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Credit derivatives as a commitment device: Evidence from the cost of corporate debt

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ABSTRACT

When a firm writes incomplete debt contracts, its limited ability to commit to not *strategically* default and renegotiate its debt requires the firm to pay higher yields to its creditors. Hedged by credit derivatives, creditors have stronger bargaining power in the case of debt renegotiation, which *ex-ante* demotivates the firm to default strategically. In this paper, I aim to investigate theoretically and empirically whether credit derivatives could help reduce the cost of debt contracting stemming from the possibility of strategic default. I find that firms with a priori high strategic default incentives experience a relatively large reduction in their corporate bond spreads after the introduction of credit default swaps (CDS) written on their debt. This result is robust to controlling for the endogeneity of CDS introduction. My finding is consistent with the presence of CDS reducing the strategic default-related cost of corporate debt, suggesting the beneficial role of credit derivatives as a commitment device for the borrower to repay the lender.

When a firm cannot credibly commit to repay its debt, its shareholders may have incentives to default strategically under the firm's financial distress. Strategic default could allow them to extract a substantial fraction of firm value from debt holders through debt renegotiation. Since the pioneering work by Hart and Moore (1994, 1998) and Bolton and Scharfstein (1990, 1996), the possibility of strategic default has been widely recognized to alter the relationship between shareholders and debt holders, which in turn affects the firm's optimal debt structure and debt valuation, among other things. It can reduce a firm's debt capacity by imposing the extra cost on its debt financing. In fact, it is well documented in the literature both theoretically and empirically that the threat of strategic default increases the cost of debt (e.g., Fan and Sundaresan, 2000 and Davydenko and Strebulaev, 2007).

Credit default swap (CDS) could reduce the strategic default-related cost of debt by helping shareholders commit credibly to be less engaged in strategic default. CDS can strengthen debt holders' bargaining power in debt renegotiation upon a firm's default. Specifically, when debt holders are insured through CDS, they stand to lose less *after* the failure of renegotiation, and are therefore less forgiving *during* debt renegotiation.[1] The better bargaining position enables debt holders to make fewer concessions to shareholders. As a result, shareholders are less incentivized to attempt to strategically renegotiate down the promised debt payments to their own advantage. The reduced threat of strategic default should then be reflected in the value of the firm's debt.

The goal of this paper is to investigate theoretically and empirically whether the presence of CDS contracts that are traded on the firm's debt relates to firms' strategic default incentives, which should be incorporated in the value of the firm's debt. More specifically, I argue and show theoretically that the presence of traded CDS should result into higher (lower) values (interest rate spreads) of the firm's debt by reducing the firm's likelihood of strategic default. (I refer to this effect of CDS as "commitment benefit of CDS".) Moreover, I examine empirically whether the firm's bond spreads are lower due to the reduced strategic default premium when a CDS contract starts trading on the firm's debt.

It is a challenging task to establish empirically the causal relationship between a firm's bond spreads and the onset of CDS trading, since the timing of CDS introduction for a given firm could be endogenous. For example, CDS trading may be initiated in

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[1] This reasoning is valid only if debt renegotiation does not constitute a credit event that triggers the CDS payments. Even though many CDS contracts written before 2009 included restructuring clauses in a contract, by which debt restructuring formally constitutes a credit event, *in practice* there is often significant uncertainty for creditors whether a particular restructuring qualifies. For example, debt restructuring in the U.S. corporate segment has never triggered a credit event, given the general disagreement about what constitutes a restructuring event.

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anticipation of the deterioration in a firms' creditworthiness, which should act against finding a reduction (if any) in bond spreads with the introduction of CDS. To mitigate the endogeneity issue, I employ an identification strategy that is similar to a difference-in-differences framework. The basic idea is to sort firms on the basis of their strategic default incentives before the onset of CDS trading, and then examine how these firms behave differently with the introduction of CDS in terms of their bond spreads.

The intuition is that the commitment benefits of CDS should be larger for firms that face the severe problem of limited commitment in the absence of CDS, i.e., firms that are expected (by creditors) to be more likely to be engaged in strategic default in the event of a firm's financial distress. If CDS plays a role as a commitment device by reducing the strategic default-related cost of contracting, we should observe a larger reduction in the cost of debt for firms that would have suffered from the higher cost of strategic default in the absence of CDS. By exploiting the cross-sectional variation in strategic default incentives, my results could be less contaminated by the endogeneity in the timing of CDS introduction.

To convey the intuition more clearly, I present a theoretical framework by extending a stylized model of strategic debt service *à la* Fan and Sundaresan (2000) and Davydenko and Strebulaev (2007), among others. The model allows me to derive the relationship between the magnitude of reductions in the likelihood of strategic default (hence, increases in debt values) and three firm characteristics – referred to as "strategic variables": (1) shareholder bargaining power, (2) liquidation costs, and (3) renegotiation frictions. In the model, CDS provides creditors with better outside options (i.e., the payment from CDS sellers that is presumably higher than the bond's post-default value) in their renegotiation with the firm's shareholders. The creditors' strengthened bargaining position due to the external options results in the lower payoffs of shareholders through debt renegotiation, and decreases the option value of strategic default ex-ante. The option value of strategic default falls most for firms whose shareholders would originally have high incentives for strategic default, such as firms with high shareholder bargaining power, high liquidation costs, or fewer renegotiation frictions. Therefore, the model predicts a positive relationship between the commitment benefits of CDS and shareholder bargaining power or liquidation costs, whereas they are negatively related to renegotiation frictions.

I test empirical predictions derived from the model using a (unbalanced) panel data set of 136 U.S. firms whose bonds are publicly traded, and for which CDS trading was initiated between 2001 and 2008. My empirical model, which is conducted in a firm-fixed and time-fixed OLS regression with an interaction term, essentially regresses the changes in a firm's bond spreads followed by the onset of CDS trading on its strategic variable *measured at the time of the onset of CDS trading*. I proxy for strategic variables with commonly used firm-specific variables in the literature, namely, the concentration of CEO equity ownership for shareholder bargaining power, asset intangibility for liquidation costs, and the dispersion of bondholders for the probability of renegotiation breakdown.

My empirical tests yield two main findings. First, while bond spreads are shown to increase for the average firm in my sample, which is consistent with the results of existing studies (e.g., Ashcraft and Santos, 2009), I find a relatively large reduction in spreads for firms with high strategic default incentives, such as (1) *high* shareholder bargaining power, (2) *high* liquidation costs, and (3) *low* renegotiation frictions. These results may suggest that the firms most vulnerable to the threat of strategic default in the absence of CDS would benefit from the presence of CDS through reductions in shareholders' incentives for strategic defaults, hence the bond spread.

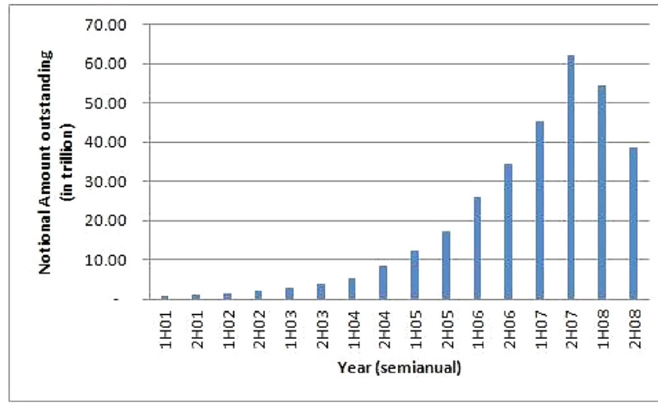

Fig. 1. Growth of the CDS markets. This figure displays the notional amount of outstanding CDS contracts in trillion dollars from 2001 to 2008, source: BIS.

Second, I show that these observed patterns between bond spreads and strategic incentives are more pronounced for the riskier firms in my sample. Specifically, when the sample of firms is divided into two sub-groups based on their credit rating at the time of CDS introduction, namely, AAA/AA/A or BBB, the effects of CDS are seen to be strong, especially for firms that belong to the subgroup with lower credit ratings. This result may be in line with the fact that debt holders' concerns about shareholders' strategic default would become more serious, hence the strategic default premium is higher in bond spreads when the firm is close to financial distress.

Robustness tests address three main potential concerns. The first is that my reasoning throughout the paper hinges on the assumption that creditors become *hedged* (so-called empty creditors) in the presence of traded CDS contracts.[2] This assumption may not hold if the majority of CDS trading consists of "naked CDS," i.e., CDS purchasers are not creditors of the firm. To address this concern, I consider a subsample of firms that has a low ratio of the (notional) amount of CDS to the amount of a firm's total debt. By focusing on those firms with a reasonably low CDS amount, I could exclude from consideration firms with a vast amount of CDS (which is sometimes even larger than the amount of total debt), for which many CDS tradings might be done by speculators, not creditors.

The second concern is dealing with the endogeneity of strategic variables employed in the analysis. It could be argued that my strategic variable is a noisy proxy and so could be correlated with other firm characteristics than strategic default incentives *per se*. To mitigate this concern, I control for other relevant firm characteristics, such as risk, information transparency, and liquidity, which could be correlated with both my strategic variable and the CDS effect on bond spreads. In fact, these firm characteristics are studied in the literature as the potential factor relating to the impact of CDS with respect to bond spreads (e.g., Ashcraft and Santos, 2009; Oehmke and Zawadowski, 2014; 2015, among others).

The final concern is that the introduction of CDS may be endogenous, which could not be fully accounted for by my control variables in a regression framework. Based on the explosive growth of CDS markets over my sample period (as shown in Figs. 1 and 2), however, it seems that a technology (or financial innovation) shock might facilitate CDS trading. As the markets expand and become more liquid, the timing of CDS trading is likely

[2] This type of creditor was first dubbed "empty creditor" by some legal scholars (e.g., Hu and Black, 2008a,b) to refer to creditors that have obtained insurance (by purchasing the CDS contract) against the firm's default, and so cease to be concerned about whether the firm will fulfill their debt payment.

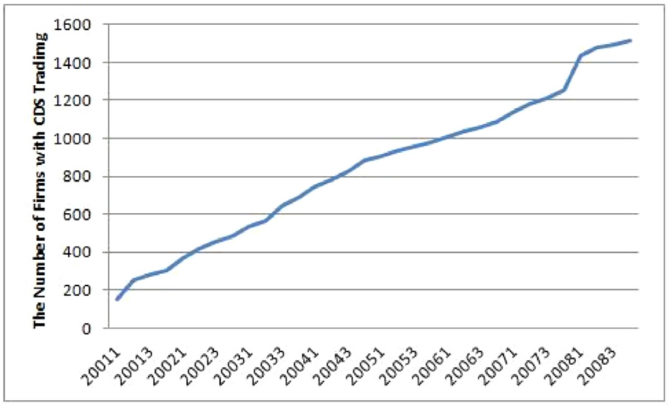

Fig. 2. Number of firms with CDS trading. This figure displays the number of firms with outstanding CDS contracts from 2001 to 2008, source: Markit.

to be exogenously affected by the ease with which traders locate prices and counterparties owing to the accumulated experience and knowledge of CDS trading. Notwithstanding, I address endogeneity concerns further by performing a propensity score matched sample analysis (Rosenbaum and Rubin, 1983). Matched firms, identified as firms that have never traded CDS but have similar characteristics to firms with CDS, are used as a control group.

This paper contributes to a growing literature of the implications of credit derivatives on corporations, particularly corporate debt financing. To the best of my knowledge, my paper is one of the first to address the impact of CDS on the cost of debt through the strategic default channel. Arping (2014) examines the impact of CDS on lending relationships and develops a theoretical model where CDS have positive implications for borrower incentives ex-ante. Norden and Wagner (2008) document that CDS trading affects the syndicated corporate loan market by providing a lead bank with a hedging opportunity. Narayanan and Uzmanoglu (2014) analyze the relation between CDS and the strategic behavior of firms but do not compare bond values for before and after the introduction of CDS. Saretto and Tookes (2013) examine the impact of CDS on a firm's debt capacity, but not debt values, which is the focus of my study. Das et al. (2014) investigate the impact of CDS trading on the corporate bond market, focusing on its efficiency and liquidity. Ismailescu and Phillips (2015) show that CDS initiation provides significant price efficiency benefits in the underlying sovereign market.

