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Credit Default Swaps and Firm Value

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Abstract

This article provides evidence that firm value declines when credit default swaps (CDSs) are initiated and that the effect is greater when CDS trading activity is higher. This decline, which arises from an increase in the cost of capital as opposed to a decrease in free cash flows, traces to a deterioration in the firm's credit quality and stock liquidity. Firm value declines less when CDS trading is likely to produce incremental information, suggesting that CDS trading has informational benefits for firm value. However, the evidence does not indicate that firm value increases because CDS availability facilitates investments.

I. Introduction

Credit default swaps (CDSs) are third-party contracts between a protection buyer and a protection seller, through which the protection buyer can insure against a reference entity's default in return for a periodic payment to the protection seller. In a frictionless world, these credit derivatives are redundant securities that do not imply any valuation consequences for the reference entity. However, when markets are incomplete or frictions impede contracting, valuation consequences can arise. In this article, we examine the valuation effects associated with the availability of CDSs on a firm.

In principle, the reference firm's value can increase or decrease depending on the effect the availability of CDSs has on the firm's financing (cost of capital) and investments (cash flows). The literature suggests that firm value can decrease because the cost of capital increases when creditors hedged with CDSs introduce renegotiation frictions that increase credit risk (Subrahmanyam, Tang, and Wang (2014)) or when investors with private information on default risk trading across CDSs and stock markets reduce stock liquidity (Boehmer, Chava, and Tookes (2015)). However, the literature also suggests that firm value can increase because

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the new information CDS trading produces on credit risk reduces the cost of capital (Batta, Qiu, and Yu (2016)) or because the ability of creditors to hedge against credit risk alleviates credit constraints, allowing the firm to undertake investments that it would have otherwise bypassed (Danis and Gamba (2018)). Whether the availability of CDSs affects firm value, and if so, how, is therefore an empirical question.

To determine the valuation effects associated with CDSs, we analyze firm value, proxied by Tobin's q, for a sample of U.S. industrial firms surrounding the initiation of CDS trading between 2001 and 2013. We find that Tobin's q declines with the initiation of CDS trading, indicating that the availability of CDSs has negative valuation consequences. We conduct several tests to examine the robustness of this finding. We use continuous measures of CDS trading activity (the notional amount of CDSs outstanding and a proxy for CDS liquidity), instead of a binary indicator of CDS introduction, and find that firm valuations are negatively related to CDS trading activity. We examine the changes in firm value associated with CDS termination (a reversal of CDS initiation) and find that firm value increases with CDS termination. Following Gompers, Ishii, and Metrick (2010), we also estimate median regressions and use alternative proxies for firm value to ensure that our finding is not a consequence of measurement error in Tobin's q.

It is conceivable that the initiation of CDS trading is in response to a contemporaneous or expected deterioration in credit quality or that the selection of firms for CDS trading is nonrandom, both of which would bias the results in favor of finding a decline in firm value. We conduct several tests to address this concern. We estimate regressions using firm fixed effects that control for unobserved time-invariant firm characteristics, conduct a within-sample test involving only those firms that had a CDS listed at any time during our sample period, and implement a propensity-score-matching method to mitigate the bias associated with firms being selected for CDS trading. We find that firm value declines with CDS initiation in these alternative empirical specifications.

Following the prior literature, we also instrument for CDS initiation using the foreign exchange hedging positions of financial institutions affiliated with the reference firm. The intuition for this instrument is that financial institutions that are heavily involved in foreign exchange hedging operations are also likely to generate demand for CDSs on their borrowers that is independent of the demand for CDSs arising from the borrowers' credit quality. Our instrumental variable estimation indicates that firm value declines with CDS initiation.

