion

We introduce a measure to demonstrate the premium in corporate bond prices reflecting the value of creditor control. Our method achieves this by synthesizing a bond without control rights using the no arbitrage relation between the bond and CDS, and comparing its price to that of the underlying bond. Empirically, we find our premium measure increases with firms' worsening credit ratings. Further, we show that the premium increases as firms near important credit events, such as defaults, bankruptcies, and covenant violations. In the cross-section, the increase around defaults is higher for firms with more tangible assets, and for securities that are pivotal (such as fulcrum bonds) to changes in control. Overall, we find the premium is positive and economically significant when creditor control rights are valuable.

Our analysis also shows that non-control related frictions including bond or CDS liquidity cannot explain the behavior of the premium near important credit events. As such, our results provide a new explanation for some of the observed CDS-bond basis violations. Our methodology can be useful in other studies in corporate finance/governance, law, and economics focusing on creditor control.

Appendix: Variable Definitions

Variable name (data source)	Definitions
Premium (TRACE, Markit)	Defined for a bond on a daily basis as (bond price - CDS implied bond price)/(bond price), where bond price is the average daily price of the bond, using only bond trades with a transaction volume >= $100,000. The CDS implied bond price is calculated by discounting the promised bond cash flows using a zero coupon curve constructed from CDS quotes (as per the methodology in Section 1).
Bond liquidity measures (TRACE)	All bond liquidity measures include only trades with a transaction volume >= $100,000.
Volume	Total trade volume of trades reported on TRACE (using uncapped trade sizes) in a two week window ending on the current date. Daily volume is calculated by dividing volume over the two-week window by 10.
Number of transactions	Total number of trades reported on TRACE in a two week window ending on the current date. Daily number of transactions are calculated by dividing number of transactions over the two-week window by 10.
Round-trip costs	Trading costs calculated as (average investor buy price minus average investor sell price)/(average investor buy price), for days with at least one investor buy and one investor sell transaction; median of daily round-trip costs is calculated over a two week window.
Amihud	Price impact calculated by sorting all N transactions in a two week window by time, calculating N-1 returns, dividing the absolute value of each return by volume (in millions), and taking the average of the N-1 resulting observations.
Price pressure (TRACE)	Calculated as (average large price - average small price)/(average large price), for any day where there are both a large and small bond transaction. Small trades are those with volume of $50,000 or less; large trades are those with volume of $100,000 or more. Price pressure is the median of daily values over the two week window. Positive price pressure indicates buying pressure in the bond.
CDS liquidity measures (Markit)	
Market depth	The number of quote contributors to the 5 year CDS quote as reported by Markit.
Number of cross-sectional quotes	The number of maturities for which CDS quotes are provided (maximum of 11).
Number of active days	The number days in the previous 14 day window with 5 year CDS quote different from the current 5 year quote.
Bond characteristics (FISD, Moody's, TRACE)	
Callable	1/0 indicator for callable bonds.
Coupon	Coupon rate (%).
Price	$ price per $100 bond.
Rating	Moody's credit rating, enumerated from 1 (for AAA rating) to 20 (for CC rating).
Seniority	1=senior secured, 2=senior, 3=senior subordinate, 4=junior, 5=junior subordinate, 6=subordinate.
Firm characteristics (Compustat)	
Tangibility	Property, plant and equipment (net) divided by total assets.
Ex-post bankruptcy restructuring characteristics	
Fulcrum bond	Indicator that the bond is in the class (as defined by a plan of reorganization) that receives the majority of the stock in the reorganized firm.
Recovery rate	Market based recovery rate calculated as in Jankowitsch, Nagler, and Subrahmanyam (2014), based on transaction prices over the default day and the following 30 days.
Auction price	Settlement price for the bond in the CDS auction, reported by Markit and ISDA.
Percentage stock to class	Percentage of the reorganized firm's stock distributed to the bond's voting class as specified in the Chapter 11 plan of reorganization and described in the Disclosure Statement.

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Table 1. Descriptive Statistics

This table reports the descriptive statistics for our sample. Full sample (Panel A) consists of all bonds for which *premium* is calculated in the period 2002-2012, using bond prices as available from TRACE and corresponding CDS quotes from Markit. *Premium* and other variables are as defined in the Appendix. Subsamples of bonds of defaulting (Panel B) and bankrupt (Panel C) firms are identified from Moody's databases. Covenant violation subsample (Panel D) is based on firms as identified from Nini, Sufi, and Smith (2012).

Panel A. Full Sample (903,469 observations; 2,020 bonds; 963 firms)

	Mean	1st quartile	Median	3rd quartile
Premium (%)	0.289	-2.378	-0.312	0.754
Rating	9.487	6	9	13
Bond characteristics				
Callable	0.734	0	1	1
Seniority	2.111	2	2	2
Coupon	6.609	5.700	6.625	7.625
Price	101.228	97.500	102.864	107.942
Offering amount ($000)	916,796	450,000	700,000	1,000,000
Age (years)	4.027	1.815	3.548	5.717
Time-to-maturity (years)	7.189	3.725	6.047	8.390
Bond liquidity measures				
Volume ($)	144,594,475	31,455,000	69,475,000	149,860,000
Number of transactions	68.366	24	44	81
Round-trip costs (%)	0.427	0.119	0.260	0.522
Amihud measure (x1000)	16.376	5.313	10.354	20.317
CDS liquidity measures				
Market depth	6.825	4	6	9
Number of cross-sectional quotes	9.760	9	11	11
Number of active days	9.667	10	10	10

Panel B. Default Subsample (100,081 observations; 199 bonds; 77 firms)

	Mean	1st quartile	Median	3rd quartile
Premium (%)	4.266	-0.768	0.795	6.075
Rating	13.424	10	14	17
Bond characteristics				
Callable	0.647	0	1	1
Seniority	1.999	2	2	2
Coupon	7.490	6.500	7.45	8.625
Price	88.624	79.750	95.563	102.500
Offering amount ($000)	891,199	400,000	550,000	1,010,000
Age (years)	3.950	1.804	3.373	5.279
Time-to-maturity (years)	6.939	3.897	5.993	8.171
Bond liquidity measures				
Volume ($)	249,607,545	50,255,250	109,250,000	238,996,000
Number of transactions	107.878	34	63	127
Round-trip costs (%)	0.594	0.155	0.327	0.678
Amihud measure (x1000)	20.491	5.547	11.714	25.491
CDS liquidity measures				
Market depth	6.954	4	6	9
Number of cross-sectional quotes	9.389	9	10	11
Number of active days	9.459	10	10	10

Table 1. Descriptive Statistics (continued)