An important precursor to my paper is Ashcraft and Santos (2009), which also examines the conditional and unconditional effects of CDS on underlying corporate bond spreads.[3] My paper is close to their study in that it also investigates changes in a firm's bond spreads before and after the onset of CDS trading. However, Ashcraft and Santos focus on different mechanisms through which CDS affects bond prices, so-called hedging and information, not the strategic default channel, which is the main contribution of my paper. Ashcraft and Santos document that safe and informationally transparent firms benefit more from the presence of CDS, whereas I contend that the main beneficiaries are the firms most vulnerable to shareholders' strategic default incentives.

My study sheds light on the ongoing debate over empty creditor problems, the phenomenon that empty creditors – creditors hedged with CDS – may have low incentives to participate in debt renegotiation and as a result, force distressed firms into bankruptcies even when continuation is optimal. On this ground, some legal scholars (e.g., Hu and Black, 2008a,b) propose the removal of those creditors' voting rights in a debt restructuring process. In a similar vein, Subrahmanyam et al. (2014) show that the presence of CDS increases the credit risk of reference firms.[4] Danis (2016) shows that the availability of CDS results in creditors' lower participation in distressed debt renegotiation. In contrast, some scholars argue about the beneficial role of empty creditors as a commitment device (e.g., Bolton and Oehmke, 2011; Campello and Matta, 2016). Using the structural model accounting for both negative and positive effects of empty creditors, Danis and Gamba (2016) find the effect of reducing the cost of corporate debt dominates, which is consistent with the main findings in my paper.

The rest of this paper is organized as follows. Section 1 presents a theoretical framework of how CDS affect the probability of strategic default, hence the strategic default premium in bond yields. The data and empirical methodology are discussed in Section 2. Section 3 reports empirical findings. Section 4 presents the results of the robustness tests. Section 5 concludes.

1. Theoretical framework and hypotheses

In this section, I present the theoretical framework for the effect of CDS on the strategic default incentives of shareholders and accordingly, the cost of a firm's debt. In doing so, I follow closely strategic debt service model with renegotiation frictions (Davydenko and Strebulaev, 2007). Their model is extended to allow for CDS-protected debt holders to bargain with shareholders during debt renegotiation. From this model, testable implications are derived on both the unconditional and conditional effect of CDS on bond spreads.

The basic setup is similar to Davydenko and Strebulaev (2007), which is: debt payments consist of a perpetual coupon payment, c, and equity holders have the option to default on this payment (and will do so when the firm value falls below an endogenous default threshold). If the firm defaults on its debt, it can be liquidated at a proportional cost $\alpha \in [0, 1]$. Debt holders have absolute priority in liquidation, leaving them with $(1-\alpha)V_D$.[5] Costly liquidation could be avoided by debt renegotiation, and a failure of renegotiation drives the firm to be liquidated through a formal bankruptcy process. To account for renegotiation frictions, it is assumed that renegotiation fails with probability $q \in [0, 1]$.[6] Once debt renegotiation is initiated, the two parties bargain over the value of the firm at renegotiation, V_R, which is divided according to the equilibrium outcome of a Nash bargaining game between equity holders and debt holders, with the optimal sharing rule, θ^*, being determined to maximize the aggregate surplus to both parties.

Now I aim to allow for this model to accommodate debt holders who have obtained insurance against a firm's default by purchasing CDS. I suppose that debt holders have purchased the *constant* amount of CDS to be paid (with cash settlement) by the CDS seller upon a firm's default, the amount of cash denoted by πV_R, $\pi \in [0, \alpha]$.[7] Debt holders keep in their possession the defaulted debt, which is worth the post-default (or recovery) value, $(1-\alpha)V_R$. That is, π is equal to zero if debt holders are *not* hedged *at all*, α if *fully*

[3] Using the sample of Asian firms, Shim and Zhu (2014) also conduct a similar study, for which they document different results from those in Ashcraft and Santos (2009).

[4] Bedendo et al. (2016), however, do not find an association between CDS and credit deterioration.

[5] Tax consideration is omitted for the simplicity of the model. The model's implication does not change with the tax advantage of debt.

[6] When q is close to zero, there are few frictions in the debt renegotiation, and there is scope for shareholders to extract firm value from debt holders. Where q equals 1, the debt cannot be renegotiated and claims are settled based on absolute priority rules.

[7] The model assumes that the CDS amount, π, is *exogenously* determined in order to focus on its effect once chosen. The endogenous choice of the CDS amount, however, would not alter the model's main predictions significantly.

hedged, and in-between if *partially* hedged.[8] The market practice would only allow the CDS payment to be triggered once debt renegotiation fails and the firm enters the formal bankruptcy process. This extended setup enables me to rewrite the optimal sharing rule of debt renegotiation in the case of debt holders being protected by CDS as follows:

$$\begin{aligned}\theta^* &= \operatorname{argmax}[\theta V_R - 0]^{\eta}[(1-\theta)V_R - (1-\alpha+\pi)V_R]^{1-\eta} \\ &= \eta(\alpha-\pi), \quad \pi \in [0,\alpha]\end{aligned} \tag{1}$$

where $\eta \in [0, 1]$ represents the bargaining power of equity holders (accordingly, $1-\eta$ for the bargaining power of debt holders). With this sharing rule, equity holders' payoff is $\theta^* V_R$ and debt holders' $(1-\theta^*)V_R$.

Equity holders' surplus from bargaining is $\theta^* V_R$, which remains unchanged with the introduction of CDS, whereas debt holders' surplus is affected (reduced) by the presence of CDS protection due to their increased outside options. More specifically, their alternative to agreeing for renegotiation is to make the renegotiation fail, in which case they would receive the CDS payment, $(1-\alpha+\pi)V_R$. This amount is higher than the amount they would have received after the failure of renegotiation in the absence of CDS, i.e., the recovery value of debt, $(1-\alpha)V_R$. Noticeably, the increase in debt holders' outside option is positively related to the amount of CDS. This CDS-induced increase in outside options would provide debt holders with a strengthened bargaining position and result in a reduced concession to shareholders (i.e., θ^* becomes lower as θ^* would be $\eta\alpha$ in the absence of CDS) by the amount of $\eta\pi V_R$.

With the optimal sharing rule, contingent claims techniques (e.g., Dixit and Pindyck, 1994) enable us to derive the optimal default boundary, V_R[9]:

$$\begin{aligned}V_R(\pi;\eta,\alpha,q) &= \left(\frac{1}{1-(1-q)\eta(\alpha-\pi)}\right)\left(\frac{-\lambda}{1-\lambda}\right)\frac{c}{r}, \\ &\pi \in [0,\alpha], \quad \eta,\alpha,q \in [0,1].\end{aligned} \tag{2}$$

Differentiating V_R with respect to the amount of CDS, π, yields:

$$\frac{\partial V_R}{\partial \pi} = -(1-(1-q)\eta(\alpha-\pi))^{-2}\left(\frac{-\lambda}{1-\lambda}\right)\frac{c}{r} < 0, \tag{3}$$

implying that the default boundary shifts downwards in the presence of CDS. The lower default boundary indicates that equity holders would continue to service their debt at lower asset values and keep the firm afloat longer.

The value of debt, $D(V)$ can be derived by:

$$\begin{aligned}D(V,\pi;\eta,\alpha,q) &= (1-P_R)\frac{c}{r} + [1-(1-q)\eta(\alpha-\pi) - q\alpha]V_R P_R \\ &= (1-P_R)\frac{c}{r} + R \times P_R,\end{aligned} \tag{4}$$

where the risk-neutral default (or renegotiation) probability, P_R, and the expected recovery for debt holders in default, R is given:

$$P_R = \left(\frac{V}{V_R}\right)^{\lambda}, \quad R = (1-q)(1-\eta(\alpha-\pi)V_R + q(1-\alpha)V_R. \tag{5}$$

Eq. (4) implies the value of debt is the renegotiation-probability weighted average of the value of the perpetual coupon stream and the expected recovery rate. The value of debt can be rewritten as:

$$D(V,\pi;\eta,\alpha,q) = \frac{c}{r} - h(\pi;\eta,\alpha,q)\frac{1}{1-\lambda}\left[\frac{1-\lambda}{-\lambda}\frac{r}{c}\right]^{\lambda}\frac{r}{c}V^{\lambda} \tag{6}$$

where

$$\begin{aligned}h(\pi;\eta,\alpha,q) = &\ (1-(1-q)\eta(\alpha-\pi) - q\alpha\lambda) \\ &(1-(1-q)\eta(\alpha-\pi))^{\lambda-1}\end{aligned} \tag{7}$$

The interest rate spread on debt, $s = c/D$, depends on the parameter π (and η, α, q) through the function $h(\cdot)$ where the value of $h(\cdot)$ is positively related to the spreads. My main hypotheses on bond spreads are obtained by analyzing the partial derivatives of $h(\pi;\ \eta,\ \alpha,\ q)$. First, I examine whether the higher CDS amount π corresponds to lower spreads by differentiating h with respect to π:

$$\begin{aligned}\frac{\partial h}{\partial \pi} = &\ \lambda(1-q)\eta(1-(1-q)\eta(\alpha-\pi))^{\lambda-2} \\ &(q\alpha(1-\lambda) + (1-(1-q)\eta(\alpha-\pi))) < 0,\end{aligned} \tag{8}$$

implying that bond spreads become lower in the presence of CDS (i.e., $\pi \neq 0$) than in the absence of CDS (i.e., $\pi = 0$). This expression leads to my first hypothesis:

H1. (CDS and bond spreads) The presence of traded CDS reduces shareholders' incentives to default strategically by strengthening debt holders' bargaining power position in default. As a result, all else being equal, bond spreads are lower when CDS contracts trades on the firm's debt.

Second, I demonstrate that the magnitude of the reductions in bond spread due to CDS increases with equity holders' bargaining power (η) and liquidation costs (α), and decreases with renegotiation frictions (q). The intuition is that the decrease in bond spreads is strongest for firms that have the highest strategic default incentives ex-ante. Indeed, the cross-derivatives of $h(\cdot)$ with respect to π and η, α, or q show the expected signs, as follows:

$$\begin{aligned}\frac{\partial^2 h}{\partial \pi \partial \eta} = &\ \lambda(1-q)(1-(1-q)\eta(\alpha-\pi))^{\lambda-3} \\ &\times [q\alpha(1-\lambda)(1+(1-q)\eta(1-\lambda)(\alpha-\pi)) \\ &+ (1-(1-q)\eta(\alpha-\pi)(1-(1-q)\eta\lambda(\alpha-\pi))] < 0, \\ \frac{\partial^2 h}{\partial \pi \partial \alpha} = &\ \lambda(1-\lambda)(1-q)^2\eta^2(1-(1-q)\eta(\alpha-\pi))^{\lambda-3} \\ &(q\alpha(2-\lambda) + (1-(1-q)\eta\alpha(\alpha-\pi)) < 0, \\ \frac{\partial^2 h}{\partial \pi \partial q} = &\ -\lambda\eta[q\alpha(1-\lambda)(1+(1-q)\eta(1-\lambda)) \\ &+ (1-(1-q)\eta(\alpha-\pi))(1-(1-q)\eta\alpha\lambda(\alpha-\pi))] \\ &\times (1-(1-q)\eta(\alpha-\pi))^{\lambda-3} > 0.\end{aligned} \tag{9}$$

Eq. 9 implies that the absolute magnitude of bond spread sensitivity to CDS would increase with η and α, but decrease with q. These relations can be more clearly seen in Fig. 3, where I plot the graphs of bond spreads with respect to π and each of three parameters. These expressions lead to my second hypothesis:

H2. (The sensitivity of bond spreads to CDS) The decrease in bond spreads is strongest for firms that have the highest strategic default incentives ex-ante, such as:

H2a: *high* shareholder bargaining power,
H2b: *high* firm liquidation costs,
H2c: *low* renegotiation frictions.

