Changes in firms' investment policies upon the CDS initiation and the role and the incentives of managers in accompanying lender-shareholder wealth transfer

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Abstract: A lender's incentive to monitor the investment activities of its client firm declines after it receives an insurance on its loan via a credit default swap (CDS). With reduced vigilance from the lender, the client can substitute its assets from safe to risky ones, resulting in wealth transfer from lenders to shareholders. However, we do not find evidence for this proposition, on average, arguably because risk-averse managers avoid projects that increase asset volatility. However, when the value and the convexity of managers' compensation considered, managers appear to act in shareholder interests following the inception of CDS trade. We find convincing evidence of asset substitution when managers hold highly convex compensation contracts. We conclude that when managers have the right incentives, they facilitate a wealth transfer from lenders to shareholders. We make two contributions to the literature. We more holistically examine the post-CDS-inception shifts in shareholder, manager, and lender forces that determine corporate policies. We also provide an alternative explanation for the literature's finding of increased bankruptcy risk post CDS inception.

JEL classification: G32, G33; M41; M48
Key words: Credit default swap (CDS); Agency conflict; Managerial compensation; Operating risks; Investment policy

1. INTRODUCTION

A credit default swap (CDS), a relatively recent financial innovation, pays its owner the face value of debt in the event of a borrower default. Since 1994, the CDS industry has grown into a multi-trillion dollar industry (ISDA, 2013). Yet, not much is known about the economic consequences of CDS, particularly its effect on the borrower behavior (Stulz 2010; Augustin et al. (2014). Subrahmanyam, Tang, and Wang (2014) find increases in borrower's bankruptcy risk following the CDS trade initiation. They explain this occurrence consistent with Hu and Black (2008) and Bolton and Oehmke (2011), that after the inception of CDS trade (CDS inception, hereafter) an "empty" lender continues to possess all the legal right of a lender but has little skin left in the game. It acts tough during the debt renegotiations and refuses debt workouts, making a distressed borrower more vulnerable to bankruptcy.

We hypothesize that an additional link exists for the increase in bankruptcy risk following the CDS inception. We argue that an empty lender begins shirking on its monitoring responsibility over the borrower's investment policies (Holmstrom and Tirole, 1997; Sufi, 2007). The borrower, upon witnessing the lender's reduced monitoring effort substitutes its safe assets with more volatile assets, to increase the call option value for shareholders. However, we do not find results to support this idea, on average. But when the value and the convexity of managerial compensation is considered, we find increases in the likelihood of asset substitution as well as bankruptcy risks post CDS inception. Our study provides evidence of managers' role and incentives in the wealth transfer that could occur following the CDS inception. We respond to Stulz (2010) who observes that "there is a dearth of serious empirical studies" on the implications of CDS. We also respond to Augustin et al. (2016) who call for more thorough examination of changes in corporate policy as well as a more holistic investigation of changes in stakeholders' interests upon CDS inception.

Due to the call option property of equity, an increase in asset volatility improves equity value despite unchanged value of expected future cash flows. This is because shareholders capture most of the upside, but do not have to bear the consequences of negative outcomes given their limited liability. If the volatility value dominates the in-the-money value of call options held by shareholders, they might benefit even when the firm pursues negative NPV projects, as long as that project increases the volatility of future cash flows. Stated differently, shareholders might benefit from the increased volatility even when the firm value declines because of the wealth transfer from lenders. Lenders, who stand to lose upon substitution of firm's assets from safe to risky ones, attempt to prevent its occurrence through covenants and active monitoring (Jensen and Meckling 1976).

However, lender monitoring and covenant enforcement is costly. Having hedged its credit exposure upon CDS inception, a lender may not have the same incentive to monitor its borrower as before (Morrison 2005). As a result, the lender may start shirking its monitoring responsibility and could impose lesser discipline upon borrowers in the event of a covenant violation (Chakraborty, Chava, and Ganduri 2015). Also, CDS trading reduces the creditor's exposure as well as its regulatory capital requirement, allowing it to expand its loan portfolio (Shan, Tang, and Yan 2014). Such an expansion would further reduce lender's monitoring effort per client.

A borrower would observe the onset of CDS trading (Martin and Roychowdhury 2015) and can detect the subsequent weakening of lender's vigilance and monitoring (Arpinr 2014). It may change its investment policies that were previously constrained by the lender's monitoring. We test this proposition by examining post-CDS changes in R&D outlays and expenditures on property, plant, and equipment, the two proxies for risky and safe assets, respectively (Coles et al.

2006).[1] We do not find evidence supporting this proposition, however. Thus, we find no evidence of asset substitution after CDS inception, on average.

Our null results could reflect the fact that risk-averse managers' interests are aligned with lenders as far as the effects of asset volatility are concerned. Unlike shareholders, undiversified managers shun firm-specific risks (Coles et al. 2006). Their perceived value of stock and option holdings decreases with asset volatility (Carpenter 2000). Thus, managers are unlikely to participate in the shareholder opportunism by increasing asset volatility when that action hurts their personal interests. We therefore examine whether shareholders offer altered compensation arrangement to manager to capitalize on the reduced lender monitoring following the CDS inception. We particularly examine vega measure of managerial compensation that increases managers' wealth upon increases in stock volatility and partly overcomes managers' risk aversion (Core and Guay 2002). We find significant increases in both total value and vega of managerial compensation after the CDS inception despite employing the usual controls. On average, CDS initiation is followed by increases of 61.26% and 66.50% of one standard deviation in these variables, respectively.

Conditional on managers holding large value and vega of compensation, we find evidence of asset substitution after the CDS inception, as evidenced by significant increases in R&D outlays and decreases in expenditures on property, plant, and equipment. We also find abnormal positive shareholder returns following the CDS inception. Our results indicate when suitably incentivized, managers act in shareholder interests and change the firm's investment policy following the CDS initiation. They appear to partake in, and facilitate a, wealth transfer from lenders to shareholders.

[1] Relative to investments in tangible assets, corporate innovation is highly risky and multi-stage endeavor with unpredictable returns (Holmstrom, 1989; Kothari, Laguerre, and Leone 2002).

Furthermore, the greater the alignment between shareholder and managers' interest are via vega and total compensation, the higher is the increase in bankruptcy risk following CDS inception.

The onset of CDS trading may not be an exogenous event. For example, factors such as firms' credit risk, profitability and the existence of asymmetric information could determine the demand for and the supply of CDS contracts (Ashcraft and Santos 2009). Those factors could also affect managerial compensation. We address the potential endogeneity problem related to the CDS inception by examining the difference in differences before and after CDS initiation relative to non-CDS firms (Subrahmanyam et al. 2014). We also consider a group of propensity-score matched firms that do not have traded CDSs (Ashcraft and Santos 2009; Martin and Roychowdhury 2015). In addition, we use a two-stage regression model, and find similar results (Martin and Roychowdhury 2015). These results indicate that our results are less likely subject to endogeneity issues.

Our results are consistent with the idea that either shareholders offer, or managers demand, a change in managers' compensation, such that managers benefits from the lender-shareholder wealth transfer upon CDS inception. We make two contributions to the literature. First, we highlight the managers' role and incentives in exacerbating lender-shareholder agency conflicts upon CDS inception. We thus respond to Augustin et al.'s (2014) call for more thorough examination of changes in corporate policy and stakeholders' interests upon CDS initiation. In particular, we present a more holistic picture of post-CDS inception shifts in the rival lender-, shareholder-, and managerial-forces that determine the firm's investment policy. Second, we provide an additional explanation for the phenomenon documented by Subrahmanyam et al. (2014). We show that the initiation of trading CDS on a firm's outstanding debt could be followed by an asset substitution that increases bankruptcy risks.

Our paper also suggests a potential mechanism to ameliorate the phenomenon we document. Arguably, a reduction in the convexity of managerial compensation can counterbalance the shift in forces that lead to increased operating risks post CDS initiation. As such, lenders could insist on increasing the debt-like components in managerial compensation that pay only if the firm remains solvent (Edmans and Liu, 2010). For example, pension and deferred compensation have the properties of debt because both are liabilities of the firm towards their managers and are disrupted in the event of bankruptcy (Sundaram and Yermack, 2007; Bolton et al., 2011).

2. LITERATURE REVIEW AND MOTIVATION OF HYPOTHESIS

The creation of CDS contracts is credited to J.P. Morgan to sell off the credit risk of Exxon Mobil in 1994 (Tett 2009). Initially, CDS contracts were used to hedge the credit risks of bank loans. After International Swaps and Derivatives Association (ISDA) standardized the CDS contracts, other participants such as asset managers started participating in the CDS market. The notional amount of outstanding CDS contracts peaked at $62.2 trillion by the end of 2007. After the financial crisis, the notional amount declined but remains in double-digit trillion dollar level.