Finally, we utilize the International Swaps and Derivatives Association's release of the Big Bang Protocol (BBP) on Apr. 8, 2009, as a quasi-experiment. Prior to the BBP, out-of-court debt restructurings were recognized as a credit event on CDS contracts that referenced most investment-grade firms, but not high-yield firms. The BBP eliminated out-of-court restructurings as a credit event on all standard CDS contracts referencing North American entities. The BBP thus strengthened the incentives for hedged creditors to resist out-of-court restructurings and favor bankruptcy, which would trigger payments on their CDS contracts, thereby increasing the expected distress costs for investment-grade firms relative to high-yield firms. We find that firm value declines more for investment-grade firms relative to high-yield firms with CDS trading following the implementation

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of the BBP. This finding supports the negative relation between CDS initiation and firm value.

Given that we observe firm value to decline with the initiation of CDS trading, we investigate the drivers of this decline next. As a first step, we examine whether the decline in firm value arises from a decrease in free cash flows or from an increase in the cost of capital. We find that CDS initiation is associated with an increase in the cost of capital and that there is no significant change in free cash flows. To further investigate the source of this increase in the cost of capital, we specifically examine the changes in credit risk and stock liquidity surrounding the inception of CDS trading. Using various measures of credit risk and stock liquidity, we find that CDS initiation increases credit risk and lowers stock liquidity, both of which increase the cost of capital.

Given the arguments in the literature that CDS availability can increase firm value, we also explore why firm value does not increase with the initiation of CDS trading. Although we observe no change in free cash flows, we find that investments decline with CDS initiation, suggesting that the availability of CDSs affects the deployment of cash toward investments. This finding is consistent with the evidence in Subrahmanyam, Tang, and Wang (2017) that firms increase their cash holdings after CDS initiation as a precautionary measure to protect themselves against hedged creditors who are less likely to renegotiate their debt in financial distress. We do, however, find that CDS initiation reduces valuations less among firms for which the information benefits associated with CDS are likely to be higher. This evidence suggests that the availability of CDSs improves information production about the firm and thus increases firm value, but it is not sufficient to outweigh the value-decreasing effects associated with CDS availability.

Our article adds to the literature on the real effects of CDSs by showing that firm value declines with the initiation of CDS trading. In a related study, Danis and Gamba (2018) theoretically investigate the net effect of CDSs on firm value by modeling a dynamic economy where firms make optimal investment and financing decisions. In their model, CDSs increase creditors' bargaining power in debt renegotiations, which reduces strategic default risk but increases bankruptcy risk. Therefore, the net effect of CDSs on firm value depends on the levels of bankruptcy costs and ex ante creditor bargaining power. Using simulated data, they find that CDS initiation increases firm value for the average U.S. corporation. Our empirical findings contradict theirs, possibly because empirical estimates reveal that the benefits of deterring strategic default are small (Davydenko and Strebulaev (2007)), or bankruptcy costs accounting for their systematic components are large (Almeida and Philippon (2008)), or their model neglects the effect CDSs have on reducing stock liquidity and increasing cash holdings.

Our evidence also contributes to the debate on the empty creditor hypothesis, which conjectures that creditors with CDS protection face incentives to resist debt renegotiations in favor of bankruptcy (Hu and Black (2008)). Danis (2017) finds evidence that supports the presence of such resistance in the out-of-court debt restructurings of reference entities. Furthermore, Subrahmanyam et al. (2014) find that bankruptcy risk increases upon CDS initiation. However, Bedendo, Cathcart, and El-Jahel (2016) do not find evidence that firms with CDSs disproportionately file for bankruptcy instead of restructuring their debt out of court, which does not

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support the empty creditor hypothesis. Our evidence supports the empty creditor hypothesis by showing that CDS initiation is associated with a decline in firm value through increasing credit risk.

The rest of the article is organized as follows: Section II reviews the relevant literature and identifies the channels through which CDSs can affect firm value. Section III contains the data and variable definitions. Section IV presents the empirical analyses and results. Finally, Section V concludes the article with a summary of the findings.