Hence, all else being equal, the absolute value of the spread sensitivity to CDS increases with shareholder bargaining power and liquidation costs, and decreases with renegotiation frictions.

The possibility of strategic default is a concern, especially for debt holders whose firm is close to financial distress. In this case,

[8] The case of π being greater than α indicates that debt holders are *excessively* hedged, i.e., have purchased even a larger amount of CDS than the value of total debt outstanding. In this paper, over-hedging is not considered because in this case, all bargaining power goes to debt holders irrespective of the amount of CDS, and debt renegotiation would never happen.

[9] λ is a negative constant that depends on firm characteristics and risk-free rate:

$$-\sqrt{\frac{2r}{\sigma^2}} \leq \lambda = \left(\frac{1}{2} - \frac{r-\beta}{\sigma^2}\right) - \sqrt{\left(\frac{1}{2} - \frac{r-\beta}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} < 0.$$

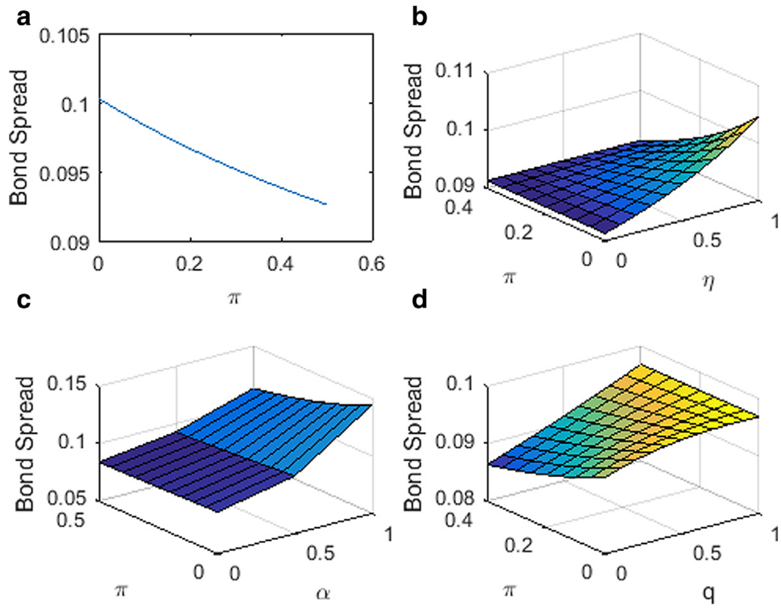

Fig. 3. Comparative static analysis of bond spreads with respect to π, η, α, q. This figure plots the impact of CDS trading on bond spreads across different π, η, α, and q. It is assumed that $V = 1.5$, $r = 7.5\%$, c $= 10\%$, $\beta = 0.03$, and $\sigma = 25\%$. Panel (a) shows the relationship between the amount of CDS (π) and bond spreads. In Panels (b)–(d), the 3-D graph plots the bond spread on the z-axis, the CDS amount (π) on the x-axis, and the equity holder's bargaining power (η), a firm's liquidation costs (α), debt renegotiation frictions (q), respectively on the y-axis.

the relation identified in hypothesis H2 should be stronger for firms that are close to default. In fact, one can see this by taking derivatives each of $\frac{\partial^2 h}{\partial\pi\partial\eta}$, $\frac{\partial^2 h}{\partial\pi\partial\alpha}$, and $\frac{\partial^2 h}{\partial\pi\partial q}$ with respect to V:

$$\frac{\partial D(V)^3}{\partial\pi\,\partial\eta\partial V} < 0, \quad \frac{\partial D(V)^3}{\partial\pi\,\partial\alpha\partial V} < 0, \quad \frac{\partial D(V)^3}{\partial\pi\,\partial q\partial V} > 0, \tag{10}$$

Note that these expressions are shown in terms of the value of debt, $D(V)$. That is, the relation in H2 is more salient among firms with low V, which translates into firms whose distance to the default threshold is closer (all else being equal), i.e., riskier firms. Hence, my third hypothesis can be derived as:

H3. (Bond spread sensitivity and firm risk) All else being equal, the relations identified in H2 are more pronounced in the risky firm.

2. Data and empirical methodology

2.1. Data source and sample selection

I construct a panel dataset of investment grade corporate bonds of publicly traded U.S. firms that initiated CDS trading during the period January 2001–December 2008. I begin by building the sample of CDS firms (i.e., firms that have traded CDS) using the Markit CDS Pricing database as follows. I start with CRSP-Compustat firms that have traded CDS by selecting only those that have ever had quote information in the Markit database. For each CDS firm, I then identify the first date (i.e., quarter) in which a US$-dominated CDS contract was traded at a five-year maturity. This quarter is used in the analysis to indicate the onset of CDS trading. I remove all firms that initiated trading in the first month of 2001, when the Markit data begin, because of uncertainty about the starting dates of these firms' CDS trading.[10] I obtain 869 CDS firms with CRSP-Compustat identifiers.

From these, I select only CDS firms for which bond information (e.g. prices and characteristics) is available. Bond pricing information is obtained from TRACE and NAIC, two bond transaction databases widely used in the recent literature.[11,12] I augment TRACE's limited coverage in earlier years with NAIC, and delete firms that have never had bond pricing information in either database. I further merge bond pricing data with the Mergent Fixed Investment Securities Database (FISD) to eliminate all but senior, unsecured, corporate debenture or medium-term notes. Bonds with no rating and with options-like features (callable, puttable, or convertible bonds or bonds with sinking funds) as well as bonds with less than one year or more than 30 years to maturity are removed. This process reduced the number of firms in the sample to 276.

Last, my sample is limited to firms that have at least one outstanding bond that has price information available both before and after the onset of CDS trading (169 firms).[13] I further restrict my analysis to firms that had investment-grade credit ratings (no worse than BBB) at the time they initiated CDS trading. Table 1 presents descriptive statistics on the final sample, which totals 136 firms and 1506 firm-quarter observations from Q2 2001 to Q3 2008. Panels A and B break down the CDS firms by industry and rating, respectively, at the time of CDS introduction. As expected, firms in the manufacturing and financial industries (67 and 32, respectively) comprise the larger portion, and firms with relatively lower ratings (i.e., A and BBB) constitute nearly 90% of the sample.

[10] This filter might create a selection bias since some large firms may have already traded CDS traded before 2001. However, 2001 marks the period from which CDS have been widely used even though CDS have been traded since 1996.

[11] TRACE first recorded bond transactions on July 1, 2002. Today, it includes all trades in the secondary OTC markets for corporate bonds, save some small retail trades on NYSE. A comprehensive description of the TRACE database is given in Downing et al. (2005).

[12] NAIC, an alternative to the no-longer available Lehman fixed income database on corporate bonds used in previous studies, covers approximately 25–40% of total over-the-counter secondary corporate bond transactions by American life, health, property and casualty insurance companies since 1994.

[13] For firms with multiple candidates of bond issues, I use one representative bond per firm to mitigate potential bias. Were all available bonds per firm used in the analysis, the results might over-represent larger companies with large numbers of bond issues, which could introduce bias inasmuch as my test focuses on credit spreads at the firm-, rather than trade- or bond-, level.

Table 1
The breakdown of the number of firms.
This table reports descriptive statistics on the final sample of CDS firms used in my main analysis (i.e., firms that initiated CDS trading during the period 2001–2008). Panels A–C present a breakdown of the number of firms by industry, rating, and year of onset of CDS trading, respectively. For each panel, number and percentage of firms are reported in the column of Freq. and Perc., respectively. The cumulative number and percentage of firms are reported in the columns of Cum. Freq. and Cum. Perc. The industry to which a firm belongs and its ratings are measured during the quarter its CDS trading begins. The onset of CDS trading is assumed to occur on the first date a U.S.-dollar-dominated CDS contract is traded at a five-year maturity.

Panel A: Number of firms by industry				
Industry	Freq.	Perc.	Cum. Freq.	Cum. Perc.
Agriculture, mining, and construction	10	7.94	10	7.35
Manufacturing	67	49.27	77	56.62
Transportation, communications, and utilities	12	8.82	89	65.44
Wholesale and retail trades	10	7.35	89	72.79
Finance, insurance, and real estate	32	23.53	131	96.32
Services and public administration	5	1.47	136	100.00
Panel B: number of firms by rating				
Rating	Freq.	Perc.	Cum. Freq.	Cum. Perc.
AAA	3	2.21	3	2.21
AA	11	8.1	14	10.19
A	60	44.11	74	54.41
BBB	62	45.59	136	100.00
Panel C: Number of firms by year of onset of CDS trading				
Year	Freq.	Perc.	Cum. Freq.	Cum. Perc.
2001	47	34.56	47	34.56
2002	40	29.41	87	63.97
2003	23	16.91	110	80.88
2004	11	8.09	121	88.97
2005	7	5.15	128	94.12
2006	2	1.47	130	95.59
2007	5	3.68	135	99.26
2008	1	0.74	136	100.00

Panel C breaks down firms by the timing (i.e., year) of CDS introduction. CDS trading begins in 2001 for 34% of firms, 2002 for 29%, 2003 for 16%, and by the third quarter of 2008 for the remainder.

2.2. Strategic Variables

In this section, I describe the way I construct the main variable in my analysis, the so-called strategic variable (*STRATVAR*), which is used to differentiate firms with high and low incentives for strategic default. For a given firm, the strategic variable is measured only once at the time of CDS introduction. For each of three strategic variables employed, the number zero follows the variable name to distinguish these time-invariant variables from other time-varying variables. Included in a regression as a interaction term with the CDS trading indicator, these variables would play a role in sorting firms into high and low strategic firms.

2.2.1. Shareholder Bargaining Power

As a measure of shareholders' bargaining power, I use CEO shareholding defined as the proportion of shares held by a CEO (*CEOSHARE0*).[14] CEOs with a high stake in a company are likely to aggressively represent equity holders in renegotiation, thus generating collective bargaining force more effectively. This is evidenced by existing studies documenting that equity deviations from the absolute priority rule (APR) in the bankruptcy process are more likely for firms with higher CEO ownership. Betker (1995), for example, documents that a 10% increase in CEO shareholding increases equity deviations from the APR in Chapter 11 by as much as 1.2% of firm value.

2.2.2. Liquidation Costs

I use asset intangibility (*INTANGIBLE0*) as a measure of liquidation costs. Debt holders should be more willing to forgive debt in renegotiation if their alternative is to face high costs in liquidation. Asset intangibility is computed as 1 minus the asset tangibility measure, which is the average of the expected exit values per dollar of the different tangible assets in liquidation weighted by their proportion of total book assets. Specifically, following Berger et al. (1996) and Almeida and Campello (2007), I compute asset tangibility as $(0.715 \times Receivables + 0.547 \times Inventory + 0.535 \times Capital + 1 \times Cash\ \ Holdings)$, scaled by the total book value of assets. Subtracting this measure of asset tangibility from1 yields the liquidation cost.[15]

2.2.3. Renegotiation Frictions

I use the dispersion of bond holders as a proxy for renegotiation frictions. Firms with a large number of bond holders have more difficulty restructuring their debt privately, resulting in formal bankruptcies due to both the hold-out problem and conflicts of interest (Gertner and Scharfstein, 1991; Bolton and Scharfstein, 1996; Bris et al., 2006). I use the number of bond issues (*ISSUENUM0*) to capture the dispersion of bond holders. This measure is computed as the logarithm of the number of outstanding public

[14] Davydenko and Strebulaev (2007), Valta (2008) and Nejadmalayeri and Singh (2012) also use CEO shareholding as a proxy for shareholder bargaining power.