Panel C. Bankruptcy Subsample (63,460 observations; 130 bonds; 53 firms)

	Mean	1st quartile	Median	3rd quartile
Premium (%)	5.196	-0.387	1.088	6.281
Rating	13.215	10	14	16
Bond characteristics				
Callable	0.649	0	1	1
Seniority	1.991	2	2	2
Coupon	7.525	6.500	7.75	8.625
Price	89.343	81.540	96.563	103.097
Offering amount ($000)	689,729	360,000	500,000	900,000
Age (years)	3.708	1.687	3.129	4.802
Time-to-maturity (years)	6.483	3.775	5.870	8.029
Bond liquidity measures				
Volume ($)	216,919,763	52,432,000	105,648,000	207,840,000
Number of transactions	102.039	35	61	116
Round-trip costs (%)	0.550	0.133	0.288	0.585
Amihud measure (x1000)	18.836	5.082	10.181	22.835
CDS liquidity measures				
Market depth	6.823	4	6	9
Number of cross-sectional quotes	9.070	8	10	11
Number of active days	9.327	10	10	10

Panel D. Covenant Violation Subsample (106,264 observations; 222 bonds; 100 firms)

	Mean	1st quartile	Median	3rd quartile
Premium (%)	1.089	-2.447	0.018	3.227
Rating	12.141	10	13	15
Bond characteristics				
Callable	0.910	1	1	1
Seniority	2.064	2	2	2
Coupon	7.397	6.500	7.375	8.25
Price	97.240	93.000	100.250	105.239
Offering amount ($000)	638,124	350,000	500,000	750,000
Age (years)	3.494	1.544	3.044	4.851
Time-to-maturity (years)	7.423	4.489	6.383	8.366
Bond liquidity measures				
Volume ($)	139,237,879	34,194,000	72,210,000	147,439,000
Number of transactions	72.019	24	44	85
Round-trip costs (%)	0.445	0.149	0.283	0.524
Amihud measure (x1000)	16.909	5.230	10.184	20.731
CDS liquidity measures				
Market depth	7.016	4	6	9
Number of cross-sectional quotes	9.659	9	11	11
Number of active days	9.625	10	10	10

Table 2. Panel Regression of Premium and Credit Ratings

This table reports the panel regressions of *premium* and credit ratings for full sample of bonds, where variables are as defined in the Appendix. Bond characteristics include callable, seniority, coupon, price, offering amount, age, and time-to-maturity. Coefficients for control variables are not reported for brevity. Before crisis (Regression 4) is defined as observations prior to January 2008. Standard errors are clustered at the firm level. ***, **, * denote significance at the 1%, 5%, and 10% levels respectively.

Dependent variable: Premium (%)	**1**		**2**		**3**		**4**		**5**	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
Rating	0.614***	6.80	0.561***	6.64	0.707***	6.75	0.510***	4.24	0.050	0.24
Rating Squared									0.025**	2.31
CDS liquidity Measures										
Market depth	-0.043***	-2.80	0.115***	6.73	-0.010***	-3.29	-0.017	-1.15	-0.040***	-2.60
Number of cross-sectional quotes	0.135***	2.50	-0.156***	-3.10	0.039	0.41	0.049	0.78	0.140***	2.58
Number of active days	-0.019	-0.41	-0.140***	-2.86	0.161	1.38	-0.024	-0.61	-0.017	-0.37
Bond liquidity Measures										
Volume (in Millions)	0.129*	1.89	0.084	1.14	0.152	1.19	0.066	0.97	0.133**	1.94
Number of transactions	0.007***	4.07	0.006***	3.61	0.013***	5.99	0.004***	2.50	0.007***	4.17
Round-trip costs (%)	-0.005***	-3.78	-0.014***	-11.88	-0.005***	-2.82	-0.006***	-4.82	-0.005***	-3.54
Amihud measure (x1000)	-0.005	-1.01	-0.031***	-6.38	0.008	1.06	0.017***	3.20	-0.005	-1.03
Constant	-4.036*	-1.78	-5.692***	-2.54	-3.454	-1.09	2.050	0.78	-1.792	-0.78
Bond characteristics§	Yes		Yes		Yes		Yes		Yes	
Year-month fixed effect	Yes		No		Yes		Yes		Yes	
Firm fixed effect	Yes		Yes		No		Yes		Yes	
Sample	Full		Full		Full		Before crisis		Full	
Obs	903,469		903,469		903,469		484,005		903,469	
Adjusted R^2	0.684		0.647		0.470		0.792		0.684	

Table 3. Premium, CDS Liquidity, and Bond Liquidity around Defaults

This table reports medians of all daily observations within a given quarter of *premium*, CDS liquidity, bond liquidity, and price pressure measures, for the default subsample. Quarter -1 is the quarter ending on the date prior to default. Variables are as defined in the Appendix.

	Premium			**CDS Liquidity Measures**			**Bond Liquidity Measures**				
Quarters	**Median (%)**	**Obs.**	**Sign test**	**Market Depth**	**Number of Cross Sectional Quotes**	**Number of Active Days**	**Daily Volume**	**Daily Number of Transactions**	**Roundtrip Cost (%)**	**Amihud Measure (x1000)**	**Price Pressure (%)**
-20	-0.014	2,457	-0.79	6.773	8.767	9.718	3,500,000	4.995	0.239	7.391	0.016
-19	0.183	2,698	10.17	6.593	9.122	9.709	3,831,000	5.605	0.238	7.450	-0.119
-18	0.268	2,981	14.71	7.109	9.141	9.577	3,500,000	4.796	0.238	8.309	-0.270
-17	0.248	3,030	11.15	8.198	9.453	9.579	3,500,000	5.939	0.246	8.129	-0.068
-16	0.197	3,197	9.71	8.723	9.658	9.626	3,500,000	6.190	0.259	7.964	-0.013
-15	0.404	3,368	13.75	9.249	9.825	9.621	3,992,000	6.463	0.286	9.034	-0.093
-14	1.048	3,374	23.55	9.091	9.973	9.488	4,050,000	5.862	0.262	8.559	-0.071
-13	1.212	3,390	23.08	8.284	10.028	9.487	3,962,500	6.519	0.309	8.826	-0.041
-12	0.814	3,605	20.67	8.575	10.008	9.526	4,000,000	6.123	0.278	9.029	-0.014
-11	0.539	3,733	16.48	7.445	9.936	9.645	3,571,000	6.110	0.283	8.665	0.003
-10	0.726	3,729	17.80	6.991	9.848	9.445	3,700,000	5.562	0.300	9.378	0.000
-9	0.929	3,817	17.59	7.034	9.629	9.552	3,834,000	4.979	0.280	9.627	-0.081
-8	1.068	3,954	19.50	6.726	9.526	9.437	4,000,000	5.243	0.285	8.643	-0.237
-7	1.619	3,876	24.00	6.857	9.454	9.481	4,000,000	5.504	0.299	9.536	-0.072
-6	1.800	4,233	23.59	6.923	9.546	9.569	4,500,000	5.956	0.367	12.683	-0.504
-5	1.828	4,204	21.13	6.699	9.747	9.674	4,750,000	5.980	0.368	11.348	-0.320
-4	2.848	4,179	20.81	6.497	9.840	9.782	5,000,000	6.202	0.442	16.269	-0.380
-3	3.536	4,002	23.05	6.149	9.888	9.563	4,282,000	6.041	0.544	20.086	-0.357
-2	3.574	3,998	18.73	6.299	9.862	9.625	5,000,000	6.707	0.667	22.725	-0.399
-1	6.310	4,309	19.45	6.003	10.025	9.474	5,500,000	9.023	0.787	31.654	0.610
1	-	-	-	-	-	-	5,500,000	8.126	0.893	39.918	2.262
2	-	-	-	-	-	-	4,742,500	5.789	0.743	28.811	2.117
3	-	-	-	-	-	-	4,572,000	5.918	0.610	23.962	1.530
4	-	-	-	-	-	-	4,000,000	5.310	0.519	19.182	1.163