CDS trades are typically initiated by third parties, other than the lender and the borrower. Yet, the creation of active CDS market for a company's debt offers the lender an opportunity to hedge its risk, which could significantly alter the debtor-creditor relationship. This is because CDS, partially or fully separates the creditor's control rights from its cash-flow rights (Hu and Black 2006; Bolton and Oehmke 2011). An empty lender is now less likely to be flexible in negotiations upon any credit event, and is less likely to continuously monitor the clients' activities to protect the value of its claim. Furthermore, it would now have a reduced interest in the efficient continuation of the debtor, and may push the debtor into inefficient bankruptcy or liquidation Consistent with this idea, Subrahmanyam et al. (2014) find increases in bankruptcy risk with CDS trade inception. Other benefits accrue to lenders upon CDS initiation. Their regulatory capital requirements are relaxed, allowing them to extend more debt to other clients (Shan, Tang, and Yan 2014).

The discussion above indicates another probable reason for the increased bankruptcy risk upon CDS trade initiation, as shown by (Subrahmanyam et al. 2014). Lenders now bear the monitoring responsibilities but have little skin left in the game. Thus, they could now reduce their monitoring and vigilance efforts because these efforts are costly and provide no additional returns. Furthermore, such efforts would now be spread over a larger number of clients. This reduced vigilance on part of lenders is likely to alter the client's operating strategies. In particular, the equilibrium between lender and shareholder forces that determine the borrowing firm's operating risks may shift given the reduced vigilance. In general, the value of residual claim holders can be viewed as a European call option on a firm's assets with debt value as the strike price. Due to this call option property, an increase in the asset risk increases the value of equity, even if it leaves the expected value of the firm's future cash flows unchanged. Shareholders then have a strong incentive to increase asset volatility. However, increased volatility will adversely impact creditors because they will suffer the loss if the firm fails while not being entitled to the potential upside gain. One implication of options pricing theory is that any managerial action that increases the volatility of firm value will increase the value of call option held by shareholders while decreasing the value of fixed claims.

Consequently, lenders try to prevent the substitution of firm's assets from safe to risky ones (Jensen and Meckling 1976). This leads to lender-shareholder conflict with regards to the preferred operating-risk level. Any shift in lender's monitoring would thus shift lender-shareholder forces toward shareholder preference, that is, toward increased asset volatility, even if it comes at the cost of a negative NPV project. Thus, we expect asset substitution upon CDS inception. We test this proposition in the hypothesis

H1: Firms substitute a part of their assets from safe to risky ones upon CDS inception.

The above discussion implies a net wealth transfer from the lenders to shareholders because of the increased operating risks upon CDS initiation. Nevertheless, it is not clear why managers would participate in such shareholder opportunism when those actions potentially hurt their personal interests. Unlike shareholders, who can easily diversify their firm-specific risks, managers' monetary capital and human capitals are disproportionately invested in their firms (Aggarwal and Samwick 1999). Yet, managers can neither sell their stock options nor easily hedge the risks of decline in their options' in-the-money values due to fluctuations in their own firms' stock prices.[2] Therefore, unlike diversified investors, whose assessment of option value increases with volatility, managers' utility from holding in-the-money options can decline with stock-price volatility (Pratt 1964; Arrow 1965; Carpenter 2000). Thus, managers holding large firm stock and in-the-money stock options can become highly risk averse (Wiseman and Gomez-Mejia 1998).

Therefore, unless managers hold out-of-money options with convex payoffs, they are reluctant to assume additional firm-specific risks (Berle and Means 1932; Jensen and Meckling 1976). Otherwise, they will act in lender's interest as far the selection of risky projects are concerned. In contrast, managers holding large options with convex payoffs will increase the asset volatility, consistent with shareholder interests.

Convexity is typically measured with vega, the increase in managers' wealth due to increases in stock volatility. We thus expect shareholders to offer higher vega to managers to

[2] Managers are not permitted to take short positions in firm securities against their option holdings (Section 16[C] of the Securities and Exchange Act [1934]). See Bettis, Bizjak, and Kalpathy (2011) for avenues available to managers for hedging their risks.

incentivize them to increase asset volatility post CDS trade initiation. We also expect shareholders to offer higher compensation to managers to partake in the resultant wealth transfer from lenders to shareholders.

H2A: The total value and the vega of managerial compensation increases after CDS trade inception.

We also expect well-compensated managers and managers with large vega incentives, irrespective of whether those incentives were reached before or after the CDS inception, to increase asset volatility, consistent with shareholder interests.

H2B: Asset substitution upon CDS inception increases in managers' vega and total compensation.

We triangulate the ideas tested in H1 and H2 to provide an additional explanation for the increases in bankruptcy risk post CDS inception, in the hypothesis:

H3: Increases in bankruptcy risk after CDS trade inception is affected by managers' incentives.

3. SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

Selection of CDS Firms

We collect data from the Markit database, which covers CDS quotes of U.S. firms starting in 2002. Markit verifies its CDS data through a multi-stage scrubbing procedure that includes evaluating the legal relationship between a reference entity and a reference obligation as well as corporate actions, CDS succession events, and credit events. We gather data on CEO's compensation from the Standard & Poor's ExecuComp database. The ExecuComp provides extensive executive compensation data including current and historical information on executive stock and option awards, pension plans, and executive compensation, and covers from 1992 forward on the top five executive officers of over 3,300 companies. We collect financial and stock price data from Compustat North America and CRSP, respectively. Next, we merge the Markit Data with the above three data bases (ExecuComp, Compustat North America and CRSP) using the ticker and also by manually cross-validating the match between these datasets based on company names. After merging these two data files, we identify 546 U.S. firms that initiated trading on single-name CDS contracts during the sample period from 1996 to 2014.

Table 1 presents the sample distribution by year for CDS firms prior to, and after, the CDS trading initiation (pre-CDS and post-CDS contract subsample). We also provide yearly distribution of non-CDS firms. The number of observations for firms subsequent to the CDS trading initiation and the non-CDS firms monotonically increases over the sample period. Table 2 reports the sample distribution by industry, which is based on Campbell (1987) industry classification. Our sample covers a range of industries, the most heavily represented being Construction (16.65% for the post-CDS contract subsample and 17.00% for the pre-CDS contract subsample), followed by Capital Goods (15.21% for the post-CDS contract subsample and 11.42% for the pre-CDS contract subsample), and Real estate and Financial (12.69% for the post-CDS contract subsample and 12.73% for the pre-CDS contract subsample).

[Insert Tables 1 and 2 here]

Descriptive Statistics

Table 3 separately reports the descriptive statistics of the variables used in our analyses for the CDS and non-CDS firms. For the CDS sample, characteristics are presented separately for periods prior to, and after the, initiation of CDS trading. We find that corporate investments in both intangible (RDEXP) and tangible (Capex) assets decrease following the CDS inception. Hence we do not find consistent support for H1 on a univariate basis. CEO’s total and excess compensation as well as Vega significantly increases after the CDS inception, which is consistent with H2A. While sales revenue increases, growth opportunities, stock return and profitability decreases subsequent to the CDS trading initiation. These results are consistent with prior studies finding that CDS firms may experience negative shock to their operational performance (Subrahmanyam et al. 2014).

[Insert Table 3 here]

4. TESTS OF HYPOTHESES

Tests of H1: Substitution from safe to risky assets upon CDS inception

Hypothesis H1 states that firms substitute a part of their assets from safe to risky ones after the CDS initiation. We estimate the following regression to test this hypothesis:

$$RDEXP_{it} \text{ or } Capex_{it} = \beta_0 + \beta_1 CDS\_TRADE_{it} + \beta_2 CDS_{Firm_i} + \beta_3 Tenure_{it}$$
$$\beta_4 Cash\_Comp_{it} + \beta_5 BTM_{it} + \beta_6 SALES_{it} + \beta_7 SurplusCash_{it}$$
$$+\beta_8 SalesGrowth_{it} + \beta_9 STRET_{it} + \beta_{10} LEV_{it} + \varepsilon_{it}, \quad (1)$$

where the dependent variable is R&D expenditures (*RDEXP*) or capital expenditures (*Capex*). Dummy variable *CDS_Trade* takes the value of one after CDS trade initiation, and zero otherwise. Dummy variable *CDS_Firm* takes the value of one for firms that have their CDS traded during our study period. These firms are considered treatment group after CDS inception. Including both *CDS_Trade* and *CDS_Firm* provides a difference-in-difference research design. The variable *CDS_Trade* captures the marginal impact of CDS introduction on corporate investments, relative to the impact on non-CDS firms at the same time. If firms substitute a part of their assets from safe to risky ones following the onset of CDS trading, as hypothesized in H1, then we would expect β_1 to be significantly positive with *RDEXP* being the dependent variable and significantly negative when *Capex* is the dependent variable. To control for the determinants and managerial incentive of investments, we include firm size (*Sales*), financial leverage (*LEV*), growth opportunity (*BTM*), and cash availability (*SurplusCash*), sales growth (*SalesGrowth*), stock return (*STRET*) following Coles et al. (2006). Also, following the literature, we use two proxies for CEO's level of risk aversion; CEO tenure (*Tenure*) and *Cash_Comp* (salary plus bonus). We control for year and industry idiosyncratic characteristics by their fixed effects in all multivariate regressions. Detailed variable definitions are provided in Appendix A.