[15] This asset intangibility measure is also employed to measure liquidation cost in Garlappi et al. (2008), Valta (2008), Favara et al. (2012), and Zhang (2012).

bond issues divided by the logarithm of the book value of a firm's total debt (Gilson et al., 1990).[16]

2.3. Risk, Information Transparency, and Liquidity

In this section, I describe how to construct three other variables, all of which are also time-invariant, and included in a regression as an interaction with the CDS trading indicator. These variables serve as a control to account for the endogeneity of strategic variables. Like strategic variables, these variables are also measured only once, at the time of CDS introduction for a given firm. Credit rating (*RATING0*) is used to reflect a firm's riskiness, and information transparency is captured by analyst coverage, defined as the number of equity analysts that forecast a firm's earnings (*ANALYSNUM0*). Firms with more analyst coverage are considered to be less informationally opaque either because analysts increase the information available about them or because they extend coverage to more transparent firms (Bhushan, 1989; Francis and Soffer, 1997; Hong et al., 2000; Chang et al., 2006). Bond liquidity is measured using the log of the bond's total number of trades (*BTRDNUM0*).

2.4. Bond Yield Spread and Control Variable

I now present the construction of dependent variables and other control variables that are known to affect bond spreads. Note that unlike the strategic variables (and other variables that are used to address the endogeneity of strategic variables) presented in the previous sections, these are time-varying variables. The dependent variable is a bond's yield spread (*BSPREAD*) computed as the difference between its yield-to-maturity and the maturity-matched Treasury bond yield. I construct a complete yield curve of Treasury bonds by linear interpolation from 1, 2, 3, 5, 7, 10, and 30-year Treasury rates using bond yields obtained from the Federal Reserve Bank of St. Louis. The bond spread control variables include the followings:

1. MKTLEV: A market value-based definition of firm leverage is computed as the market value of long-term debt divided by the book value of total assets.
2. FIRMSIZ: Market value-based firm size is defined as the logarithm of the book value of long-term debt plus the market value of common equity.
3. STOCKVOL: The historic volatility of equity is measured in terms of the standard deviation of daily stock prices over the past three months.
4. RATING: An ordinal number is assigned to a firm's S&P rating as follows: AAA = 1, AA+ = 2, AA = 3, AA− = 4, A+ = 5, A = 6, A− = 7, BBB+ = 8, BBB = 9, BBB− = 10, BB+ = 11, BB = 12, BB− = 13, B+ = 14, B = 15, and B− = 16.
5. BLIQ: Individual-level bond liquidity is measured by the logarithm of the bond's total number of trades in a quarter.
6. BMKTLIQ: Aggregate-level bond market liquidity is measured by the logarithm of total number of trades for the universe of corporate bonds in a quarter.

2.5. Descriptive Statistics

To obtain the data necessary to compute these variables, my sample of CDS firms is further merged with Compustat Quarterly for accounting and rating information, ExecuComp for managerial shareholding data, and I/B/E/S for data on equity analysts' earning forecasts. Table 2 presents the summary statistics for these six variables. As shown in Panel A, the mean (median) is 0.58 (0.11), 0.59 (0.57), and 0.23 (0.24), and the standard deviation 1.76, 0.13, and 0.11 for *CEOSHARE0, INTANGIBLE0*, and *ISSUENUM0*, respectively. The median rating (*RATING0*) of CDS firms is 7 (i.e., A-) and the average number of analysts 9 (*ANALYSNUM0*). The mean and standard deviation of *BTRDNUM0* is 1.43 and 1.26, respectively. Panel B presents the correlation matrix for these six variables. That the variables are not significantly related to one another suggests that each of variables captures a distinct aspect of the firm.

Table 3 reports summary statistics on bond yield spreads and control variables described above. Panels A and B show that a bond's yield spreads monotonically increase with a firm's credit rating and a bond's maturity. Panel C compares firms before and after the start of their CDS trade. It shows that there is a reduction in stock volatility, deterioration in credit quality, increase in leverage and firm size, improvement in bond liquidity at both individual and market level, and a slight decrease in yield spreads. The results of lower yield spreads and higher leverage after the onset of CDS trading are different from Ashcraft and Santos (2009), who find the opposite results. But, when controlling for other credit factors in a regression, I also observe an increase in spreads. My result on leverage is consistent with Saretto and Tookes (2013), who document that firms with traded CDS maintain higher leverage ratios.

2.6. Empirical Specification

I estimate the model below in Eq. (11) using ordinary least squares (OLS) regression with both firm-fixed and time-fixed effects. I use *within-firm* rather than *between-firm* information to control for potential omitted variables that would differ between firms. Within a firm, I compare the secondary market prices of the same bond of the firm before and after the onset of CDS trading. To get around the potential endogeneity in the firm's bond issuance decisions, I employ market prices of the bond unlike existing studies that use issuance prices.

$$\begin{aligned} BSPREAD_{i,t} &= \alpha_i + \beta_1\, TRADING_{i,t} + \beta_2\, STRATVAR_i \\ &\quad + \beta_3\, TRADING_{i,t} \times STRATVAR_i \\ &\quad + \sum_j \gamma_j\, CONTROL(j)_{i,t} + \delta_t\, TimeDummies + \varepsilon_{i,t}, \quad (11) \end{aligned}$$

where α_i is included to control for firm-fixed effects, and time dummy variables for time (i.e., quarter-year) fixed effects. $BSPREAD_{i,\,t}$ is bond spreads of firm i in quarter t, and $TRADING_{i,\,t}$ is a dummy variable that is equal to zero for firm-quarters before the onset of CDS trading, and 1 otherwise. $STRATVAR_i$ is strategic variables measured in the quarter before the onset of CDS trading (i.e., $CEOSHARE0_i$, $INTANGIBLE0_i$, or $ISSUENUM0_i$). I use lagged values (by one quarter) for the controls to mitigate the potential endogeneity problem. All standard errors are clustered at the firm level.

Note that $STRATVAR_i$ is a *time-invariant* variable while $TRADING_{i,\,t}$ is a time-varying variable.[17] Specifically, the interaction term $TRADING_{i,\,t} \times STRATVAR_i$ takes zero for all the quarters of firm i before the start of CDS trading, and 1 × (the value of firm i's *STRATVAR* at the time of CDS introduction) for all quarters after CDS trading. This setup would be similar to a difference-in-differences framework with a continuous variable for the treatment/control indicator. In other words, by interacting time-invariant strategic variables with the TRADING dummy, I am allowed to sort firms before the onset of CDS trading into firms with high and low strategic incentives, and then examine how these groups of firms behave differently with the introduction of

[16] The same measure of renegotiation friction is used in Davydenko and Strebulaev (2007) and Nejadmalayeri and Singh (2012).

[17] Hence the strategic variable, $STRATVAR_i$ is subsumed under the firm-fixed effect model.

Table 2
Firm-specific variables at the time of the onset of CDS trading.
This table reports summary statistics on firm-specific variables at the time of the onset of CDS trading. Panel A gives the summary statistic. CEOSHARE0 is the proportion (in percentage) of shares held by a CEO, INTANGIBLE0 is the ratio of intangible to total assets, defined as $0.715 \times Receivables + 0.547 \times Inventory + 0.535 \times Capital + 1 \times Cash\ Holdings$, and ISSUENUM0 is the logarithm of the number of outstanding public bond issues divided by the logarithm of the book value (in billions) of the firm's total debt. *RATING*0 is the ordinal S&P rating and is given by the following transformation: AAA = 1, AA = 2, AA = 3, AA− = 4, A+ = 5, A = 6, A− = 7, BBB+ = 8, BBB = 9, BBB = 10. *ANALYSNUM*0 is the number of equity analysts that forecast a firm's earnings. *BTRDNUM*0 is the logarithm of the total number of the bond's trades in a quarter. All variables are measured during the quarter of the onset of CDS trading. Panel C presents the correlation matrix between strategic, hedging, and information variables. The p-values are reported in parentheses (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

Panel A: Summary statistics

	N	Mean	Median	Min	Max	Std. Dev.
CEOSHARE0	125	0.58	0.11	0	12.54	1.76
INTANGIBLE0	125	0.59	0.57	0.32	0.96	0.13
ISSUENUM0	133	0.23	0.24	0	0.56	0.11
RATING0	136	7.02	7.00	1	10	2.09
ANALYSNUM0	121	9	10.1	1	28	6.5
BTRDNUM0	136	1.43	1.09	0	6.81	1.26

Panel B: Correlation matrix

	CEOSHARE0	INTANGIBLE0	ISSUENUM0	RATING0	ANALYSNUM0	BTRDNUM0
CEOSHARE0	1					
INTANGIBLE0	0.03	1				
ISSUENUM0	0.09	−0.07	1			
RATING0	0.16*	−0.10	0.00	1		
ANLYSNUM0	−0.19**	−0.09	−0.10	−0.14	1	
BTRDNUM0	0.04	0.03	−0.13	−0.03	0.10	1

Table 3
Determinants of bond spreads.
This table reports the summary statistics on bond yield spreads and control variables. Panels A and B present a breakdown of yield spreads (in bps) by credit rating and time to maturity, respectively. Panel C reports the summary statistics on control variables as well as credit spreads before and after the onset of CDS trading. Leverage is long-term debt divided by market value of total assets, Size equals the logarithm of long-term debt plus the market value of common equity, Stock Volatility is the standard deviation of daily equity returns for the past three months, Rating is the ordinal S&P rating and is given by the following transformation: AAA = 1, AA+ − 2, AA = 3, AA− = 4, A+ − 5, A = 6, A− = 7, BBB+ − 8, BBB = 9, BBB− = 10, BB+ − 11, BB = 12, BB− = 13, B+ = 14, B = 15, B− = 16, Profitability is earnings before tax and depreciation divided by total assets, and Maturity is the remaining time in years to maturity date.

Panel A: Bond spread by rating

Rating	Obs	Mean	Median	Std. Dev.
AAA	37	80.1	65.7	47.5
AA	92	152.6	108.8	109.1
A	663	156.7	120.0	122.9
BBB	669	232.5	178.7	180.7
BB	42	343.1	282.4	204.4
B	7	353.1	270.3	210.9
ALL	1,513	195.5	149.1	162.1

Panel B: Bond spread by maturity

Maturity	Obs	Mean	Median	Std. Dev.
Short (<3 years)	573	190.5	107.0	194.4
Medium (3–10 years)	689	197.1	163.7	137.8
Large (>10 years)	251	202.3	167.6	141.2
ALL	1,513	195.5	149.1	162.1

Panel C: Variables before and after the onset of CDS trading

	All			Before			After		
	Obs	Mean	Std Dev	Obs	Mean	Std. Dev.	Obs	Mean	Std Dev
BSPREAD	1513	195.47	162.06	494	199.76	125.44	1019	193.39	177.14
TRADING	1513	0.67	0.46	494	0.00	0.00	1019	1.00	0.00
MKTLEV	1502	0.23	0.19	489	0.21	0.15	1013	0.24	0.20
FIRMSIZ	1502	9.25	1.22	489	9.00	1.30	1013	9.37	1.16
STOCKVOL	1480	0.30	0.17	489	0.30	0.12	991	0.29	0.19
RATING	1513	7.17	2.16	494	6.73	2.14	1019	7.38	2.14
BLIQ	1461	2.18	1.60	442	1.67	1.43	1019	2.40	1.62
BMKTLIQ	1513	118.20	37.77	494	100.78	32.24	1019	126.40	37.38

Table 4
Benchmark regression: unconditional effects of CDS.
This table reports the estimated coefficients of the regression model:

$$BSPRD_{i,t} = \alpha_i + \beta_1\ TRADING_{i,t} + \sum_j \gamma_j\ CONTROL(j)_{i,t} + \delta_t\ TimeDummies + \varepsilon_{i,t},$$

where α_i denotes the firm fixed effects, $BSPRD_{i,\,t}$ is the bond spread of firm *i* in quarter *t*, $TRADING_{i,\,t}$ is equal to zero for the firm-quarters before the onset of CDS trading, and one otherwise. $CONTROL_{i,\,t}$ is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)	(4)
TRADING	34.3**	30.5**	31.9**	23.6
	[2.17]	[2.06]	[2.11]	[1.65]
RATING		−8.8	−6.5	2.2
		[−0.62]	[−0.44]	[0.17]
$RATING^2$		2.3**	2.2**	1.6*
		[2.32]	[2.18]	[1.56]
BLIQ			−10.2*	−7.1*
			[−1.91]	[−1.74]
BMKTLIQ			−6.5***	−3.1*
			[−5.33]	[−1.79]
FIRMSIZ				−14.3
				[−0.73]
STOCKVOL				214.4***
				[4.49]
MKTLEV				112.5
				[1.17]
Firm-fixed effect	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes
Number of firms	136	136	136	136
Number of observations	1,513	1,513	1,461	1,424
R^2	0.37	0.41	0.43	0.46

CDS. In this regard, the coefficient β_3 on the interaction term is my main interest, which captures the differential effects of CDS on credit spreads across firms with different (i.e., high or low) strategic incentives.