Table 4. Premium, CDS Liquidity, and Bond Liquidity around Defaults: Bankruptcy Subsample

This table reports medians of all daily observations within a given quarter of *premium*, CDS liquidity, bond liquidity, and price pressure measures, for the bankruptcy subsample. Quarter -1 is the quarter ending on the date prior to default. Variables are as defined in the Appendix.

	Premium			**CDS Liquidity Measures**			**Bond Liquidity Measures**				
Quarters	**Median (%)**	**Obs.**	**Sign test**	**Market Depth**	**Number of Cross Sectional Quotes**	**Number of Active Days**	**Daily Volume**	**Daily Number of Transactions**	**Roundtrip Cost (%)**	**Amihud Measure (x1000)**	**Price Pressure (%)**
-20	0.217	2,012	8.29	6.614	8.663	9.766	3,100,000	4.448	0.239	7.293	0.114
-19	0.727	2,163	17.31	6.569	9.178	9.751	3,800,000	5.272	0.235	7.545	-0.157
-18	0.932	2,201	22.66	7.048	9.169	9.539	3,050,000	4.449	0.227	8.357	-0.212
-17	0.906	2,420	20.49	8.250	9.292	9.446	3,770,000	5.771	0.256	7.434	0.000
-16	0.536	2,503	16.09	9.033	9.470	9.549	3,150,000	4.565	0.234	6.943	-0.015
-15	0.522	2,561	15.12	9.349	9.716	9.494	3,100,000	4.933	0.247	7.721	-0.038
-14	0.867	2,498	20.93	9.408	9.863	9.335	4,000,000	5.409	0.238	7.590	-0.033
-13	1.298	2,609	22.57	7.934	9.857	9.366	3,305,000	5.101	0.265	7.147	-0.056
-12	0.821	2,656	20.10	7.892	9.909	9.529	3,154,000	5.244	0.264	8.066	-0.080
-11	0.640	2,623	14.98	6.797	9.857	9.516	3,340,000	6.028	0.253	7.174	-0.022
-10	1.338	2,653	22.00	6.490	9.799	9.465	3,460,000	5.271	0.260	9.018	-0.282
-9	1.210	2,621	17.79	6.517	9.718	9.413	3,500,000	4.617	0.259	8.421	-0.263
-8	1.511	2,662	21.24	6.931	9.813	9.437	3,500,000	4.976	0.272	9.328	-0.299
-7	3.095	2,666	28.62	7.126	9.625	9.563	4,000,000	5.720	0.299	10.239	-0.256
-6	2.147	2,688	22.95	6.998	9.445	9.533	4,000,000	5.765	0.359	13.551	-0.429
-5	2.658	2,642	18.60	6.448	9.531	9.643	4,400,000	6.452	0.416	13.879	-0.440
-4	3.373	2,512	15.64	5.917	9.555	9.741	4,250,000	6.165	0.455	19.813	-0.428
-3	3.063	2,395	13.92	5.808	9.615	9.562	4,000,000	6.134	0.544	22.404	-0.379
-2	2.138	2,131	8.77	6.112	9.885	9.676	4,525,000	6.912	0.739	29.455	-0.622
-1	6.542	2,342	14.92	5.545	9.882	9.449	5,627,000	10.889	0.935	40.934	0.549
1	-	-	-	-	-	-	7,250,000	9.456	1.308	48.703	3.259
2	-	-	-	-	-	-	5,000,000	6.366	0.885	31.817	3.040
3	-	-	-	-	-	-	5,000,000	6.349	0.792	29.224	2.713
4	-	-	-	-	-	-	4,000,000	5.663	0.710	25.093	2.074

Table 5. Premium, CDS Liquidity, and Bond Liquidity around Covenant Violations

This table reports medians of all daily observations within a given quarter of *premium*, CDS liquidity, bond liquidity, and price pressure measures, for the covenant violation subsample. Quarter -1 is the quarter containing the covenant violation as identified from 10-Q and 10-K reports. Variables are as defined in the Appendix.

	Premium			**CDS Liquidity Measures**			**Bond Liquidity Measures**				
Quarters	**Median (%)**	**Obs.**	**Sign test**	**Market Depth**	**Number of Cross Sectional Quotes**	**Number of Active Days**	**Daily Volume**	**Daily Number of Transactions**	**Roundtrip Cost (%)**	**Amihud Measure (x1000)**	**Price Pressure (%)**
-8	0.343	2,009	6.49	8.096	8.848	9.660	3,887,500	5.401	0.290	9.156	-0.469
-7	0.216	2,256	3.71	7.776	9.005	9.489	3,500,000	5.621	0.293	10.712	-0.403
-6	0.876	2,678	11.83	8.164	8.969	9.533	3,770,000	4.935	0.314	10.251	-0.431
-5	0.602	2,847	11.79	8.043	9.162	9.700	3,753,000	4.645	0.282	10.263	-0.343
-4	0.796	3,100	12.14	8.112	8.828	9.637	4,000,000	5.114	0.283	8.439	-0.187
-3	0.698	3,275	17.77	7.916	8.970	9.609	3,275,000	4.555	0.265	8.177	-0.031
-2	0.589	3,642	16.40	7.455	8.962	9.569	3,650,000	4.123	0.255	9.077	-0.199
-1	1.011	3,762	20.71	7.260	9.275	9.529	4,000,000	5.014	0.273	8.476	-0.203
1	1.471	3,607	23.66	7.459	9.346	9.466	4,000,000	5.756	0.303	9.681	-0.067
2	1.324	3,638	20.82	7.974	9.614	9.607	3,732,500	4.831	0.300	10.417	-0.045
3	0.801	3,592	16.28	7.904	9.696	9.600	3,400,000	4.689	0.315	10.198	0.000
4	0.621	3,796	14.09	7.990	9.830	9.587	4,000,000	5.313	0.315	9.701	0.051
5	0.474	3,792	9.94	7.655	9.737	9.432	3,995,000	5.370	0.294	9.839	0.006
6	0.377	3,640	9.05	7.272	9.674	9.571	3,500,000	4.861	0.313	9.991	0.101
7	0.508	3,564	10.15	7.118	9.856	9.520	3,000,000	4.434	0.309	9.222	0.286
8	0.409	3,432	8.98	7.328	9.991	9.507	3,000,000	4.883	0.265	9.197	0.283