We report results of equation (1) in Table 4. The first two columns of Table 4 report results with RDEXP and the last two columns report results with Capex being the dependent variables. The first and third columns include the dummy variable of CDS_Firm, while the second and fourth columns do not. The coefficients on CDS_Trade is not significant in any test. Thus we do not find any significant change in either risky or safe assets upon CDS inception, on average. Thus, H1 that predicts asset substitution upon CDS inception is rejected.

[Insert Table 4 here]

Tests of H2: Changes in Managerial Compensation after CDS inception

We hypothesize that the onset of CDS trading reduces lender banks' monitoring efforts, thus enabling borrower firms substitute safe assets with risky ones. We also hypothesize that managers would participate in such shareholder opportunism when those actions are consistent with their personal interests. We examine whether shareholders offer, or managers demand, higher vega and higher compensation to increase asset volatility post CDS trade initiation. We employ the following regression specification to test this prediction:

$$Total\_Comp_{it} \text{ or } Excess\_Comp_{it} \text{ or } Vega_{it}$$

$$=\beta_0+\beta_1 CDS\_Trade_{it}+\beta_4 CDS\_Firm_i+\sum\beta_n Controls_{it}+\varepsilon_{it} \qquad (2)$$

where the dependent variable is either total compensation (*Total_Comp*), excess compensation (*Excess_Comp*), or *Vega*. Of interest is the coefficient on *CDS_Trade* (β_1). If shareholders increase CEOs' total compensation and vega to encourage them to increase operating risks following the onset of CDS trading, then we expect β_1 to be significantly positive.

Following prior literature (Core, Holthausen, and Lacker 1999; Core, Guay, and Lacker 2008), equation (2) also employs a number of control variables. To control a determinant and an incentive of CEO compensation, we include firm size (*Sales*), firm reputation (*S&P500*), growth opportunity (*BTM*), and current and prior year's Stock Return (*STRET*) and profit ratio (*ROA*) in Equation (2) Also, we use *Cash_Comp* (salary plus bonus) and CEO tenure (*Tenure*) to control for CEO's level of risk aversion. Detailed variable definitions are provided in Appendix A. With Vega as dependent variable, we follow Richardson (2002) and Coles et al. (2006), to select control variables. We include firm size (*Sales*), financial leverage (*LEV*), growth opportunity (*BTM*), and cash (*CashSize*), sales growth (*SalesGrowth*), and Stock Return (*STRET*) and stock return volatility (*STRETVOL*) following Coles et al. (2006). We also control for CEO tenure. Detailed variable definitions are provided in Appendix A.

The results are reported in Table 5. The first two columns of Table 5, Panel A report results with *Total_Comp*, and the last two columns report results with *Excess_Comp*, as dependent variables. Table 5, Panel B reports results with *Vega* as the dependent variable. The coefficient on *CDS_Trade* is consistently positive and significant in all models (p-value < 0.01), providing strong support for the hypothesis (H2) that the CDS trading initiation is positively associated with CEO's total as well as excess compensation. Our results suggest that managers demand or shareholder change managers' compensation in a way as to improve managers' incentives to increase firm operating risks and also to partake in lender-shareholder wealth transfer.

[Insert Table 5 here]

Additionally, we examine whether managers holding incentives consistent with shareholders interest increase the asset volatility post CDS inception in the following regression:

$$
\begin{aligned}
RDEXP_{it} \text{ or } Capex_{it} = {} & \beta_0 + \beta_1 CDS\_Trade_{it} \\
& + \beta_2 (Vega_{it} \text{ or } Total\_Comp_{it}) \\
& + \beta_3 CDS\_Trade_{it} \times (Vega_{it} \text{ or } Total\_Comp_{it}) \\
& + \beta_4 CDS\_Firm_i + \sum \beta_n Controls_{it} + \varepsilon_{it} \qquad (3)
\end{aligned}
$$

In equation (3), the dependent variable is RDEXP or Capex. We use one of the two proxies of managers' incentives in the model at a time *Total_Comp* or *Vega*. The coefficient of interest is on the interaction term *CDS_Trade* × (*Vega* or *Total_Comp*). If managers have the right incentives to increase operating risk taking following the onset of CDS trading, then we would expect β_3 to be significantly positive for RDEXP and to be significantly negative for Capex. We follow Coles et al. (2006) in the selection of control variables. Detailed variable definitions are provided in Appendix A.

Results of equation (3) are reported in Panels A and B of Table 6 for *Vega* and *Total_Comp*, respectively. The first two columns in each Panel report results with *RDEXP* and the last two columns report results with *Capex* as dependent variables. The coefficients on the interaction term *CDS_Trade* × (*Vega* or *Total_Comp*) are consistently positive and significant with *RDEXP* and as the dependent variable and negative with *Capex* as the independent variable in one model. Results of the two panels provide support for the hypothesis that when managers have right incentives, they engage in asset substitution consistent with shareholder interests but contrary to lender's interests.

Based on the coefficient estimates from the models in Table 6, Panel A, the effect of a one standard deviation increase in vega is associated with the increase in R&D expenditure by around 1.06 (an increase of 5.32% based on mean R&D of 0.02). This effect of *Vega* on corporate investment policy subsequent to CDS trading appears to be large and economically significant.

[Insert Table 6 here]

Tests of H3: The joint effect of CDS inception on managerial interests on default risk?

H2 tests indicate that when managers have the right incentives, they substitute safe assets with risky ones post CDS inception. Resulting increase in operating risk, however, could also increase the bankruptcy risk. We test in H3 whether CDS inception exacerbates bankruptcy risk for firms with managers holding incentives consistent with shareholder preferences. We estimate

$$DefaultRisk_{it} = \beta_0+\beta_1 CDS\_Trade_{it}+\beta_2(Vega_{it}\ or\ Compensation_{it}) +\beta_3 CDS\_Trade_{it}\times(Vega_{it}\ or\ Compensation_{it})+\beta_4 CDS\_Firm_i +\sum\beta_n Controls_{it}+\varepsilon_{it}, \quad (4)$$

where *DefaultRisk* is an indicator variable that takes a value of 1 if a firm files for bankruptcy filing after the CDS trading initiation. Our main interest is that the coefficient on the interaction term *CDS_Trade* × (*Vega* or *Total_Comp*). A positive β_3 would be consistent with H3. We follow Subrahmanyam et al. (2014) in the selection of control variables; firm size (*MKV*), debt size (*LNDEBT*), stock return (*STRET*), stock return volatility (*RETVOL*), and profitability (*ROA*). Detailed variable definitions are provided in Appendix A.

The results are reported in Table 7. The coefficient on *CDS_Trade* is significant and positive, suggesting that firms' default risk increases subsequent to the CDS trading. This finding is consistent with Subrahmanyam et al. (2014). More important, the coefficients on the interaction term *CDS_Trade* × (*Vega* or *Total_Comp*) are consistently positive and significant (p-value < 0.05), providing strong support for the hypothesis that when managers have incentives consistent with shareholder interests, the onset of CDS trading is followed by managerial actions that increase corporate default risk.

[Insert Table 7 here]

Overall, our finding so far indicate that, (1) levels of CEO's compensation as well as vega increase after the onset of CDS trading and that such compensation levels and changes are associated with asset substitution and increased bankruptcy risk. Our results are consistent with the idea of shift in lender, shareholder, and manager forces following CDS inception and that such shifts affect corporate investment policies in a manner causing wealth transfer from lenders to shareholders. Furthermore, our results suggest that shareholders offer, or managers demand, a part of this wealth transfer. Our findings also provide an additional explanation for the increase in bankruptcy risk following CDS inception documented by Subrahmanyam et al. (2013).