3. Empirical Findings

In this section, I present my main empirical findings on the impact of CDS trading on bond spreads. I first examine the *unconditional* effect of CDS as a benchmark (with the *TRADING* variable alone in the regression), followed by its *conditional* effect upon the firm's strategic default incentives (with both the *TRADING* variable and its interaction term with the strategic variable).

3.1. Unconditional Effects of CDS Trading

The estimated coefficients on the main variable, *TRADING*, along with coefficients on other controls are presented in Table 4. The results are presented for four different model specifications according to the selection of control variables. In Column (1), only variables of interest to me are included, without any controls. Column (2) adds credit ratings (*RATING*) to control for the firm's creditworthiness. Firm-specific bond liquidity (*BLIQ*) and aggregate corporate bond market liquidity (*BMKTLIQ*) are included in Column (3) to reflect the fact that corporate bond illiquidity accounts for a significant part of bond spreads. Finally, in Column (4), firm size (*FIRMSIZ*), equity volatility (*STOCKVOL*), and market leverage (*MKTLEV*) are further controlled.

Except for the model specification in Column (4), it is shown that the coefficients on *TRADING* on credit spreads are positive and statistically significant at 10% level, with the magnitude of 23 ∼ 34 basis points (bps). This implies that bond spreads increase with the introduction of CDS trading *on average* for firms in my sample. Control variables are shown to have their expected signs. The nonlinear effect of credit ratings is captured in the negative coefficient on $RATING^2$, which is statistically significant. Bond liquidity measures are negative and statistically significant both at the individual-bond and at the aggregate market level. As expected, stock volatility is the most significant variable with the positive sign whereas firm's asset size and market leverage do not play a further significant role.

Table 5
Conditional effects of CDS: shareholder bargaining power.
This table reports the estimated coefficients of the regression model:

$$BSPRD_{i,t} = \alpha_i + \beta_1\ TRADING_{i,t} + \beta_2\ CEOSHARE0_i + \beta_3\ TRADING_{i,t} \times CEOSHARE0_i + \sum_j \gamma_j\ CONTROL(j)_{i,t} + \delta_t\ TimeDummies + \varepsilon_{i,t},$$

where α_i denotes the firm fixed effects, $BSPRD_{i,\,t}$ is the bond spread of firm *i* in quarter *t*, $TRADING_{i,\,t}$ is equal to zero for the firm-quarters before the onset of CDS trading, and one otherwise. $CEOSHARE0_i$ is the proportion of shares held by a CEO in the quarter before the onset of CDS trading. $CONTROL_{i,\,t}$ is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)	(4)
TRADING × CEOSHARE0	−8.5***	−9.0***	−9.9***	−9.9***
	[−2.75]	[−2.87]	[−4.05]	[−4.27]
TRADING	51.0***	47.0***	48.2***	41.5***
	[2.86]	[2.87]	[2.90]	[2.64]
RATING		−7.8	−5.6	1.2
		[−0.55]	[−0.39]	[0.08]
$RATING^2$		2.2**	2.1*	1.7*
		[2.32]	[2.18]	[1.67]
BLIQ			−11.4*	−8.2*
			[−1.91]	[−1.82]
BMKTLIQ			−6.1***	−2.5
			[−4.78]	[−1.36]
FIRMSIZ				−27.5
				[−1.31]
STOCKVOL				220.8***
				[4.57]
MKTLEV				37.4
				[0.36]
Firm-fixed effect	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes
Number of firms	115	115	115	115
Number of observations	1,322	1,322	1,279	1,246
R^2	0.38	0.41	0.43	0.46

The positive coefficients on *TRADING* seem to be at odds with my first hypothesis H1, which should predict the negative relation between CDS trading and bond spreads. This seemingly contradictory result possibly arises due to the inability of the empirical model to identify the strategic default channel of CDS *per se*, through which shareholder's reduced incentives of strategic default are reflected in bond spreads. In fact, there are other mechanisms through which CDS trading increases bond spreads.[18] If these channels are dominant, it would be difficult for the current empirical setting to identify the strategic default channel, which

[18] For instance, Ashcraft and Santos (2009) empirically find a positive relationship, and they attribute this result to the possibility that creditors have fewer incentives to monitor debtors (i.e., the firm) once they are protected with CDS. It is also theoretically proved that CDS may drive investors' demands on credit exposures out of the bond market toward CDS markets. As a result, the presence of CDS would result in higher bond spreads (see Che and Sethi, 2016; Oehmke and Zawadowski, 2015).

Table 6
Conditional effects of CDS: liquidation cost.
This table reports the estimated coefficients of the regression model:

$$BSPRD_{i,t} = \alpha_i + \beta_1\ TRADING_{i,t} + \beta_2\ INTANGIBLE0_i + \beta_3\ TRADING_{i,t} \times INTANGIBLE0_i + \sum_j \gamma_j\ CONTROL(j)_{i,t} + \delta_t\ TimeDummies + \varepsilon_{i,t},$$

where α_i denotes the firm fixed effects, $BSPRD_{i,\,t}$ is the bond spread of firm i in quarter t, $TRADING_{i,\,t}$ is equal to zero for the firm-quarters before the onset of CDS trading, and one otherwise. $INTANGIBLE0_i$ is the ratio of intangible to total assets in the quarter before the onset of CDS trading. $CONTROL_{i,\,t}$ is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)	(4)
TRADING × INTANGIBLE0	−62.7	−119.0*	−158.2***	−182.2***
	[−0.87]	[−1.90]	[−2.62]	[−3.34]
TRADING	68.9	97.6**	124.1***	130.5***
	[1.53]	[2.44]	[3.21]	[3.32]
RATING		−3.8	−1.9	6.2
		[−0.28]	[−0.14]	[0.46]
RATING^2		2.1**	2.1**	1.4
		[2.10]	[2.03]	[1.39]
BLIQ			−12.0**	−3.5**
			[−2.08]	[−2.04]
BMKTLIQ			−6.6***	−3.5**
			[−5.48]	[−2.04]
FIRMSIZ				−22.9
				[−1.07]
STOCKVOL				212.6***
				[4.04]
MKTLEV				91.2
				[0.88]
Firm-fixed effect	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes
Number of firms	125	125	125	125
Number of observations	1411	1411	1364	1331
R^2	0.34	0.38	0.4	0.43

Table 7
Conditional effects of CDS: renegotiation frictions.
This table reports the estimated coefficients of the main regression model:

$$BSPRD_{i,t} = \alpha_i + \beta_1\ TRADING_{i,t} + \beta_2\ ISSUENUM0_i + \beta_3\ TRADING_{i,t} \times ISSUENUM0_i + \sum_j \gamma_j\ CONTROL(j)_{i,t} + \delta_t\ TimeDummies + \varepsilon_{i,t},$$

where α_i denotes the firm fixed effects, $BSPRD_{i,\,t}$ is the bond spread of firm i in quarter t, $TRADING_{i,\,t}$ is equal to zero for the firm-quarters before the onset of CDS trading, and one otherwise. $ISSUENUM0_i$ is the normalized number of outstanding public bond issues (i.e. log(the number of bonds)/log(total debt) in the quarter before the onset of CDS trading). $CONTROL_{i,\,t}$ is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)	(4)
TRADING × ISSUENUM0	174.3**	153.2**	156.7**	149.2*
	[2.29]	[2.07]	[1.91]	[1.85]
TRADING	−4.1	−3.2	−0.5	−7.2
	[−0.21]	[−0.16]	[−0.02]	[−0.33]
RATING		−9.4	−8	0.8
		[−0.66]	[−0.54]	[0.06]
RATING^2		2.3**	2.3**	1.6
		[2.32]	[2.23]	[1.61]
BLIQ			−9.8**	−6.8
			[−1.82]	[−1.64]
BMKTLIQ			−6.5***	−3.1*
			[−5.34]	[−1.78]
FIRMSIZ				−13.9
				[−0.72]
STOCKVOL				214.4***
				[4.45]
MKTLEV				115.1
				[1.19]
Firm-fixed effect	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes
Number of firms	133	133	133	133
Number of observations	1,501	1,501	1,450	1,413
R^2	0.38	0.41	0.43	0.46

is the main focus of my study. Therefore, in the next section, I exploit the cross-sectional variation in a firm's strategic incentives, which would yield the unique predictions for the strategic channel I am interested in.

3.2. Conditional Effects of CDS Trading upon Strategic Incentives

Table 5 shows the estimated coefficients for the regression with a CEO shareholding (*CEOSHARE*0) as a proxy for the firm's strategic default incentive. As in the results of unconditional effects of CDS in Table 4, the results are presented for four different model specifications. It is noticeable that while coefficients on *TRADING* remain positive, coefficients on its interaction with a strategic variable (*TRADING* × *CEOSHARE*0) are observed to be *negative* and statistically significant at the 1% level, irrespective of model specifications. The negative coefficient on the interaction term indicates that firms with high CEO ownership have lower bond spreads after CDS trading compared to firms with low CEO ownership. The magnitude of coefficient, which is sizable and fairly stable across specifications, ranges from –8.5 to –9.9. This represents that a one-standard deviation increase in *CEOSHARE0* (1.76) translates into a decrease by 17 bps in average credit spreads.[19]

Table 6 presents the results of the regression for asset intangibility (*INTANGIBLE0*) as a strategic proxy. It is shown that coefficients on the interaction term are all *negative* regardless of specification, which suggests that firms with a large portion of intangible assets have lower bond spreads after CDS trading compared to firms with a small portion of intangible assets. Unlike the results in Table 5, however, the coefficient varies with model specifications in both statistical significance and magnitude. It is not very significant for the specification in Column (1), and becomes significant when a larger number of variables is controlled for. The magnitude tends to be bigger (in an absolute term) with the large number of controls, ranging from –62.7 in Column (1) to –182.2 in Column (4). This may suggest that asset intangibility would be a noisier proxy and more endogenous than equity ownership. In comparison with the results for *CEOSHARE0*, an one-standard deviation increase in the ratio of intangible to total assets (0.13) is associated with a reduction of 24 bps in average bond spreads.

The results of the regression with *ISSUENUM0* are presented in Table 7. In contrast to the other two variables, coefficients on the interaction term are *positive*, which is highly significant and robust to different model specifications. The magnitude, ranging from 149.2 to 174.3 tends to become smaller once more variables are controlled for. This result indicates that the decrease (not increase, as in the case of former variables) in the number of bond issues results in a larger reduction in credit spreads. The economic impact, though, is similar to that of the other two variables, and a one-standard deviation decrease in the normalized number of bond issues (0.11) translates into a reduction of 15 bps in average bond spreads.

To summarize, these results are in line with my second hypothesis H2 that firms with higher strategic incentives benefit more from the introduction of CDS. To interpret estimated coefficients

[19] The estimated coefficient in Column (4) is used for this calculation.