Table 6. Panel Regressions of Premium and Time-to-Event

This table reports the panel regressions of *premium* and time to credit events. The independent variable Event period indicator equals one for observations in the quarter prior to default/bankruptcy/covenant violation and zero otherwise. The sample period begins either five years or one year prior to default date. Variables are as defined in the Appendix. Standard errors are clustered at the firm level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Premium (%)	**1**		**2**		**3**		**4**		**5**		**6**	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
Event period indicator ([-0.25yr,0])	4.968***	3.43	4.120***	2.87	3.854*	1.78	4.977***	2.53	0.249	0.67	1.145***	2.80
CDS Liquidity Measures												
Market depth	-0.059	-0.77	-0.873***	-4.42	-0.109	-1.07	-1.057***	-3.22	-0.006	-0.17	0.056	0.76
Number of cross-sectional quotes	0.159	0.47	0.666	0.76	0.621*	1.80	1.697*	1.93	0.083	0.95	-0.051	-0.49
Number of active days	0.002	0.01	0.410	1.07	-0.023	-0.13	0.767***	2.64	0.363*	1.86	-0.113	-1.22
Bond Liquidity Measures												
Volume (in Millions)	0.871***	3.85	-0.206	-0.39	1.176***	4.06	0.422	0.54	0.606***	3.43	0.442*	1.69
Number of transactions	-0.004	-1.27	-0.003	-0.89	0.001	0.19	-0.001	-0.21	-0.003	-0.88	-0.011**	-2.14
Round-trip costs (%)	-0.002	-0.42	-0.007	-1.06	0.002	0.25	0.004	0.42	-0.005	-1.25	-0.004	-1.15
Amihud measure (x1000)	-0.004	-0.21	-0.066***	-3.01	-0.010	-0.37	-0.061***	-2.58	0.032***	2.61	0.009	0.44
Constant	-7.197	-0.98	-15.531	-1.23	-19.200***	-2.57	2.795	0.18	-6.962***	-2.93	7.169**	2.17
Year-quarter fixed effect	Yes		Yes		Yes		Yes		Yes		Yes	
Firm fixed effect	Yes		Yes		Yes		Yes		Yes		Yes	
Sample	Default		Default		Bankruptcy		Bankruptcy		Covenant Violation		Covenant Violation	
Sample Period	[-5yr,0]		[-1yr,0]		[-5yr,0]		[-1yr,0]		[-5yr,0]		[-1yr,0]	
Obs	68,904		15,912		47,613		8,954		31,605		12,639	
Adjusted R^2	0.425		0.474		0.426		0.535		0.438		0.545	

Table 7. Panel Regression of Premium and Tangibility

This table presents panel regressions of *premium* and tangibility of firm assets. The independent variable *tangibility* is measured as property, plant and equipment (net) divided by total assets, using quarterly observations from Compustat. Observations of the premium for the corresponding quarter are calculated by taking the median of all daily observations in the same quarter. The regressions use all quarters in the five-year window preceding default. Standard errors are clustered at the firm level. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Premium (%) [-5yr,0yr]	**1**		**2**	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**
Tangibility	13.559**	2.07	24.984**	2.20
Constant	-0.332	-0.23	-13.395	-1.35
Year-quarter fixed effect	Yes		Yes	
Firm fixed effect	No		Yes	
Sample	Default		Default	
Obs	661		661	
Adjusted R^2	0.065		0.622	

Table 8. Cross-Section Regressions of Premium and Bankruptcy Characteristics

This table presents regressions of the change in *premium* on the following bankruptcy characteristics: (i) the recovery rate to the corresponding bond, (ii) the auction price, (iii) a dummy for a fulcrum security, and (iv) the percentage of stock distributed to the bond's class. The Appendix provides further detail for these variables. The dependent variable is calculated as the difference in the premium in the final quarter ending on the day prior to the default date and the premium in the prior five years. For each bankruptcy case, we include the bond with the lowest average daily trading volume in the five year period preceding default. Standard errors are robust. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Diff. in Average Premium (%) ([-0.25yr,0yr] - [-5yr,-0.25yr])

Specification		**Coefficient**	**t-stat**	**Sample**	**Obs.**	R^2
	Recovery Rate	1.774***	5.25			
1	**Recovery Rate Squared**	-0.021***	-5.24	Bankruptcy	35	0.377
	Constant	-27.925***	-4.73			
	Auction Price	1.380***	3.39			
2	**Auction Price Squared**	-0.015***	-3.01	Bankruptcy	32	0.216
	Constant	-15.645**	-2.59			
3	**Fulcrum Dummy**	11.310*	1.96	Bankruptcy	42	0.086
	Constant	-5.903	-1.32			
4	**% Stock to Class**	15.501**	2.09	Bankruptcy	41	0.106
	Constant	-5.388	-1.40			

Figure 1. Premium and Firms' Credit Ratings

This figure plots the relation between *premium* and firms' credit ratings. Ratings are enumerated from 1 (for AAA rating) to 20 (for CC rating). Both mean and median premium are plotted.