5. ROBUSTNESS CEHCK

Propensity Score Matching

Selection of Matched Control Firms

The onset of CDS might not be an exogenous event. For example, factors such as firms' credit risk and growth opportunities that affect the demand for, and the supply of, CDS contracts (Ashcraft and Santos 2009) could also affect managerial compensation. We follow the extant literature to address this potential endogeneity issue. We employ a propensity score matching approach (Aschcraft and Santos 2009; Martin and Roychowdhury 2015). This matching approach involves matching treatment and control firms based on similarity of observable firm characteristics (Dehejia and Wahba 2002). We implement this procedure by first estimating a logit regression to model the probability of initiating the CDS trading, using the sample of treatment firms and the benchmark sample, which includes firms that did not initiate CDS trading during our sample period. Our model follows the approach employed by prior studies (Aschcraft and Santos 2009; Martin and Roychowdhury 2015). Specifically, we use the following logistic model to predict the onset of CDS trading:

$$Prob(CDS_{i,t}=1) = \alpha + \beta_1 INVESTMENTGRADE_{i,t-1} + \beta_2 RATING_{i,t-1} + \beta_3 LEV_{i,t-1} + \beta_4 PROFITMARGIN_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_6 RETVOL_{i,t-1} + \beta_7 MB_{i,t-1} + \varepsilon, \quad (5)$$

where *CDS* is a dummy variable that equals one if the firm has traded CDSs during the sample period, and zero otherwise. Firms' credit risk is proxied by *INVESTMENTGRADE, RATING, LEV*, and *PROFITMARGIN*. *INVESTMENTGRADE* is an indicator variable equal to one if a firm has an S&P credit rating above BB+, and zero otherwise. *RATING* is an indicator variable that takes the value of one if a firm has an S&P credit rating, and zero otherwise.[3] *LEV* is leverage, computed as the firm's total debt divided by total assets. *PROFITMARGIN* is net income divided by sales. We also include firm size (*SIZE*), return volatility (*RETVOL*), and market-to-book ratio (*MB*) to account for the effects of the overall information environment and growth opportunities on the demand and supply of CDS contracts. *SIZE* is the natural logarithm of market value of equity. *RETVOL* is the standard deviation of monthly stock return within a fiscal year, and *MB* is the ratio of market value of equity to total assets. We use all Compustat firms with available information during the period 1997–2010. Specifically, for firms with CDS trading initiated during the sample

[3] Our results remain unchanged when *INVESTMENT GRADE* and *RATING* are defined as continuous variables.

period, we include observations up to the last fiscal year prior to the CDS-trade-initiation year for estimating Equation (5).

Table 8, Panel B reports the estimation results of the logit model (5). Consistent with prior literature (Martin and Roychowdhury 2015), the model reasonably predicts the onset of CDS trading; the proportion of concordant pairs is over 90 percent and the proportion of discordant pair is less than 10 percent. Firms that are larger, have higher credit ratings, and lower stock return volatility are more likely to experience CDS trading. Consistent with Martin and Roychowdhury (2015), these findings indicate an adverse selection view, where banks (potential protection buyers) have superior private information about the debt instruments they originate. Consequently, protection seller offer CDS contracts mainly on firms that are relatively less risky and have more transparent information environments. As the next step, we estimate the propensity score for each firm using the predicted probabilities from the logit model, and match each CDS firm to a non-CDS firm by year and the Campbell (1996) industry classification using the nearest neighbor matching score. We use matching with replacement to choose two matched non-CDS firms per CDS firm whose propensity score distance is closest to that of the CDS firm.[4] Thus, we have 14,943 firm-years for the propensity-matched design.[5]

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[4] Compared to matching without replacement, matching with replacement decreases bias and circumvents the potential problem that the results are potentially subject to the order in which the treatment units are matched (Dehejia and Wahba 2002, 153). Dehejia and Wahba (2002, 154) contend "When the treatment and comparison units are very different, finding a satisfactory match by matching without replacement can be very problematic. In particular, if there are only a handful of comparison units comparable to the treated units, then once these comparison units have been matched, the remaining treated units will have to be matched to comparison units that are very different. In such settings, matching with replacement is the natural choice."

[5] The reduced sample size for the non-CDS firms is caused by (1) performing propensity matching with replacement such that one control firm is potentially matched to multiple treatment firms, (2) missing values in the control variables, and (3) cessation of Compustat coverage due to various reasons, including bankruptcy and merger and acquisition by other firms.

We conduct a covariate balance analysis on the pre-CDS period differences between the treatment and control groups following Cohen (1988). The analysis shows that the differences between the two groups are small for most of the variables, except SIZE. These results (untabulated) indicate that our propensity matching process is largely successful.[6]

Tests of Relation between CDS Initiation and CEO Compensation

We hypothesize that management compensation and vega increase after the CDS initiation in order to incentivize managers to increase corporate risk taking behavior. Table 8, Panel C reports the results based on the propensity matching approach. We find that the coefficient on *CDS_Trade*, which represents the incremental effect of the CDS trading initiation on management compensation for the CDS firms relative to the non-CDS firms, are significantly positive. This result provides further credence to our finding in Table 5 that managerial compensation and vega increase following the onset of CDS trading.

Two-Stage Least Squares (2-SLS) Specification

In this section we examine whether our main finding is robust to a 2-SLS specification. In the first stage, we estimate a regression of a binary variable *CDS_TRADE* on all variables of the CDS determinant model specified in equation (7) as well as all control variables in equations (1) and (2).

$$CDS\_Trade_{i,t} =$$

$$\alpha + \beta_1 INVESTMENTGRADE_i + \beta_2 RATING_i + \beta_3 LEV_i + \beta_4 PROFITMARGIN_i$$

$$+ \beta_5 SIZE_i + \beta_6 RETVOL_i + \beta_7 MB_i + \beta_8 Tenure_{it} + \beta_9 Sales_{it}$$

[6] Cohen (1988) suggests that Effect Size Indices of 0.2, 0.5, and 0.8 represent small, medium, and large effect sizes, respectively.

$$+\beta_{10}S\&P500_{it}+\beta_{11}STRET_{i}+\beta_{11}STRET_{it-1}+\beta_{12}ROA_{i}+$$

$$\beta_{13}ROA_{it-1}+\beta_{14}CashCompensation_{i}+\beta_{15}CashSize+\varepsilon, \quad (6)$$

where *CDS_TRADE* equals one for CDS firms after the inception of CDS trading and zero before the onset of CDS trading. It equals zero for all non-CDS firms. In the second stage we use the predicted value of *CDS_TRADE* from the first stage and estimate a regression of *Total_compensation*, *Excess_ compensation*, and *Vega* on the fitted value of *CDS_TRADE* along with all the control variables specified in Equation (2).

In the first stage, we include four instrumental variables, *INVESTMENTGRADE*, *CREDIT_RATE*, *PROFITMARGIN*, and *RETVOL*, following Martin and Roychowdhury (2015), to predict the initiation of CDS trading but unrelated to the residual in the second-stage regression. We include the investment grade and credit rating variables to address firm's credit risk (Longstaff et al. 2011; Subrahmanyam et al. 2014). We also include return volatility and profit margin ratio to consider the effect of overall information environment and growth opportunities on the incentive for CDS contract initiation (Martin and Roychowdhury 2015). To validate our choice of instrumental variables, we follow Larcker and Rusticus (2010) and implement weak instrument identification tests. The *partial F* is 669.16 (p-value < 0.001) and the under-identification test (Chi^2) is 1,452.99 (p-value < 0.001), respectively for Panel B. The *partial F* is 200.52 (p-value < 0.001) and the under-identification test (Chi^2) is 1,091.20 (p-value < 0.001), respectively for Panel C. These results suggest that the instrument passes the weak-instrument tests, and explains a significant amount of the variation in management compensation. The weak-instrument test yields a Cragg-Donald Wald F of 1530.49 (p-value < 0.001) for Panel B and 1133.87 (p-value < 0.001), respectively, compared with the Stock-Yogo critical value.[7] This test shows that the instrumental variable improves the specification over the OLS specification.

Table 9, Panel A reports the first stage results and Panel B and C report the second stage results. Our interest is in the coefficient on *CDS_TRADE* in Panel B and C. Panel B and C include a dummy variable, which equals one if the firm had CDS traded during any time in the sample period and zero otherwise. The coefficient on *CDS_TRADE* captures the effect of CDS trading on management compensation incremental to the pre-CDS management compensation of CDS firms. The coefficient on *CDS_TRADE* is positive and significant when the dependent variables are *Total_Compensation*, *Excess_Compensation* and *Vega*, suggesting that the value and the vega of management compensation increases following the introduction of CDS trading.

Identifying Lender Banks that Most Likely Used CDS Contracts

Martin and Roychowdhury (2015) show that if the proportion of risk based capital ratio increases for a bank that lends to a borrower with CDS contracts in the same year in which its CDS trading were initiated, that bank is more likely to have purchased CDS protection against the underlying borrower's default risk. This is because the increase in risk based capital ratio in the same year indicates that the lender bank likely hedged its risk with respect to that borrower through the new CDS contracts. Following this argument, we examine identify lender banks' whose risk based capital ratio increases in the same year as CDS contract initiation. We expect these banks to be more lax in their monitoring following CDS inception. More important, we expect the association between CDS initiation and management compensation changes to be stronger for those firms whose lender banks likely purchased the CDS contracts.

[7] Stock and Yogo (2005) provide a critical value table for a 5% test: Stock-Yogo C.V.: 10% Max IV size 16.38 and 15% Max IV size 8.96.

We identify lenders to CDS and non-CDS firms in our sample using the Dealscan database, and collect banks' risk based capital ratio from the Federal Reserve's Y-9C reports. By using banks' risk based capital ratio, we try to identify lender banks by dividing the borrower sample into two groups: firm-year observations with the increase in banks' risk based capital ratio and the others with decreases. We then reestimate equation (3) examining the joint effect of CDS inception and managerial incentives on asset substitution, separately for these groups.