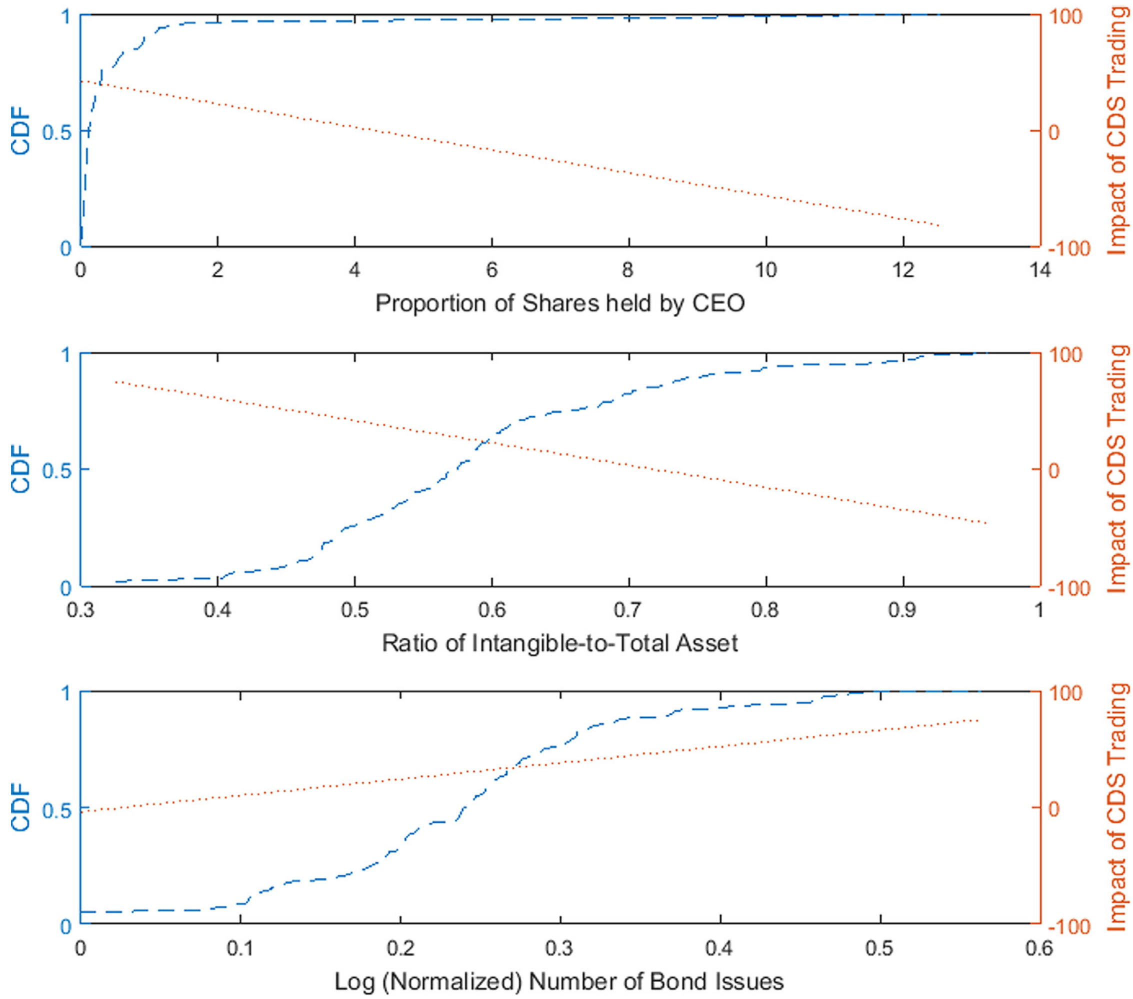

Fig. 4. Bond spread changes and strategic variables at the time of CDS introduction. This figure plots the impact of CDS trading across firm characteristics (CEO shareholding in the top panel, asset intangibility in the middle panel, and bondholder dispersion in the bottom panel) an on bond spreads. The dashed curved line (for the *y*-axis on the left) illustrates the cross-sectional CDF (Cumulative Distribution Function) of a firm characteristic measured in the quarter before the onset of CDS trading. The dotted straight line (for the *y*-axis on the right) plots the changes in average bond spreads after the onset of CDS trading.

more clearly, in Fig. 4 I plot the (model-estimated) changes in bond spreads as a function of the strategic variable in my sample.[20] There is one figure for each strategic variable (*CEOSHARE0* in the top, *INTANGIBLE0* in the middle, *ISSUENUM0* in the bottom panel). The curved line represents the cross-sectional Cumulative Distribution Function (CDF) of each variable. The solid (dotted) straight line represents the spread reductions following the onset of CDS trading. The graph reveals that firms with highest (lowest) value for *CEOSHARE0* and *INTANGIBLE0* (*ISSUENUM0*) experience a reduction in spreads while the remainder of the firms experience an increase in spreads.

3.3. The CDS effect and firm riskiness

In this section, I examine how a firm's riskiness relates to the CDS effect presented in the previous sections. More specifically, I aim to investigate whether the relation between bond spreads and strategic variables would be more pronounced among the group of firms with high risk (or, low creditworthiness). I tackle this question from two different approaches: First, I do a subsample analysis by running the same regression in Eq. (11) *separately* for each of two subgroups of firms, namely, those rated A- and higher, and those rated BBB+ or lower.[21] Second, I do a dummy variable analysis by including in the regression the dummy, *HIGHRISK* which is equal to 1 if the rating is BBB+ or lower, and zero otherwise. This dummy variable is then multiplied by each of three strategic variables and the trading dummy to construct the triple interaction term, i.e., $TRADING_{i,\,t} \times STRATVAR_i \times HIGHRISK_i$.

The results for the subgroup analysis are presented in Panel A of Table 8.[22] It is shown that coefficients on *TRADING* × *STRATVAR* tend to be more statistically significant for the group of high risk firms. Moreover, the magnitude of coefficients is observed to be bigger for the sample of high-risk firms. For instance, the coefficient on the interaction term with *CEOSHARE0* (−11.3) suggests that a one-standard deviation increase in *CEOSHARE0* for the high-risk firms (2.43) is associated with a reduction of 27 bps. For the group of low-risk firms, the coefficient (−6.4) indicates that a one-standard deviation increase (1.02) is associated with a 6.1 bps reduction. This pattern is similarly shown in the regression with a

[20] The graphs are drawn only based on two estimated coefficients in specification (4), *TRADING* and *TRADING* × *STRATVAR* from Table 5 for *CEOSHARE0*, Table 6 for *INTANGIBLE0*, and Table 7 for *ISSUENUM0*.

[21] I divide firms in this way in order to have a similar number of firms in each group (A- is the median credit rating of the firms in my sample).

[22] To conserve space, I report only the coefficients on the variables of main interest to me for the specifications in Column (4) in table from Tables 5–7.

Table 8
The CDS effect and firm riskiness.
Panel A of this table reports the estimated coefficients on the interaction terms of *TRADING* with each of three proxies for shareholder's incentives of strategic default, namely *CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0. The same regression model is estimated in Column (4) of Table 5 through Table 7. The results are presented separately for two subgroups of firms based on their risk measured in the quarter before the onset of CDS trading, namely those rated BBB+ or lower (High Risk Firms) in Columns (1)–(3), and those rated A- and higher (Low Risk Firms) in Columns (4)–(6). Panel B presents the estimated coefficients for the triple interaction term between *TRADING, STRATVAR*, and *HIGHRISK. HIGHRISK* is a dummy variable which is equal to 1 if firms belong to the group of high risk firm, and zero otherwise. In both panels, the control variable is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

Panel A: Subgroup analysis

	High risk firms			Low risk firms		
	(1)	(2)	(3)	(4)	(5)	(6)
TRADING × CEOSHARE0	−11.3***			−6.4		
	[−3.76]			[−0.64]		
TRADING × INTANGIBLE0		−385.7***			−165.3***	
		[−4.37]			[−3.27]	
TRADING × ISSUENUM0			188.9			22.6
			[1.48]			[0.20]
TRADING	74.8**	103.0	−5.5	28.4*	126.3***	19.2
	[2.59]	[1.06]	[−0.18]	[1.71]	[3.50]	[0.67]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	47	34	61	68	70	72
Number of observations	490	424	615	756	765	798
R^2	0.54	0.52	0.5	0.45	0.46	0.46

Panel B: Dummy variable analysis

	CEOSHARE0	INTANGIBLE0	ISSUENUM0
TRADING × STRATVAR*HIGHRISK	−14.8	−110.4	167.3
	[−1.37]	[−0.98]	[0.97]
TRADING × STRATVAR	0.80	−136.6**	87.0
	[0.08]	[−2.36]	[0.80]
TRADING × HIGHRISK	52.4**	63.2	−16.4
	[2.06]	[0.87]	[−0.39]
Control variables	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes
Number of firms	86	90	94
Number of observations	1086	1107	1177
R^2	0.5	0.47	0.49

dummy variable for the whole sample, whose results are reported in Panel B of Table 8. The coefficient on *TRADING* × *STRATVAR* × *HIGHRISK* is negative for *CEOSHARE*0 and *INTANGIBLE*0, but positive for *ISSUENUM*0. These results would imply that the conditional effect of CDS trading upon the strategic variable is more pronounced for the group of riskier firms.

4. Robustness

4.1. Subsample of firms with low CDS amount outstanding

The reasoning of my study depends crucially on the assumption that creditors of the firm become empty creditors after the onset of CDS trading. This assumption would not be the case if the majority of CDS trading consisted of "naked CDS," i.e., buyers of CDS are not creditors of the firm. To mitigate this concern, I consider a subsample of firms that have a reasonably low ratio of CDS notional to the total amount of debt outstanding. The basic idea is that I want to focus on firms whose CDS contracts traded in the market are likely to be purchased by their creditors, rather than speculators who would buy the CDS without holding the firm's bond.[23] In doing so, I construct a dummy variable, *LOWCDS*, which is equal to1 if the firm's ratio of CDS to debt is low (i.e., lower than 0.7) on average during my sample period, and zero if the ratio is high (i.e., higher than 0.7).[24] In Table 9, the coefficients on the triple interaction term between *TRADING* × *STRATVAR* and *LOWCDS* are observed to be negative for *CEOSHARE*0 and *INTANGIBLE*0, but positive for *ISSUENUM*0. This may suggest that my earlier findings are less likely to be contaminated by the possibility of most CDS trading being naked.

[23] I acknowledge that the low CDS subsample still cannot fully address the naked CDS issue because it is still impossible to distinguish between hedging purpose and speculation purpose of CDS purchase from the outstanding amount of CDS. This can be done only with the investor-level data for the CDS positions, which are not accessible. Alternatively, the trading volume of CDS might be useful for this purpose because the more naked traders that exist, the more trading is likely to occur, but I do not have access to these data either.

[24] The ratio of CDS to total debt amount being high or low is based on the median ratio (0.7) for the sample of firms studied in Subrahmanyam et al. (2014). Based on this criterion, about 20% of firms in my sample are identified as having a low amount of CDS relative to their total debt on average during my sample period. I thank the authors for providing me with the data on the list of firms whose average ratio of CDS to debt is reasonably low during the period 2001–2008.

Table 9
Firms with low CDS amounts outstanding.
This table reports the estimated coefficients on the triple interaction terms between *TRADING*, *STRATVAR*, and a dummy variable, *LOWCDS*, which is equal to one if the firm belongs to the sub-group of sample whose ratio of notional CDS amount to the total debt outstanding is low (i.e., less than 0.7) on average for the period of 2001 to 2008, and zero otherwise. The strategic variable, *STRATVAR*, includes each of three proxies for shareholder's incentives of strategic default, *CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0 in the quarter before the onset of CDS trading. The control variable is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	CEOSHARE0	INTANGIBLE0	ISSUENUM0
TRADING × STRATVAR × LOWCDS	−10.1*	−6.6	368.6**
	[−1.72]	[−0.06]	[2.42]
TRADING × STRATVAR	−10.3***	−270.0***	114.1
	[−6.35]	[−4.94]	[1.36]
TRADING × LOWCDS	−20.4	−32.2	−95.9***
	[−1.01]	[−0.49]	[−2.80]
Control variables	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes
Number of firms	86	90	94
Number of observations	1086	1107	1177
R^2	0.50	0.47	0.50

4.2. Alternative empirical methodologies

So far I have shown that a firms' (especially firms with high strategic incentives) *average* bond spreads would be reduced after the introduction of CDS. In this section, I investigate when and how a decrease in bond spread changes would take place after the onset of CDS trading. I address this question by employing two additional empirical frameworks: one is a cross-sectional event study, and the other a difference-in-differences framework with the indicator (not continuous as before) variable for treatment and control groups.