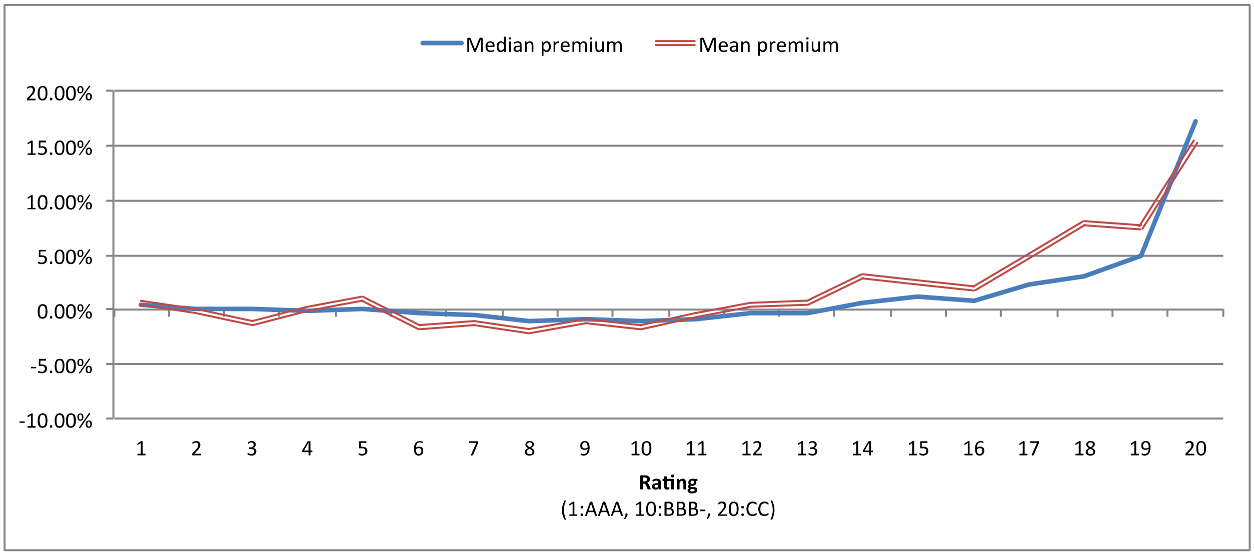
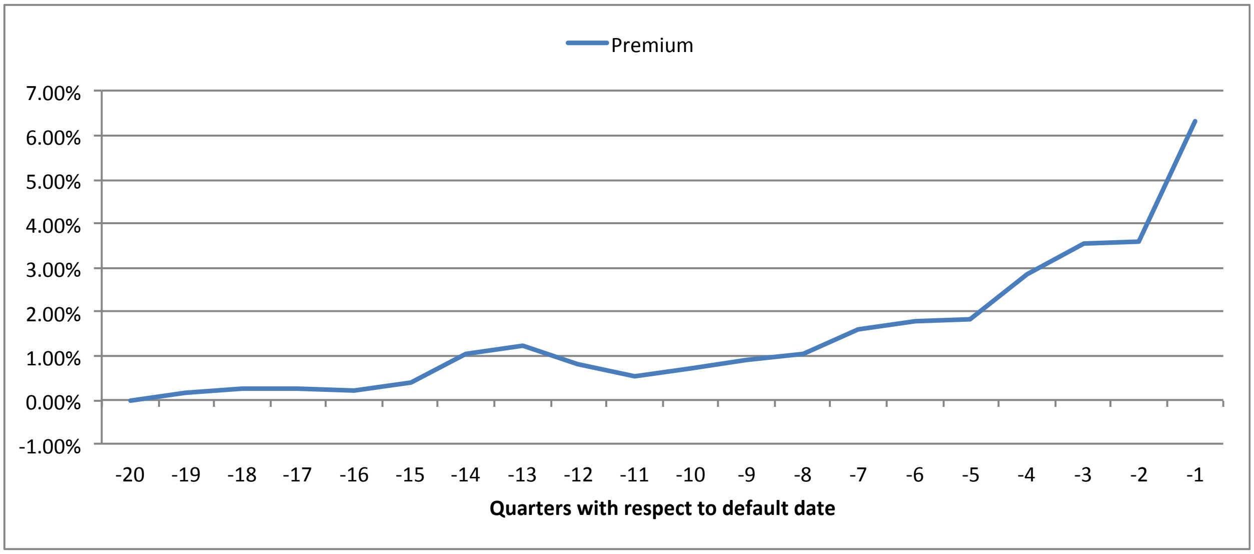


Figure 2. Premium prior to Default

This figure plots the evolution of *premium* for the default subsample using quarterly observations for the 5 year period ending on the date prior to default (Panel A) and weekly observations for the shorter 1 year period ending on the date prior to default (Panel B). Quarterly observations are calculated as the median over all daily observations within the quarter, while weekly observations are calculated as the median over all daily observations within the week.

Panel A. Quarterly Premium



Panel B. Weekly Premium

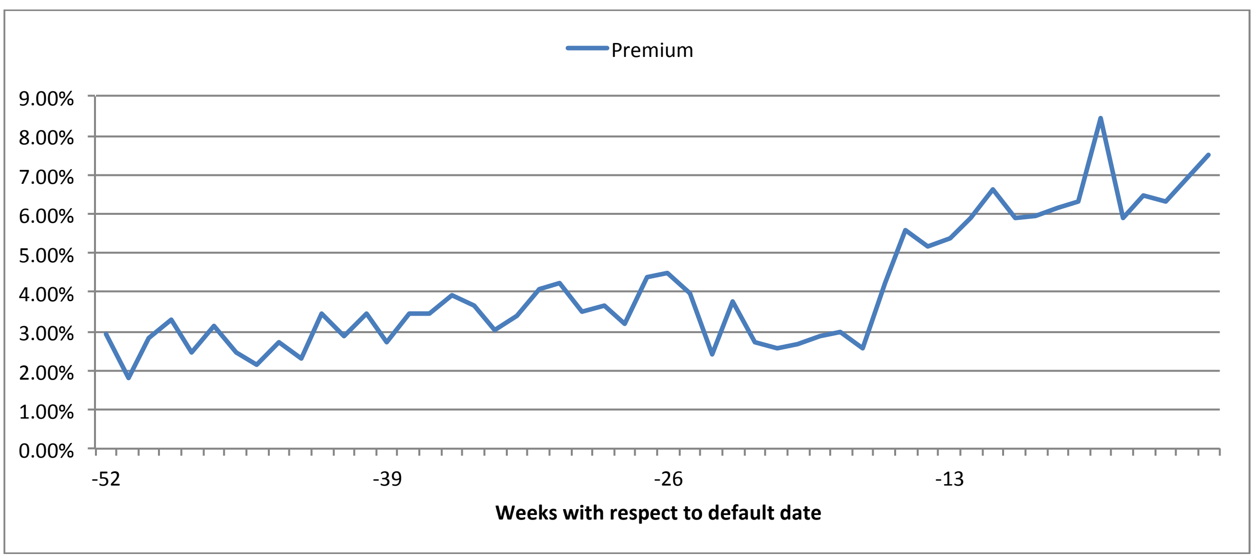
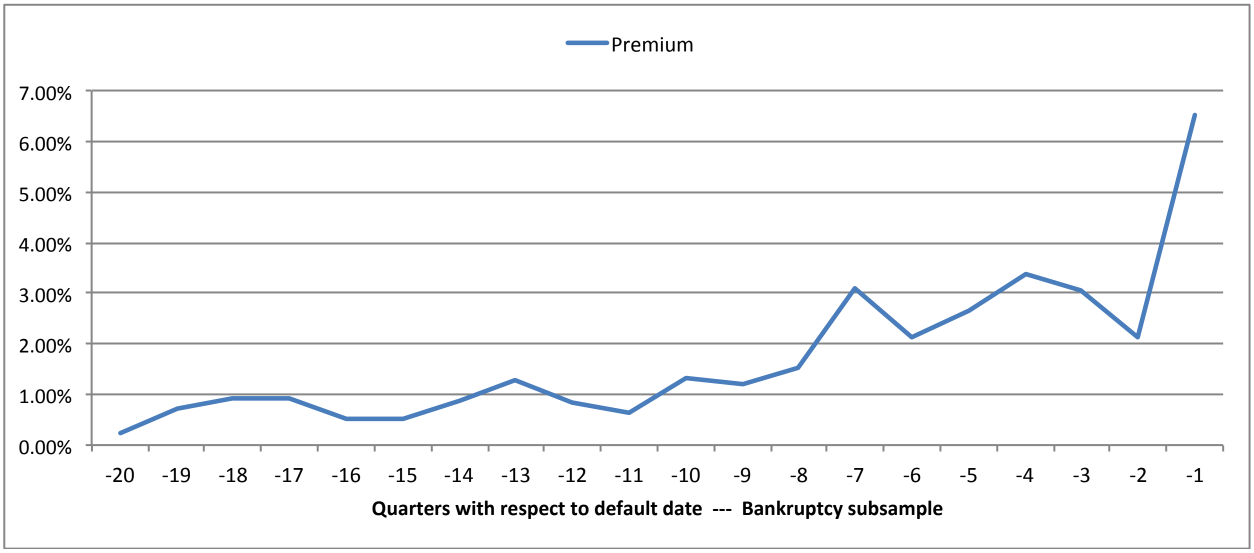