Table 10 presents results of this analysis. The coefficients on the interaction term of *CDS_TRADE* and *Vega* are positive and significantly stronger for firms experiencing the increase in banks' risk based capital ratio. Results for Capex, hwoever, are not significant. Thus, borrowers exhibit greater corporate risk taking behavior only if lenders exhibit an increase in the proportion of the risk based capital ratio. In sum, this analysis reveals that the positive association between CDS initiation and risk taking is indeed stronger when the lender banks are likely to have purchased the CDS contracts.

[Insert Table 10 here]

6. CONCLUSION

Prior studies show that a CDS inception increases the likelihood of borrower bankruptcy. We provide an additional link between the two events. We argue that having obtained insurance on its risky asset, the empty lender reduces its monitoring effort over the borrower's investment policy. With reduced lender monitoring, managers of the borrowing firm substitute the firm's safe assets with more volatile assets if they possess compensation incentives consistent with shareholders, who prefer higher asset volatility to improve the value of their equity call option. Our results indicate when suitably incentivized, managers act in shareholder interests and change the firm's investment policy following the CDS initiation. Hence, they appear to partake in, and facilitate a, wealth transfer from lenders to shareholders.

We make two contributions to the literature. First, we highlight the managers' role and incentives in exacerbating lender-shareholder agency conflicts upon CDS inception. Thus, we present a more holistic picture of post-CDS inception shifts in lender-, shareholder-, and managerial-forces that determine a firm's investment policies. Second, we provide an additional explanation for the phenomenon documented by Subrahmanyam et al. (2014). We show that the initiation of trading CDS on a firm's outstanding debt could be followed by an asset substitution that increases the firm's bankruptcy risk.

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Appendix A
Variable Definition

*CDS_Fir*m = one if the firm is in the CDS sample and zero otherwise.
CDS_Trade = a dummy variable that equals one after the inception of CDS trading and zero before CDS trading. The coefficient of interest is that of *CDS_Trade*, which captures the impact of CDS trading on Manager Compensation after the inception of CDS trading.
Total_Comp = the logarithm of salary, bonus, long-term incentive plan payouts, the value of restricted stock grants, the value of options granted during the year, and any other annual pay for the CEO in year t.
Excess_Comp = Excess compensation as actual compensation minus expected compensation. Our benchmark model for expected compensation follows prior research in this area (e.g., Smith and Watts, 1992; Core, Holthausen, and Larcker, 1999; Murphy, 1999): Regress the natural logarithm (Log) of compensation on proxies for economic determinants of CEO compensation
Vega = the dollar change in the executive's wealth for a 0.01 change in standard deviation of returns.
RDEXP = Research and development (R&D) expenditure divided by total assets at the end of fiscal year t, set to 0 if missing.
CAPEX = Capital expenditure scaled by total assets at the end of fiscal year t.
Tenure = the logarithm of the CEO's tenure in years at the end of year t.
SALES = the logarithm of firm sales for year t-1.
S&P500 = one if the firm is in the S&P500 at the end of year t, and zero otherwise.
BTM = (book value of assets) / (book value of liabilities + market value of equity) at the end of year t-1.
STRET = the firm's stock return for year t.
STRETVOL = Standard deviation of firm i's daily stock returns for year t.
ROA = income before extraordinary items divided by average total assets for year t.
SIZE = the logarithm of total assets at year t.
Firm_Age = the logarithm of one plus the difference between the year t and the firm's year of birth. The year of birth is computed as the minimum value of the first year the firm appears on the CRSP.
SalesGrowth = Net sales in year t less net sales in year t−1 scaled by net sales in year t−1.
Cash_Comp = the logarithm of salary and bonus for the CEO in year t.
SurplusCash = Cash from assets-in-place to total assets
MKV = the natural logarithm of firm's market value *(prcc_f*csho)* for year t.
LNDEBT = the natural logarithm of firm's total debt.
INV_GRADE = one if a firm has a S&P credit rating above BB+, and zero otherwise.
CREDIT_RATE = one if a firm has a S&P credit rating, and zero otherwise;
PROFITMARGIN = net income divided by sales.
LEV = Firm i's leverage ratio, defined as debt divided by total assets at the end of fiscal year t.
CashSize = Cash and short-term investments at the end of year t divided by total at the end of fiscal year t.
Default Risk = one if the firm files for bankruptcy for next five years, and zero otherwise.

Table 1
Sample Distribution by Fiscal Year

	CDS Firms		Non CDS Firms
	Pre CDS Contract	Post CDS Contract	
1996	221		512
1997	330		807
1998	352		874
1999	373		885
2000	385		895
2001	247	153	867
2002	185	242	901
2003	111	329	944
2004	64	374	972
2005	33	399	959
2006	21	436	1,031
2007	16	439	1,215
2008	8	441	1,167
2009	6	456	1,181
2010	6	448	1,193
2011	4	440	1,157
2012	2	436	1,133
2013		437	1,104
2014		195	389
	2,364	5,225	18,186

Table 1 report the sample distribution across year. The sample consists of 25,775 firm-year observations for a sample period between 1996 and 2014.

Table 2
Sample Distribution by Industry (Number of Firm-Years)

	CDS Firms		Non CDS Firms
	Pre CDS Contract	Post CDS Contract	
Construction	402	870	1,748
Transportation	252	526	2,485
Food/tobacco	61	162	357
Leisure	273	598	2,962
Textiles/trade	98	239	495
Services	97	185	663
Petroleum	152	313	600
Capital goods	270	795	3,051
Utilities	206	356	2,536
Consumer durables	179	329	1,269
Basic Industry	58	137	509
Real estate and Financial	301	663	943
Others	15	52	568
	2,364	5,225	18,186

Table 2 report the sample distribution across the Campbell (1997) industry classifications, respectively. The sample consists of 25,775 firm-year observations for a sample period between 1996 and 2014.

Table 3
Sample descriptive statistics for CDS firms, before and after the CDS inception

	Pre CDS Contract		Post CDS Contract		Pre − Post
Variable	Mean	S.D.	Mean	S.D.	Mean Diff.
Total_Comp	8.2217	0.9679	8.8146	0.7948	0.5929***
Excess_Comp	-0.1238	0.7906	0.1412	0.6277	0.2650***
Vega	124.5637	183.4287	246.5392	280.2887	121.9755***
RDEXP	0.0200	0.0399	0.0137	0.0295	-0.0063***
CAPEX	0.0664	0.0545	0.0462	0.0457	-0.0202***
Tenure	1.6156	0.9261	1.5476	0.8609	-0.0680***
SALES	8.1092	1.2021	8.8461	1.2285	0.7369***
S&P500	0.5309	0.4992	0.6272	0.4836	0.0963***
BTM	0.6460	0.2643	0.7034	0.2315	0.0573***
STRET	1.1957	0.4688	1.1474	0.3936	-0.0483***
ROA	0.0478	0.0673	0.0445	0.0652	-0.0033**

Table 2 reports descriptive statistics for the full sample. The sample consists of 7,589 firm-year observations for a sample period between 1996 and 2014 for the pre CDS contract and post CDS contract subsamples, separately. All variables are defined in Appendix A.

Table 4
Asset substitution upon the initiation of CDS Trading

Dep. Variable =	*RDEXP*	*RDEXP*	*CAPEX*	*CAPEX*
CDS_Trade	-0.0018	0.0008	0.0004	0.0015
	(-1.0283)	(0.4955)	(0.2075)	(0.6301)
CDS_Firm	0.0030		0.0013	
	(1.7082)*		(0.3768)	
Tenure	0.0004	0.0004	0.0003	0.0004
	(0.7553)	(0.7435)	(0.3163)	(0.3197)
Cash_Comp	0.0012	0.0011	-0.0024	-0.0024
	(0.7011)	(0.6539)	(-1.4997)	(-1.5210)
BTM	-0.0013	-0.0013	-0.0025	-0.0025
	(-1.6702)*	(-1.6602)*	(-1.4035)	(-1.4124)
SALES	0.0027	0.0027	0.0015	0.0015
	(4.2080)***	(4.1700)***	(4.7255)***	(4.7744)***
SurplusCash	-0.2583	-0.2577	0.0426	0.0429
	(-5.1393)***	(-5.1378)***	(1.7130)*	(1.7461)*
SalesGrowth	0.0004	0.0003	0.0038	0.0038
	(0.0839)	(0.0757)	(0.8600)	(0.8566)
STRET	0.0013	0.0013	-0.0041	-0.0042
	(0.7515)	(0.7344)	(-2.3045)**	(-2.3228)**
LEV	-0.0394	-0.0395	-0.0055	-0.0056
	(-4.3350)***	(-4.3460)***	(-0.6685)	(-0.6751)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	13,056	13,056	12,924	12,924
Adj. *R*-square	0.4953	0.4946	0.4176	0.4176