For an event study, I consider two specific points in time, (−2, 8), i.e., two quarters before and eight quarters afterwards. Abnormal bond spreads are computed for each time point for a given bond that has data available for both time points.[25] In Fig. 5, I plot the median abnormal spread for high and low strategic firms separately, the solid line indicating high strategic variable, and the dashed line low strategic variable. I note that abnormal bond spreads tend to decrease, especially for firms with high *CEOSHARE*0 and *INTANGIBLE*0, and low *ISSUENUM*0. This pattern is similarly shown in the regression setting, Table 10, for which I regress the (abnormal) spread change between two time points (i.e., two quarters before and eight quarters after the onset of CDS trading) on each strategic variable.

For a difference-in-differences framework, I group firms based on *STRATVAR* into high (i.e., above the sample median value) and low (i.e., below the sample median value) groups using the sample median value, and create a dummy variable, *STRATVAR_TREAT*, which is equal to 1 if *STRATVAR* is high, and zero if *STRATVAR* is low. The intuition is that high strategic firms are considered as if they are "treated" whereas low strategic firms would serve as the control groups in a regression. With this treatment/control indicator with respect to high strategic default incentives, I run the standard difference-in-differences type regression with time-fixed effects, and report the results in Table 11, in which all standard errors are clustered at the group (i.e., treatment or control) level. Coefficients on the interaction terms between CDS trading and the strategic treatment dummy (i.e., *CEOSHARE_TREAT*, *INTANGIBLE_TREAT*, or *ISSUENUM_TREAT*) are all shown to have the expected signs.

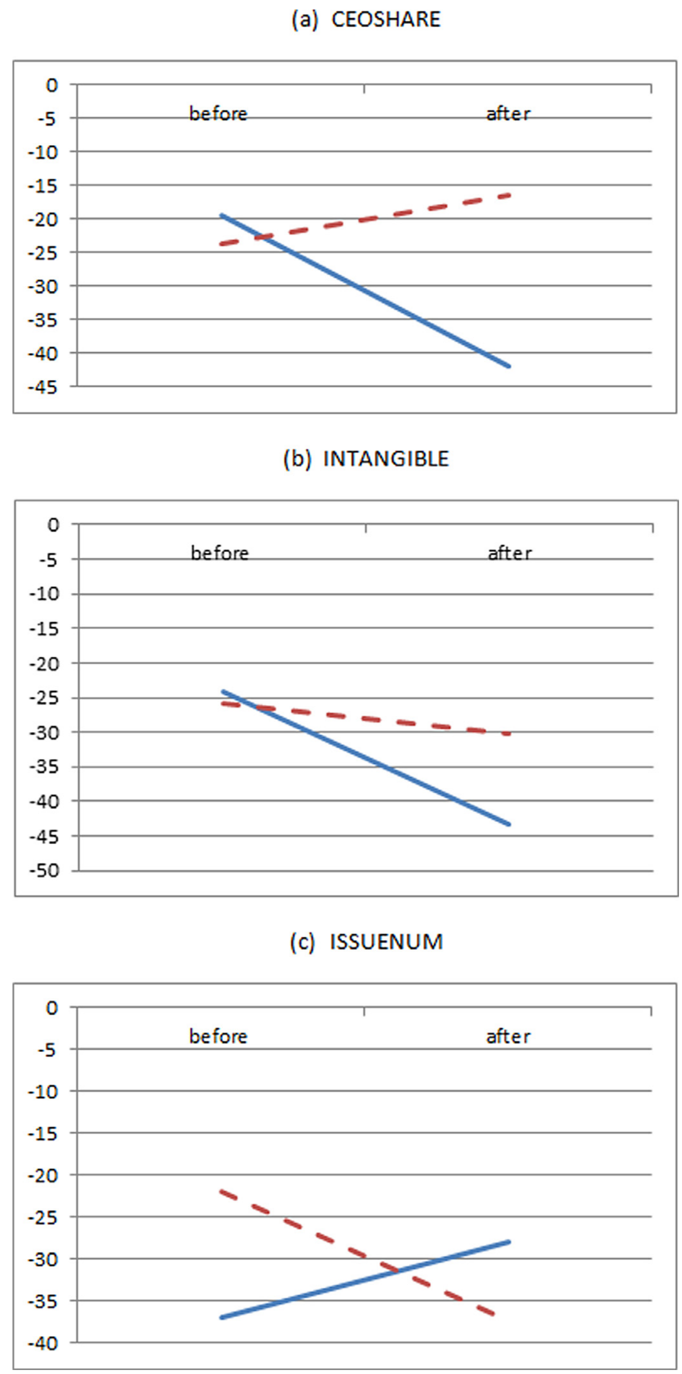

Fig. 5. Abnormal bond spreads before and after the CDS trading for high vs. low strategic variables. This figure provides the plots of abnormal bond spreads two quarters before, and eight quarters after the onset of CDS trading. For each period, the median values of the spreads are plotted for firms with high strategic variables for the solid line, and firms with low strategic value for the dashed line.

[25] Since my sample is an unbalanced panel, this restriction reduces my sample size significantly to 25 firms.

Table 10
The Changes in Bond Spreads and Strategic Variables.
This table reports the estimated coefficients on each of three strategic variables (*CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0) along with two other control variables, the changes in ratings (Δ*RATING*) and changes in bond liquidity, Δ*BLIQ*. Dependent variable is the change in bond spreads in Columns (1)–(3), and the changes in *abnormal* bond spreads in Columns (4)–(6). All change variables are measured between two points in time: two quarters before- and eight quarters after the onset of CDS trading. *RATING* is a numerical value assigned for the S&P's credit ratings and *BLIQ* is measured as the logarithm of the total number of the bond's trades in a quarter. The *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	Dependent Variable					
	ΔBond Spread			Δ*Abnormal* Bond Spread		
	(1)	(2)	(3)	(4)	(5)	(6)
CEOSHARE0	−24.21*			−11.7		
	[-1.84]			[-1.15]		
INTANGIBLE0		−228.6			−44.6	
		[-1.32]			[-0.32]	
ISSUENUM0			625.7**			346.7*
			[2.60]			[1.87]
ΔRATING	23.2	24.6	6.5			
	[1.10]	[1.21]	[0.33]			
ΔBLIQ	−1.1	−8.1	−1.0			
	[-0.06]	[-0.49]	[-0.07]			
Number of Firms	25	30	31	25	30	31
R^2	0.07	0.00	0.15	0.05	0.00	0.10

4.3. Accounting for the endogeneity of strategic variables

Since my strategic variables are not totally random, they could pick up other characteristics of the firm than strategic default intentives of shareholders, *per se*. In this case, there may be concern that the main results of my study, i.e., the conditional effect of CDS upon strategic proxies, could be spurious. In this section, I aim to mitigate this concern by examining whether my results are robust to controlling for other firm characteristics at the time of CDS introduction. I consider three different firm characteristics, which have been studied in the literature as relevant to the relation between CDS trading and bond spreads.

First, I consider the firm's riskiness and informational transparency. It is empirically shown (e.g., Ashcraft and Santos, 2009) that safe (or informationally transparent) firms benefit more than risky (or informationally opaque) firms in terms of the reduction of bond spreads after the inception of CDS trading. If my strategic proxies happen to capture these characteristics, it would be difficult to argue that my findings point to the existence of a strategic default channel.[26] The next candidate is a bond's liquidity. It is theoretically documented (e.g., Oehmke and Zawadowski, 2015) that the effects of CDS on bond spreads would depend on the liquidity of underlying bonds. The authors argue that illiquid bonds would benefit more than liquid bonds from the traded CDS. Therefore, I control for bond liquidity as well as credit ratings and analyst coverage (as a proxy for risk and information transparency, respectively).

I control for each of three firm characteristics in a regression in the form of its interaction with the CDS trading dummy in the otherwise identical empirical model in Eq. (11). This new interaction term essentially allows me to double-sort firms at the time of CDS introduction based on strategic variables *and* the controlling characteristic. In other words, I can exploit the variation of strategic variables while keeping other firm characteristics constant. The regression results are reported in Table 12, in which four

Table 11
Difference in Differences Framework: High (Treat) vs. Low (Control) Strategic Firms.
This table reports the estimated coefficients for the difference-in-difference regression framework. Firms are grouped based on *STRATVAR* into high (i.e., above the sample median value) and low (i.e., below the sample median value) groups. A dummy variable, *STRATVAR_TREAT*, is equal to one if *STRATVAR*0, which is high and zero if *STRATVAR*0 is low, is created for each of three strategic variables (*CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0). The control variable is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Time-fixed effects are included for all model specifications. Standard errors are clustered at the group level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)
TRADING × CEOSHARE_TREAT	−12.3**		
	[−29.96]		
CEOSHARE_TREAT	−3.8		
	[−0.84]		
TRADING × INTANGIBLE_TREAT		−38.4	
		[−5.43]	
INTANGIBLE_TREAT		135.8*	
		[11.12]	
TRADING × ISSUENUM_TREAT			33.0**
			[15.22]
ISSUENUM_TREAT			−27.3
			[−5.96]
TRADING	22.3	16.3	−1.1
	[5.93]	[2.54]	[−0.26]
RATING	−14.3**	−29.4	−8.8
	[−25.97]	[−4.41]	[−0.38]
$RATING^2$	2.4*	3.8	2.0
	[12.23]	[4.73]	[1.41]
BLIQ	−5.2	−5.4	−7.4
	[−1.17]	[−1.63]	[−5.47]
BMKTLIQ	−1.8	−2.1	−1.9
	[−3.19]	[−3.61]	[−5.22]
FIRMSIZ	−12.9	−1.0	−12.7
	[−1.28]	[−0.10]	[−0.91]
STOCKVOL	249.8*	285.5**	255.1
	[9.23]	[15.22]	[2.91]
MKTLEV	88.4	101.7	104.6
	[4.63]	[1.10]	[4.88]
Time-Fixed Effect	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes
Number of Observations	1,246	1,331	1,413
R^2	0.50	0.48	0.50

different specifications are examined for each strategic variable: firm risk, information transparency, and bond liquidity are controlled individually in Columns (1)–(3), respectively, and all three together in Column (4). Coefficients on *TRADING* × *STRATVAR* remain highly significant even when these alternative characteristics are controlled for, which suggests that my results are less likely to be contaminated by the endogeneity problem with my strategic variable.

Regardless of the empirical specification adopted, the interaction term *TRADING* × *RATING*0 is shown to be notably positive for Table 12. This result is consistent with the existing evidence in Ashcraft and Santos (2009), which documents that safe firms (i.e., firms with the smaller number for *RATING*0) benefit whereas risky firms (i.e., firms with the larger number for *RATING*0) are penalized by CDS trading.

4.4. Endogeneity of CDS trading

Another potential concern is the possibility that the onset of CDS trading is endogenously determined. To mitigate the potential impact of endogeneity, I perform a matched sample analysis as fol-

[26] This is, however, unlikely to be the case because Panel C in Table 2 shows that there is little correlation between any of three strategic variables, and the proxy for firm risk or information transparency.