Figure 3. Premium prior to Bankruptcy

This figure plots the evolution of *premium* for the bankruptcy subsample using quarterly observations for the 5 year period ending on the date prior to default (Panel A) and weekly observations for the shorter 1 year period ending on the date prior to default (Panel B). Quarterly observations are calculated as the median over all daily observations within the quarter, while weekly observations are calculated as the median over all daily observations within the week.

Panel A. Quarterly Premium



Panel B. Weekly Premium

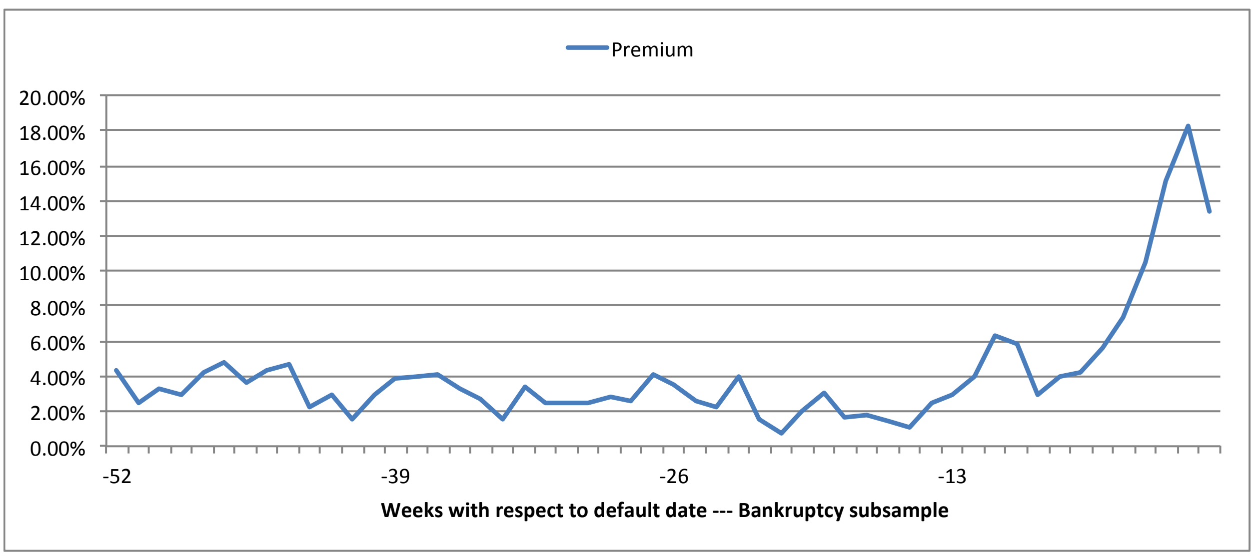


Figure 4. Premium around Covenant Violations

This figure plots quarterly observations of *premium* in quarters surrounding a covenant violation, where quarter -1 is the quarter containing the covenant violation as identified from 10-Q and 10-K reports. Quarterly observations are calculated as the median over all daily observations within the quarter.