Table 4 reports the effect of CDS trading upon corporate risk taking. The dependent variables are research and development expenditures scaled by assets (R&D) and net capital expenditure scaled by assets (Capex), where net capital expenditure is the capital expenditure net of sale of property, plant and equipment. Control variables are as described in Appendix A. Year and industry fixed effects are included. t-statistics based on robust standard errors clustered by year and industry are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

Table 5
Changes in CEO compensation upon the initiation of CDS trading

Panel A: Total compensation and excess compensation

	CDS Sample	Full Sample	CDS Sample	Full Sample
Dep. Variable	*Total_Comp*	*Total_Comp*	*Excess_Comp*	*Excess_Comp*
CDS_Trade	0.3823	0.3257	0.3141	0.2696
	(4.7475)***	(4.0030)***	(3.8491)***	(3.4228)***
CDS_Firm		-0.1159		-0.1191
		(-1.5521)		(-1.8677)*
Tenure	0.0608	0.0175	0.0450	0.0062
	(2.6917)***	(1.0170)	(2.2974)**	(0.4357)
SALES	0.3363	0.4080	-0.0384	0.0130
	(13.9493)***	(28.1387)***	(-1.5718)	(1.0245)
S&P500	0.0499	0.1024	-0.1046	-0.0316
	(0.9746)	(2.0754)**	(-2.1743)**	(-0.6388)
BTM	-0.5629	-0.6098	-0.0077	-0.0901
	(-2.2926)**	(-4.8897)***	(-0.0426)	(-0.9185)
$STRET_t$	0.0693	0.0859	0.0267	0.0314
	(1.5355)	(2.8130)***	(0.6561)	(1.2017)
$STRET_{t-1}$	0.1393	0.1507	0.0438	0.0529
	(4.5856)***	(6.7315)***	(1.7522)*	(2.6984)***
ROA_t	-0.2024	-0.4100	0.0048	-0.3298
	(-0.6302)	(-2.4619)**	(0.0160)	(-1.5459)
ROA_{t-1}	0.0064	-0.2270	0.2630	-0.0401
	(0.0220)	(-1.4371)	(1.1505)	(-0.2211)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	7,589	25,775	7,589	25,775
Adj. *R*-square	0.361	0.465	0.0527	0.0135

Table 5 continued
Changes in CEO compensation upon the initiation of CDS trading

Panel B: Vega

	CDS Sample	Full Sample
Dep. Variable =	*Vega*	*Vega*
CDS_Trade	0.0486	0.0706
	(4.0110)***	(5.5814)***
CDS_Firm		-0.0155
		(-1.3068)
Tenure	0.0549	0.0207
	(5.0890)***	(4.0399)***
Cash_Comp	0.0476	0.0397
	(2.0206)**	(2.9285)***
SALES	0.0874	0.0546
	(12.8855)***	(15.4828)***
BTM	0.0074	0.0065
	(3.0373)***	(5.0062)***
CashSize	0.2390	0.1713
	(2.1097)**	(5.0450)***
STRET	-0.0448	-0.0206
	(-3.3816)***	(-3.2083)***
STRETVOL	-0.3723	-0.1046
	(-2.0853)**	(-1.3970)
LEV	-0.0046	-0.0261
	(-0.0941)	(-1.1891)
Year Fixed Effect	Yes	Yes
Industry Fixed Effects	Yes	Yes
Num. of obs.	7,026	24,149
Adj. R-square	0.322	0.334

Table 5, Panel A reports the effect of CDS trading upon CEO's total and excess compensation. Panel B reports the effect of CDS trading upon vega. Vega is the dollar change in the CEO's wealth for a 0.01 change in standard deviation of returns. Control variables are as described in Appendix 1. Year and industry fixed effects are included. *t*-statistics based on robust standard errors clustered by year and industry are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

Table 6
Asset substitution upon the CDS inception, conditional on CEO incentives

Panel A: Levels of Vega

Dep. Variable =	*RDEXP*	*RDEXP*	*CAPEX*	*CAPEX*
CDS_Trade	-0.0022	-0.0027	-0.0034	-0.0013
	(-1.1303)	(-1.7405)*	(-1.0280)	(-0.5436)
Vega	0.0053	-0.0016	0.0112	-0.0031
	(1.3929)	(-0.6732)	(2.6251)***	(-0.7821)
CDS_Trade × *Vega*	0.0016	0.0058	-0.0075	0.0010
	(1.9904)**	(3.1016)***	(-2.9567)***	(0.3450)
CDS_Firm		0.0035		0.0034
		(1.6992)*		(0.9289)
Tenure	0.0007	0.0009	0.0019	0.0010
	(1.3743)	(1.9739)**	(1.4174)	(0.9159)
Cash_Comp	-0.0018	-0.0010	-0.0019	-0.0009
	(-1.7708)*	(-1.2007)	(-1.4094)	(-0.7676)
BTM	-0.0004	-0.0012	-0.0027	-0.0032
	(-0.5095)	(-1.5308)	(-1.0590)	(-1.7090)*
SALES	0.0017	0.0020	0.0012	0.0018
	(3.9909)***	(4.8343)***	(3.4316)***	(4.8754)***
SurplusCash	-0.1798	-0.1917	0.0571	0.0343
	(-4.1748)***	(-4.3894)***	(1.5586)	(1.4211)
SalesGrowth	-0.0011	-0.0001	0.0051	0.0040
	(-0.4023)	(-0.0366)	(0.7490)	(0.8304)
STRET	0.0015	0.0016	-0.0034	-0.0040
	(1.2244)	(1.3208)	(-2.0344)**	(-2.4155)**
LEV	-0.0317	-0.0284	-0.0116	-0.0066
	(-3.9575)***	(-3.9740)***	(-1.1141)	(-0.7007)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	7,945	14,636	7,892	14,490
Adj. R-square	0.657	0.640	0.425	0.473

Table 6
Asset substitution upon the CDS inception, conditional on CEO incentives

Panel B: Levels of total compensation

Dep. Variable =	*RDEXP*	*RDEXP*	*CAPEX*	*CAPEX*
CDS_Trade	-0.0126	-0.0331	0.0050	-0.0126
	(-0.8173)	(-2.0274)**	(0.2350)	(-0.9646)
Total_Comp	0.0039	0.0020	0.0016	-0.0006
	(3.5133)***	(2.4047)**	(0.6916)	(-0.5828)
CDS_Trade × *Total_Comp*	0.0011	0.0035	-0.0010	0.0015
	(0.6955)	(2.0239)**	(-0.4449)	(0.9754)
CDS_Firm		0.0033		0.0011
		(1.9140)*		(0.3219)
Tenure	0.0009	0.0004	0.0012	0.0003
	(1.4772)	(0.6537)	(0.9766)	(0.2646)
Cash_Comp	-0.0028	-0.0006	-0.0034	-0.0022
	(-2.7092)***	(-0.4150)	(-2.1466)**	(-1.7767)*
BTM	-0.0012	-0.0024	-0.0014	-0.0025
	(-1.5059)	(-2.5635)**	(-0.5588)	(-1.2792)
SALES	0.0029	0.0028	0.0009	0.0016
	(3.8333)***	(3.9730)***	(3.0164)***	(4.6573)***
SurplusCash	-0.2710	-0.2865	0.0528	0.0425
	(-4.1277)***	(-4.5639)***	(1.4774)	(1.7327)*
SalesGrowth	0.0019	-0.0008	0.0048	0.0038
	(0.4320)	(-0.1713)	(0.6897)	(0.8593)
STRET	0.0007	0.0017	-0.0028	-0.0040
	(0.3606)	(0.9939)	(-1.2874)	(-2.1908)**
LEV	-0.0492	-0.0396	-0.0091	-0.0052
	(-4.1308)***	(-4.1883)***	(-0.8123)	(-0.6246)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	7,148	13,054	7,100	12,922
Adj. R-square	0.476	0.495	0.358	0.416

Table 6 reports whether management compensation structure affects the effect of CDS trading upon corporate asset substitution behavior. The dependent variables are research and development expenditures scaled by assets (R&D) and net capital expenditure scaled by assets (Capex), where net capital expenditure is the capital expenditure net of sale of property, plant and equipment. Vega is the dollar change in the CEO's wealth for a 0.01 change in standard deviation of returns. Control variables are as described in Appendix 1. Year and industry fixed effects are included. *t*-statistics based on robust standard errors clustered by year and industry are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