Table 12
Accounting for the Endogeneity of Strategic Variables.
This table reports the estimated coefficients on the interaction terms of *TRADING* with each of the three strategic variables, namely *CEOSHARE*0 (in Columns (1)–(4)), *INTANGIBLE*0 (in Columns (2)–(8)), and *ISSUENUM*0 (in Columns (9)–(12)), after controlling a firm's credit rating (*RATING*0), analyst coverage (*ANALYSNUM*0), and bond liquidity (*BTRDNUM*0) *in the quarter before the onset of CDS trading*. The same regression models are estimated (shown in Table 5 through Table 7) except three additional interaction terms are included (i.e., *TRADING* × *RATING*0, *TRADING* × *ANALYSNUM*0, and *TRADING* × *BTRDNUM*0). *RATING*0 is a firm's long-term credit rating, *ANALYSNUM*0 the number of equity analysts reported in I/B/E/S earnings forecast datasets, and *BTRDNUM*0 is the logarithm of the bond's total trades in a quarter. For each strategic variable, four different model specifications are considered with first three columns including each of three new interaction terms separately, and the fourth column with all of three together. The control variable is the well-known determinant of bond spreads including credit rating (*RATING*), bond liquidity at an individual-level (*BLIQ*) and a market-level (*BMKTLIQ*), firm size (*FIRMSIZ*), stock volatility (*STOCKVOL*), and market leverage (*MKTLEV*). Both firm-fixed effects and time-fixed effects are included for all model specifications. Standard errors are clustered at the firm level, and the robust *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	CEOSHARE0				INTANGIBLE0				ISSUENUM0			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
TRADING × STRATVAR	−12.0***	−10.3***	−11.2***	−12.4***	−189.7***	−220.8***	−205.2***	−250.9***	163.6**	110.6	189.0**	182.1**
	[−4.07]	[−4.97]	[−3.38]	[−3.63]	[−3.42]	[−4.41]	[−3.78]	[−4.96]	[2.08]	[1.52]	[2.13]	[2.40]
TRADING	−24.3	−49.7*	37.7*	−3.7	120.0***	164.3***	133.6***	190.7***	−47.1	12.9	−24.6***	−13.5
	[−0.73]	[1.93]	[1.78]	[−0.17]	[2.38]	[3.71]	[3.07]	[3.70]	[−1.24]	[0.50]	[−0.99]	[−0.33]
TRADING × RATING0	10.0*			6.4	2.3			−0.2	5.4			2.7
	[1.83]			[1.50]	[0.47]			[−0.06]	[1.05]			[0.59]
TRADING × ANALYSNUM0		−7.1		−9.4		−5.5		−12.3		−6.6		−15.2
		[−0.64]		[−0.78]		[−0.47]		[−1.04]		[−0.64]		[−1.51]
TRADING × BTRDNUM0			3	3.6			6.2	4.9			6	6.7
			[0.53]	[0.72]			[1.12]	[0.95]			[1.09]	[1.37]
Control Variables	Yes				Yes				Yes			
Firm-Fixed Effect	Yes				Yes				Yes			
Time-Fixed Effect	Yes				Yes				Yes			
Number of Firms	115	109	91	86	125	112	100	90	133	120	104	94
Number of Observations	1,246	1,200	1,127	1,086	1,331	1,214	1,206	1,107	1,413	1,296	1,276	1,177
R^2	0.47	0.49	0.48	0.5	0.43	0.46	0.44	0.47	0.46	0.48	0.47	0.49

lows. I first construct a sample of non-CDS firms closely matched to my CDS firms based on several dimensions of firm characteristics likely to predict CDS trading. I then use this sample in the analysis as a control group. My basic assumption is that, conditional on the matching, the timing of the onset of CDS trading can become somewhat random. The detailed matching procedure is explained below.

Following Mayhew and Mihov (2004) and Ashcraft and Santos (2009), I estimate the ex-ante probability of the onset of CDS trading for a given firm using a probit model in which the dependent variable is a dummy variable that takes the value 1 if CDS begins to trade in the current quarter and zero otherwise.[27] Explanatory variables include firm characteristics considered likely to predict CDS trading.[28] I then choose for each quarter non-CDS firms that match CDS firms as closely as possible in terms of the estimated probability of CDS trading. Last, provided they have bond information available, I assign to each matched firm a counterfactual date (i.e., quarter) for the onset of CDS trading.

The probit regression results are reported in Panel A of Table 13. Consistent with Oehmke and Zawadowski (2014), it is shown that CDS trading is more likely for firms with lower ratings, firms with higher equity volatility, and firms with lower dispersion of analysts' earning forecasts.[29] I use these estimated coefficients to compute the propensity scores and select firms that have not traded CDS but are closely matched to traded firms in terms of their scores. By means of this procedure I identify 55 matched firms from the sample of non-CDS firms. Panel B presents the descriptive statistics of both traded and matched samples.

For the combined sample of both traded and matched firms (i.e., a total of 191 firms), I re-estimate the regression model in Eq. (11) and report the results. As shown in Table 14, the coefficients on the three renegotiation proxies remain statistically significant for most cases, even after adding the matched firms to my original sample.

4.5. Alternative strategic proxies

An alternative way to get around the endogeneity problem with my strategic variable would be to employ different variables to proxy for a firm's incentive of strategic default, and see whether the results are robust. Since it is difficult to find a perfect proxy for bargaining power, and the literature does not identify a definite proxy for it, I follow Davydenko and Strebulaev (2007) and use *CEO's tenure* with the firm as an additional proxy. When the CEO is entrenched and has high firm-specific human capital, measured by longer tenure, the CEO may be in a better position to bargain on behalf of shareholders. I employ the ratio of *nonfixed assets* and the proportion of short-term debt to proxy for liquidation costs and renegotiation frictions, respectively. In unreported tables, they show the similar patterns to the original variables.[30]

5. Conclusion

In this paper, I provide a theoretical and empirical analysis of ex-ante commitment benefits of CDS, i.e., the benefit of CDS reducing the firm's incentives for strategic default on its debt. First, I develop a theoretical framework by extending a stylized model of strategic debt service with debt renegotiation, which allows me to relate the changes in a bond's yield spreads due to the presence of CDS-protected debt holders (so-called empty creditors) to (1) shareholder bargaining advantages in renegotiation and (2) renegotiation frictions. I use two variables to capture shareholder advantages, namely the concentration of equity ownership (proxied

[27] I record only the first quarter of CDS trading, after which the firm-quarters of a firm are dropped from the sample.

[28] I include as covariates equity volatility, profitability, firm size, credit rating, leverage, industry, and dispersion of analysts' earnings forecast, all of which are lagged by one quarter to ensure that no outcome variable is included as a regressor.

[29] It is worth noting that this estimation exercise is not intended for making any causal inferences about CDS trading. My goal is to project relevant firm characteristics on the probability of CDS trading and use them as the matching dimension.

[30] Tables are available from the author on request.

Table 13
Matching estimation results.
This table reports the results of the propensity score matching, in which the I run the probit regression for the probability of CDS trading with explanatory variables *a priori* considered to predict the trading of CDS. In Panel A, coefficients on the covariates are reported. *MKTLEV* is market leverage of firm measured as long-term debt divided by market value of total assets, *FIRMSIZ* is firm size as a natural logarithm of long-term debt plus common equity, *STOCKVOL* is stock volatility as a standard deviation of 60 prior day's stock returns, *PRFIT* is profitability as earnings before tax and depreciation divided by total assets, and *FRSTDIS* is a analyst's forecast dispersion as the raw dispersion divided by the firm's stock price. Raw dispersion is computed as the cross-sectional standard deviation of the most recently revised quarterly earnings per share estimates. Panel B reports the descriptive statistics of matching variables for both *Traded* and *Matched* firms. The *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

Panel A: The prediction of probability of CDS trading

	Probability of CDS Trading
MKTLEV	−0.09
	(0.30)
FIRMSIZ	−0.04
	(0.03)
STOCKVOL	0.78***
	(0.28)
RATING	0.21***
	(0.07)
RATING^2	−0.02***
	(0.00)
PRFIT	4.05
	(3.39)
FRSTDISP	−81.89**
	(39.99)
Time Fixed Effects	No
Industry Fixed Effects	Yes
R^2	10.12%
N	8546

Panel B: Summary statistics for traded and matched firms

	Traded			Matched		
	N	MEAN	STD	N	Mean	STD
MKTLEV	1502	0.23	0.19	569	0.28	0.22
FIRMSIZ	1502	9.25	1.22	569	9.61	1.10
STOCKVOL	1480	0.30	0.17	580	0.34	0.21
RATING	1513	7.16	2.17	582	7.21	2.52
PRFIT	1511	0.02	0.01	569	0.02	0.01
FRSTDISP	1335	0.00	0.00	562	0.00	0.00

Table 14
Results for the Propensity Score Matching on the Time of CDS Introduction
This table reports the results of the propensity score matched sample analysis, in which the coefficients on the interaction terms of *TRADING* with each of the three renegotiation variables, namely *CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0, are estimated with the *matched* sample added to the original sample. The same regression models are estimated (shown in Table 5 through Table 7). Panels A–C present the results for the regression for *CEOSHARE*0, *INTANGIBLE*0, and *ISSUENUM*0, respectively. All three proxies are measured in the quarter before the onset of CDS trading. To conserve the space, only coefficients on the *TRADING* variable and interaction terms are reported. The *t*-statistics are given in brackets (***, **, and * stand for significance at the 1%, 5%, and 10% levels using a two-tailed test).

	(1)	(2)	(3)	(4)
Panel A: Shareholder bargaining power				
TRADING × CEOSHARE0	−6.9***	−8.1***	−6.0**	−6.7***
	[−2.57]	[−2.76]	[−2.01]	[−2.61]
TRADING	56.4***	53.8***	54.8**	47.1***
	[3.76]	[4.03]	[3.92]	[3.77]
R^2	0.34	0.38	0.40	0.42
Number of observations	1,810	1,810	1,736	1,698
Number of firms	163	163	163	162
Panel B: Liquidation cost				
TRADING × INTANGIBLE0	−47.2	−55.0	−89.8	−123.9**
	[−0.63]	[−0.91]	[−1.42]	[−2.18]
TRADING	68.2	67.4*	93.3**	102.2***
	[1.43]	[1.78]	[2.38]	[2.82]
R^2	0.31	0.35	0.37	0.40
Number of observations	1,974	1,974	1,891	1,843
Number of firms	179	179	179	178
Panel C: Renegotiation frictions				
TRADING × ISSUENUM0	115.9*	118.0**	131.7**	137.1**
	[1.91]	[2.12]	[2.15]	[2.25]
TRADING	11.9	7.9	8.9	−1.1
	[0.64]	[0.44]	[0.46]	[−0.06]
R^2	0.34	0.38	0.39	0.42
Number of observations	2048	2048	1963	1920
Number of firms	184	184	184	183

by CEO shareholding) and the firm's liquidation costs (proxied by asset intangibility). The dispersion of bond holders (proxied by the number of public bond issues) is used to reflect renegotiation frictions that the firm faces.

To test my predictions, I employ the secondary market prices of corporate bonds of U.S. investment-grade firms that initiated CDS trading between 2001 and 2008, and compare a bond's yield spreads between pre- and post-CDS trading. My analysis shows that while an average firm experiences a slight increase in spreads following the onset of CDS trading, firms whose creditors would have been highly vulnerable to shareholders' strategic defaults in the absence of CDS experienced a relative large reduction in spreads. In particular, the greater benefit accrues to those firms with high shareholder bargaining power and firms with fewer renegotiation frictions. Furthermore, these relations are more pronounced among riskier firms that have more chance of undergoing debt renegotiation in the near future.

This paper provides the first empirical evidence of the beneficial role of CDS and empty creditors through their impact on shareholders' incentives for strategic default. Much of the news media and existing law literature has focused on the negative impact of these and hence, how to regulate the CDS markets accordingly. For instance, legal scholars propose removing the voting rights of empty creditors in the debt restructuring process. My results imply that it would also erode their commitment benefits. More broadly, my findings support the novel view of the economic role of CDS markets as commitment devices: by giving more credibility to borrowers' commitment to repay debt, CDS could contribute to a reduction in the (inefficient) cost of corporate debt.

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