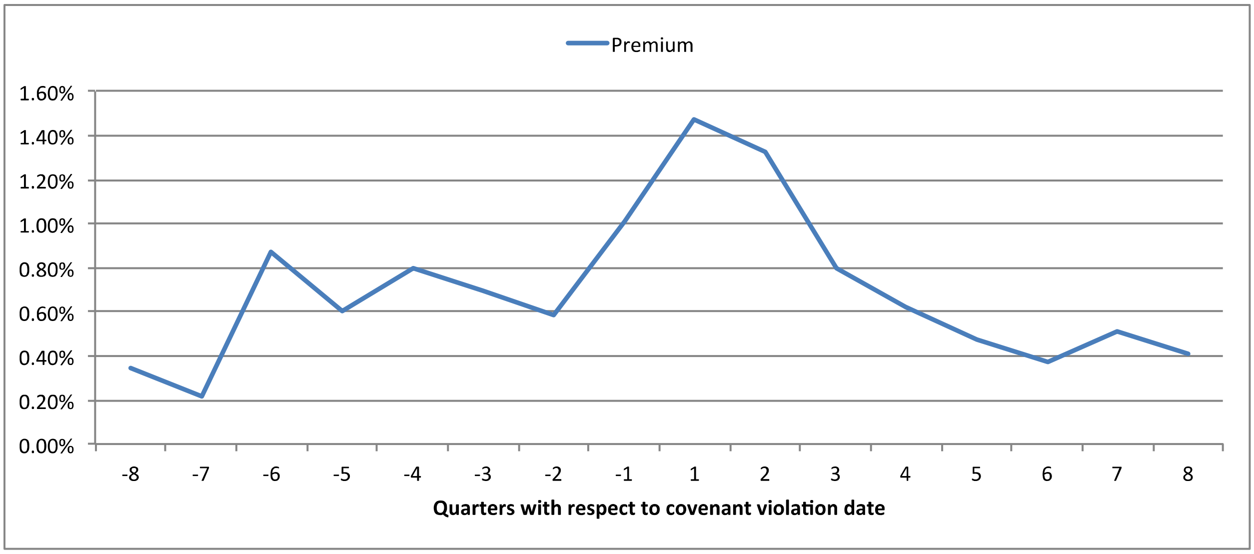
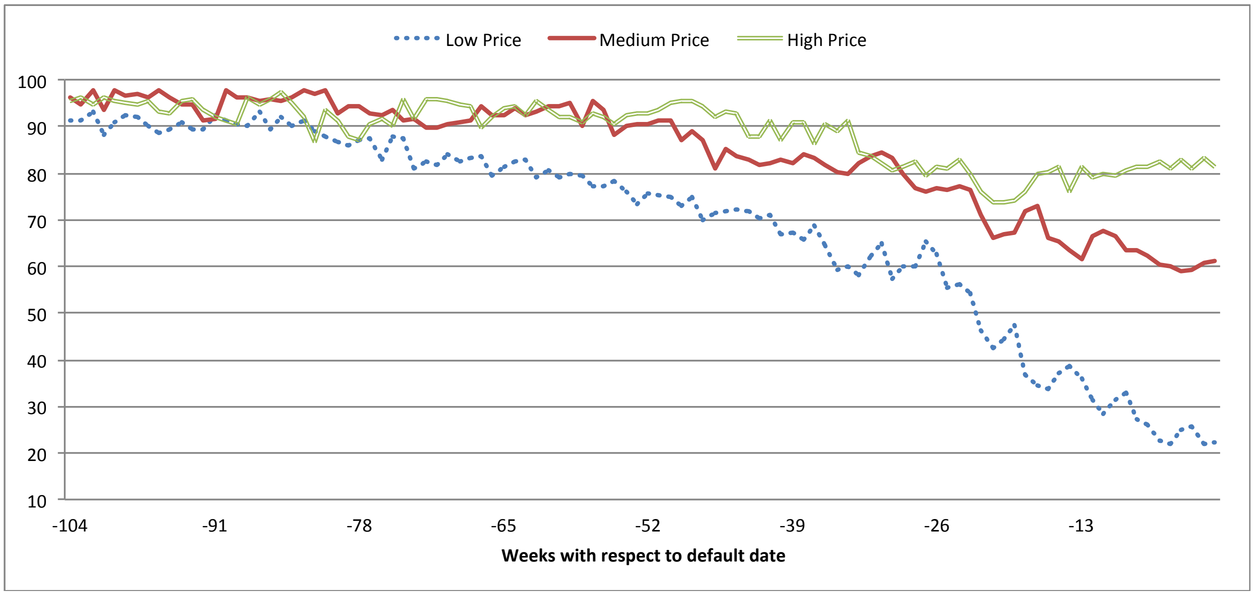


Figure 5. Premium vs. Bond Prices at Default

This figure plots the evolution of *premium* and bond prices towards default for different bond price groups. Panel A shows the evolution of bond prices categorized as high (above \$70), medium (\$40 to \$70) and low (below \$40) according to the bond's median price in the 30-day window prior to the default date. Panel B shows the evolution of *premium* up to the date of default for the three bond price groups (high, medium, and low). For both *premium* and bond price, weekly observations are calculated as the median over all daily observations within the week.

Panel A. Evolution of bond prices



Panel B. Evolution of premium

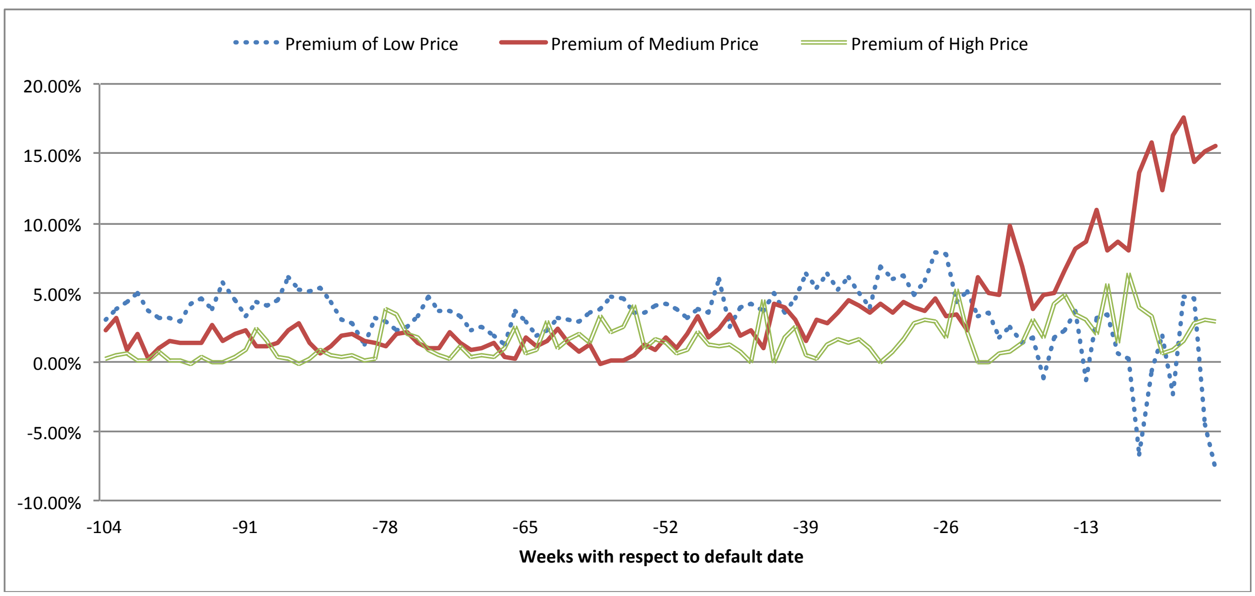


Figure 6. Pre-Crisis Premium vs. CDS-Bond Basis

This figure plots the relation between rating and the premium in our paper as well as the CDS-bond basis reported in other papers. To make the results comparable, we group rating notches (e.g., A+, A, and A- are grouped as A). Our premium is the median of all daily premium values available for a given rating in the period July 2002 - July 2007 (right axis). The literature examining the CDS-bond basis reports the basis as a difference in yields between the CDS and bond (left axis). Our premium can be converted to an approximately equivalent yield spread by dividing by five (based on bond duration as explained in the Section 2.4.1). The results for Bai and Collin-Dufresne (2013) are from their Table 1 pre-crisis, and we exclude their CCC/NR rating group which contains bonds (NR) of unknown credit quality. The results for Nashikkar, Subrahmanyam, and Mahanti (2011) are from their Table 6, where we average across liquidity quintiles and define their '>=C' group as rating class B. The results for Fontana (2012) are from his Table 14 (adj. basis). The results for Han and Zhou (2011), Longstaff, Mithal, and Neis (2005), and Augustin (2012) are from their Tables 5, 2, and 3, respectively.