Table 7
Joint effect of CDS inception and CEO compensation on risk of bankruptcy

Dep. Variable =		*Default Risk*		
CDS_Trade	13.7772	3.2178	13.4463	12.6295
	(11.7541)***	(1.0269)	(11.6416)***	(11.1772)***
Total_Comp		0.0600		
		(0.5380)		
CDS_Trade × *Total_Comp*		1.1431		
		(3.2208)***		
Excess_Comp			-0.0287	
			(-0.2636)	
CDS_Trade ×*Excess_Comp*			0.6205	
			(1.9863)**	
Vega				0.5877
				(2.0639)**
CDS_Enter × *Vega*				0.8203
				(2.1872)**
CDS_Firm	-15.3796	-14.8670	-15.1316	-14.4190
	(-23.8746)***	(-23.6986)***	(-24.1518)***	(-22.2026)***
Tenure	-0.1590	-0.1601	-0.1574	-0.1667
	(-2.0991)**	(-2.1319)**	(-2.1234)**	(-1.8712)*
MKV	-0.7973	-0.8258	-0.7953	-0.8463
	(-10.3111)***	(-9.3146)***	(-10.0561)***	(-11.4490)***
LNDEBT	0.4490	0.4432	0.4498	0.4109
	(3.4131)***	(3.4500)***	(3.4056)***	(3.1456)***
STRET	-0.0314	-0.0253	-0.0312	0.0040
	(-0.1822)	(-0.1486)	(-0.1817)	(0.0229)
STRETVOL	2.0037	2.0146	2.0196	2.0948
	(1.7937)*	(1.8343)*	(1.8153)*	(2.0760)**
ROA	-2.5543	-2.5277	-2.5768	-2.5094
	(-4.6856)***	(-4.5938)***	(-4.7381)***	(-4.1588)***
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	20,157	20,157	20,157	18,990
Adj. R-square	0.2366	0.2385	0.2369	0.2469

Table 7 reports the joint effect of CDS initiation and CEO compensation changes on the risk of bankruptcy. *Default Risk* is an indicator variable equal to 1 if the firm files for bankruptcy for next five years, and 0 otherwise. Vega is the dollar change in the CEO's wealth for a 0.01 change in standard deviation of returns. Control variables are as described in Appendix 1. Year and industry fixed effects are included. *t*-statistics based on robust standard errors clustered by year and industry are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

Table 8
Changes in CEO Compensation upon CDS inception (propensity matched sample)

Panel A: Comparison between CDS and propensity matched non-CDS firms in the year before CDS inception

	CDS		Non CDS		CDS – Non CDS
Variable	Mean	S.D.	Mean	S.D.	Mean Diff.
Total_Comp	8.5696	0.9609	8.7319	1.1389	-0.1623**
Excess_Comp	0.0777	0.81939	0.2799	0.8802	-0.2023***
Vega	200.7024	255.2474	203.0151	276.7447	-2.3127
Tenure	1.5387	0.9048	1.7033	0.9099	-0.1646**
SALES	8.4558	1.1960	8.4457	1.3840	-0.0101
S&P500	0.5766	0.4947	0.2984	0.4583	-0.2782***
BTM	0.6674	0.2559	0.6970	0.2583	0.0296
STRET	1.1371	0.4167	1.0897	0.3778	0.0474
ROA	0.0434	0.0651	0.0339	0.0765	0.0095*
CashSize	0.0903	0.1098	0.1003	0.1193	0.0100***
STRETVOL	0.0893	0.0518	0.0923	0.0553	-0.0030***
LEV	0.2754	0.1539	0.2847	0.1970	-0.0094***

Panel B: First stage model: Prediction model for probability of initiating CDS trading

	ESTIMATE
Intercept	-7.592019
	(-14.63)***
INV_GRADE	0.2104
	(2.4192)**
CREDIT_RATE	1.0496
	(8.9653)***
LEV	0.6891
	(3.5621)***
PROFITMARGIN	-0.0335
	(-0.1573)
SIZE	0.3462
	(13.0236)***
STRETVOL	-1.8892
	(-2.9139)***
MB	-0.1052
	(-3.4763)***
Year Fixed Effect	Yes
Industry Fixed Effects	Yes
Observations	15,244
Chi Square	1841.59 (P-Value <.0001)
Percent concordant	91.5
Percent discordant	7.8

Table 8 continued

Changes in CEO Compensation upon CDS inception (propensity matched sample)

Panel C: Changes in CEO Compensation upon the Initiation of CDS Trading

Dep. Variable =	*Total_Comp*	*Total_Comp*	*Excess_Comp*	*Excess_Comp*
CDS_Trade	0.3319	0.1215	0.2908	0.1027
	(4.6163)***	(2.0286)**	(3.8709)***	(1.8466)*
CDS_Firm	-0.3313		-0.2830	
	(-4.3681)***		(-3.4715)***	
Tenure	0.0607	0.0563	0.0617	0.0559
	(2.4515)**	(2.6440)***	(3.0529)***	(3.4681)***
SALES	0.4125	0.3955	0.0195	0.0334
	(12.2146)***	(12.8006)***	(0.7890)	(1.4962)
S&P500	0.0400	-0.0016	-0.1045	-0.1443
	(0.4931)	(-0.0239)	(-1.1802)	(-2.1038)**
BTM	-0.5670	-0.5327	-0.0573	-0.0721
	(-2.6065)***	(-2.4988)**	(-0.3425)	(-0.4899)
$STRET_t$	0.0899	0.0713	0.0382	0.0229
	(2.3278)**	(2.0075)**	(1.1526)	(0.7617)
$STRET_{t-1}$	0.1712	0.1433	0.0867	0.0586
	(5.1652)***	(5.3243)***	(2.5562)**	(2.2866)**
ROA_t	-0.2248	-0.1339	-0.0376	0.0535
	(-0.6833)	(-0.4936)	(-0.0985)	(0.1607)
ROA_{t-1}	-0.2977	-0.4066	0.0803	-0.0798
	(-0.6912)	(-1.0331)	(0.1918)	(-0.2127)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	11,421	11,421	11,421	11,421
Adj. R-square	0.403	0.389	0.0478	0.0307

Panel D: Changes in Vega of CEO wealth after CDS inception

Dep. Variable =	*Vega*	*Vega*
CDS_Trade	0.0501	0.0085
	(3.5686)***	(0.3320)
CDS_Firm	-0.0465	
	(-2.1579)**	
Tenure	0.0339	0.0336
	(3.7654)***	(3.7537)***
Cash_Comp	0.0624	0.0636
	(2.8160)***	(2.8544)***
SALES	0.0692	0.0694
	(9.0675)***	(8.8406)***
BTM	0.0121	0.0121
	(3.9279)***	(3.9867)***
CashSize	0.1899	0.1922
	(1.7119)*	(1.7813)*
STRET	-0.0311	-0.0308
	(-2.1429)**	(-2.0804)**
STRETVOL	-0.0096	-0.0004
	(-0.0416)	(-0.0019)
LEV	-0.0982	-0.0939
	(-2.0452)**	(-1.9130)*
Year Fixed Effect	Yes	Yes
Industry Fixed Effects	Yes	Yes
Num. of obs.	14,943	14,943
Adj. R-square	0.323	0.319

Table 8 reports results by using the propensity matching approach. Panel A reports the univariate differences between treatment and control samples. Panel B reports estimation results of a logistic model to predict the onset of CDS trading. The propensity score matching approach involves pairing treatment and control firms based on similar observable characteristics (Dehejia and Wahba 2002). The dependent variable, *CDS_Trade*, equals 1 if a CDS is traded on a firm, and 0 otherwise. The independent variables include *INV_GRADE*, an indicator variable that equals 1 if a firm has a S&P credit rating above BB+, and 0 otherwise; *CREDIT_RATE*, an indicator variable that equals 1 if a firm has a S&P credit rating, and 0 otherwise; *MB*, the ratio of market value of equity to book value of total assets; *PROFITMARGIN*, net income divided by sales; *RETVOL*, standard deviation of monthly stock return within a fiscal year. Other variables are defined in Appendix A. The sample period spans 1997 to 2010, and includes firms with and without traded CDS during this period. For firms with traded CDS, only firm-years prior to the onset of CDS trading are included in the sample. Table 10 Panel B reports the regression results where CDS trading increases corporate tax avoidance, based on the propensity-matched treatment and control samples. *t*-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen, 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 9

Changes in CEO compensation upon the initiation of CDS Trading (two-stage instrumental variable approach)

Panel A: 1st stage model

DEP. VARIABLE	*CDS_ENTER*
INV_GRADE	-0.2027
	(-1.6268)
CREDIT_RATE	2.5726
	(11.9944)***
LEV	1.2888
	(3.6152)***
PROFITMARGIN	-0.4534
	(-0.9843)
SIZE	0.3712
	(4.6986)***
STRETVOL	-3.8433
	(-6.0713)***
MB	-0.4798
	(-6.6939)***
Tenure	0.0019
	(0.0407)
Sales	0.3911
	(4.8041)***
S&P500	0.9543
	(8.0409)***
$STRET_t$	-0.1373
	(-2.3133)**
$STRET_{t-1}$	-0.1842
	(-3.4766)***
ROA_t	1.5412
	(1.8552)*
ROA_{t-1}	-1.4027
	(-3.6823)***
Cash_Comp	-0.2807
	(-4.0285)***
CashSize	1.3790
	(3.1147)***
Year Fixed Effect	Yes
Industry Fixed Effects	Yes
Observations	27,925
R-square	0.392