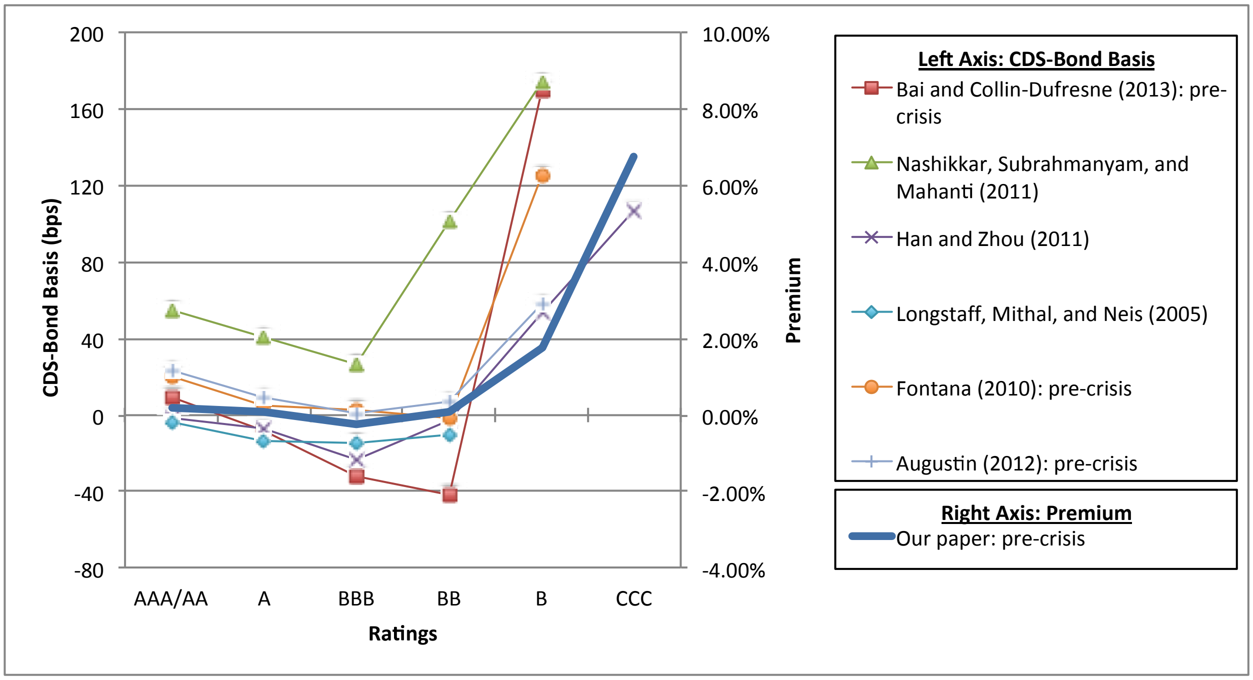


Figure 7. Premium: Pre-, Mid-, and Post-Crisis

This figure plots the relation between premium and firms' credit ratings in different time periods. Ratings are enumerated from 1 (for AAA rating) to 20 (for CC rating). The premium is the median of all daily premium values available for a given rating and time period.

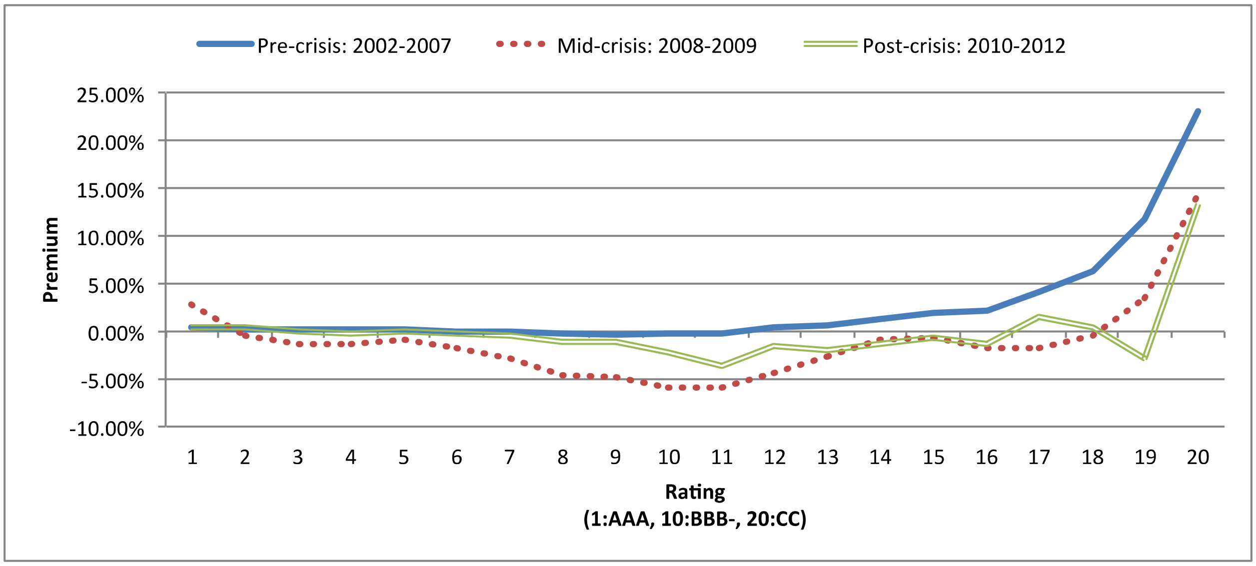


Figure 8. CDS Liquidity Measures vs. DTCC Trading Activity

This figure plots weekly observations of market depth, number of cross-sectional quotes, number of active days along with number of contracts traded in the year leading up to default. Weekly observations of the first three variables (defined in the Appendix) are averages of all daily observations within a week and derived from Markit data. Number of contracts traded is the actual number of CDS transactions obtained from DTCC. Since DTCC transactions data are available only from July 2010, this graph covers a subsample of 18 defaults in the period July 2010-June 2012.