Panel B: 2nd stage model

Dep. Variable =	*Total_Comp*	*Total_Comp*	*Excess_Comp*	*Excess_Comp*
CDS_Trade	1.5490	1.5749	0.9558	0.9505
	(6.1234)***	(6.0511)***	(6.7230)***	(6.5049)***
CDS_Firm	0.0330		-0.0068	
	(0.8232)		(-0.2497)	
Tenure	0.0119	0.0119	0.0047	0.0047
	(0.7137)	(0.7104)	(0.3423)	(0.3423)
Sales	0.3351	0.3365	-0.0249	-0.0252
	(33.0343)***	(33.0600)***	(-2.5022)**	(-2.4703)**
S&P500	0.0557	0.0587	-0.0592	-0.0598
	(1.0421)	(1.1442)	(-1.0977)	(-1.1353)
BTM	-0.6133	-0.6119	-0.0921	-0.0923
	(-5.0755)***	(-5.0741)***	(-0.9030)	(-0.9109)
$STRET_t$	0.0758	0.0760	0.0244	0.0244
	(2.4740)**	(2.4817)**	(0.8867)	(0.8856)
$STRET_{t-1}$	0.1459	0.1461	0.0494	0.0494
	(6.6542)***	(6.6594)***	(2.4431)**	(2.4315)**
ROA_t	-0.1359	-0.1361	-0.1723	-0.1723
	(-0.7967)	(-0.7987)	(-0.8142)	(-0.8135)
ROA_{t-1}	-0.0871	-0.0900	0.0171	0.0177
	(-0.6178)	(-0.6381)	(0.1054)	(0.1082)
Partial F-Statistic	F = 669.16 (p < 0.0001)			
Weak Identification Test	Cragg-Donald Wald F = 1530.49 Stock-Yogo C.V.: 10% Max IV size 16.38 Stock-Yogo C.V.: 15% Max IV size 8.96			
Underidentification test	Chi^2 = 1452.99 (p < 0.0001)			
Endogeneity test	Chi^2 = 35.246 (P < 0.0001)			
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Num. of obs.	23,754	23,754	23,754	23,754
Adj. R-square	0.473	0.473	0.015	0.015

Panel C: 2nd stage model

Dep. Variable =	*Vega*	*Vega*
CDS_Trade	0.6875	0.2446
	(24.2872)***	(31.6281)***
CDS_Firm	-0.3993	
	(-22.2765)***	
Tenure	0.0228	0.0213
	(15.4929)***	(17.8650)***
Cash_Comp	0.0530	0.0405
	(21.1678)***	(20.7600)***
SALES	0.0334	0.0270
	(23.1548)***	(20.9163)***
BTM	0.0070	0.0060
	(16.0531)***	(16.9992)***
CashSize	0.1457	0.1437
	(15.7888)***	(19.2344)***
STRET	-0.0189	-0.0211
	(-6.7959)***	(-9.3705)***
STRETVOL	-0.2345	-0.1036
	(-9.5289)***	(-5.3740)***
LEV	-0.0396	-0.0649
	(-5.0793)***	(-10.0750)***
Partial F-Ststistic	F = 200.52 (p < 0.0001)	
Weak Identification Test	Cragg-Donald Wald F = 1133.87	
	Stock-Yogo C.V.: 10% Max IV size 16.38	
	Stock-Yogo C.V.: 15% Max IV size 8.96	
Underidentification test	Chi^2 = 1091.20 (p < 0.0001)	
Endogeneity test	Chi^2 = 837.60 (P < 0.0001)	
Year Fixed Effect	Yes	Yes
Industry Fixed Effects	Yes	Yes
Num. of obs.	27,923	27,923
Adj. *R*-square	0.170	0.234

Table 9 reports results on the relation between CDS initiation and management compensation using a 2-SLS approach. Panel A reports the first stage model results. Panel B and C report second stage results when the dependent variables are *Total_Comp* and *Vega*, respectively. All variables are defined in Appendix A. *t*-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen, 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

Table 10
Effect of CDS Initiation on CEO Compensation, conditioning on Lender Identity

Risk capital ratio =	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase
Dep. Variable =	*RDEXP*	*RDEXP*	*CAPEX*	*CAPEX*	*RDEXP*	*RDEXP*	*CAPEX*	*CAPEX*
CDS_Trade	-0.0025	-0.0074	0.0053	-0.0050	0.0158	-0.0624	-0.0144	-0.0192
	(-0.5889)	(-2.2606)**	(0.9067)	(-1.3982)	(0.8316)	(-2.0275)**	(-0.5304)	(-0.7002)
Vega	0.0101	0.0147	-0.0052	-0.0132				
	(1.4090)	(1.3755)	(-0.5463)	(-1.2770)				
CDS_Trade × Vega	0.0078	0.0326	-0.0022	0.0061				
	(2.5457)**	(2.4766)**	(-0.7090)	(0.7741)				
Total_Comp					0.0038	0.0038	0.0010	-0.0002
					(2.9876)***	(1.4949)	(0.4427)	(-0.0616)
CDS_Trade× Total_Comp					-0.0019	0.0071	0.0022	0.0017
					(-0.9662)	(2.0905)**	(0.7131)	(0.5205)
Difference	0.0248		0.0083		0.009		-0.0005	
	(1.84)*		(0.98)		(2.30)**		(-0.11)	
CDS_Firm	0.0073	0.0019	0.0011	-0.0001	0.0080	0.0017	0.0012	0.0010
	(3.6695)***	(0.5752)	(0.1548)	(-0.0261)	(3.5373)***	(0.5622)	(0.1843)	(0.2260)
Tenure	0.0006	-0.0025	0.0028	-0.0005	0.0016	-0.0015	0.0024	-0.0008
	(1.1273)	(-2.4298)**	(1.2937)	(-0.3279)	(1.6135)	(-1.8181)*	(1.2967)	(-0.6225)
Cash_Comp	0.0001	0.0021	0.0002	-0.0067	-0.0025	0.0000	-0.0015	-0.0076
	(0.0567)	(0.6945)	(0.0768)	(-4.4469)***	(-1.2200)	(0.0055)	(-0.4900)	(-3.8871)***
BTM	-0.0043	-0.0011	-0.0071	-0.0025	-0.0040	-0.0009	-0.0080	-0.0033
	(-3.4832)***	(-2.4106)**	(-2.6755)***	(-0.7619)	(-2.6640)***	(-1.0534)	(-2.9250)***	(-1.0668)
SALES	0.0028	0.0038	0.0015	0.0022	0.0028	0.0040	0.0014	0.0021
	(13.9132)***	(2.4377)**	(2.2196)**	(3.0774)***	(5.6257)***	(2.8969)***	(2.4344)**	(3.1713)***
SurplusCash	-0.2593	-0.2386	0.0512	0.0184	-0.2747	-0.2684	0.0536	0.0255
	(-5.3315)***	(-3.9670)***	(1.0318)	(0.5119)	(-4.4697)***	(-4.1747)***	(1.1233)	(0.8540)
SalesGrowth	-0.0053	0.0055	0.0068	0.0025	-0.0071	0.0055	0.0055	0.0030
	(-0.7333)	(0.9660)	(0.8986)	(0.5472)	(-1.0161)	(1.3415)	(0.7892)	(0.6538)
STRET	0.0008	-0.0008	-0.0006	-0.0078	0.0004	-0.0013	-0.0005	-0.0076
	(0.4290)	(-0.2597)	(-0.2142)	(-7.7482)***	(0.1881)	(-0.3680)	(-0.1572)	(-4.3600)***
LEV	-0.0539	-0.0425	-0.0421	0.0010	-0.0570	-0.0487	-0.0416	0.0040
	(-4.5212)***	(-2.7826)***	(-2.5849)**	(0.0311)	(-3.7487)***	(-3.0838)***	(-2.6492)***	(0.1628)

Industry and year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of obs.	3,697	3,467	3,691	3,451	3,697	3,467	3,691	3,451
Adj. *R*-square	0.472	0.571	0.409	0.344	0.472	0.554	0.410	0.342

Table 10 reports results on the relation between CDS initiation and management compensation, conditional on lender identity. We identify lenders to CDS and non-CDS firms in our sample using the Dealscan database, and collect the risk weights on banks' assets from the Federal Reserve's Y-9C reports. We infer that lenders which a change in risk capital ratio increased are more likely to have hedged their risk to the specific borrower through the CDS contracts. We then categorize the sample into two subsamples, e.g., firm-year observations with the increase in the capital ratios and firm-year observations with the increase in the capital ratios. All variables are defined in Appendix A. *t*-statistics in parentheses are based on robust standard errors clustered by industry and year (Petersen, 2009). ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.