II. CDSs and Firm Value

The initiation of CDS trading can decrease or increase firm value depending on its effect on the firm's cost of capital and investments. This section summarizes arguments in the literature based on whether they predict a decrease or an increase in firm value.[1]

A. CDSs and Decrease in Firm Value

The arguments in the literature that predict a decrease in firm value following the initiation of CDS trading relate to an increase in the firm's credit risk or a decrease in its stock liquidity, both of which raise the firm's cost of capital.

1. Credit Risk Channel

Legal scholars Hu and Black (2008) argue that when creditors hedge using CDSs, they not only insure their cash flows but also decouple the cash flows from the associated control rights, effectively becoming "empty creditors." Empty creditors, they argue, face incentives to resist out-of-court debt renegotiations and favor a costlier bankruptcy resolution when the firm is in distress because bankruptcy triggers payments on their CDS contracts. Bolton and Oehmke's (2011) theoretical work shows that such incentives increase the firm's bankruptcy risk. Morrison (2005) and Parlour and Winton (2013) also point out that hedging with CDSs reduces lenders' incentives to monitor, permitting the borrowing firm to undertake riskier projects, thereby increasing the firm's credit risk.

In line with these arguments, Subrahmanyam et al. (2014) find that the initiation of CDS trading increases a firm's probability of a rating downgrade and bankruptcy. The empirical evidence shows that this CDS-related increase in credit risk can translate into a higher cost of debt. Ashcraft and Santos (2009) find that at-issue bond spreads increase with CDS initiation for risky reference entities, whereas Narayanan and Uzmanoglu (2018) find that secondary market bond spreads increase with CDS trading activity. Similarly, Amiram, Beaver, Landsman, and Zhao (2017) find that loan spreads increase with the inception of CDS trading. This literature thus suggests that the increase in credit risk associated with the availability of CDSs could decrease firm value.

[1] Augustin, Subrahmanyam, Tang, and Wang (2014) provide a detailed review of the CDS literature.

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2. Liquidity Channel

Boehmer et al. (2015) argue that the availability of CDSs allows investors with private information about the firm's credit risk to trade strategically across the CDS and equity markets. This, they argue, has the effect of driving out uninformed investors from the equity market, thereby decreasing the firm's stock liquidity. They show that CDS initiation increases the effective bid–ask spread on the firm's stock by 19.4%. Amihud and Mendelson (1986) provide evidence that a decrease in stock liquidity increases the firm's cost of equity, suggesting that the decrease in stock liquidity associated with the availability of CDSs could decrease firm value. Similarly, Das, Kalimipalli, and Nayak (2014) argue that bond liquidity could decline with the availability of CDSs but find weak evidence to support it.

B. CDSs and Increase in Firm Value

The literature also predicts that firm value can increase because the availability of CDSs reduces the cost of capital by improving the reference firm's information environment or increases investments by alleviating its supply-side credit frictions.

1. Information Channel

Cao (1999) argues that introducing derivative instruments increases the incentive for investors to collect information about the underlying firm's assets and therefore leads to more informative security prices. Because they are derivative instruments for trading credit risk, CDSs can also stimulate information production about the reference firm's assets, thereby reducing the adverse-selection costs associated with financing (e.g., Diamond and Verrecchia (1991), Easley and O'Hara (2004)) and lowering the cost of capital. Empirical evidence in Acharya and Johnson (2007), Ni and Pan (2015), and Batta et al. (2016) indicates that CDS trading activity indeed reveals incremental information about the reference firm's credit risk. This literature, therefore, suggests that the incremental information production associated with the availability of CDSs could reduce the cost of capital and increase firm value.

2. Investment Channel

Bolton and Oehmke (2011) theoretically show that the availability of CDSs reduces the threat that the firm will strategically default because hedging with CDSs protects creditors against default. Consequently, they argue that firms can use CDSs to commit against strategic default and thereby raise their debt capacity. Narayanan and Uzmanoglu (2018) show that this reduction in the threat of strategic default is reflected in bond-level credit spreads. Saretto and Tookes (2013) show that the reduced threat of strategic default increases debt capacity by providing evidence that firms increase their leverage and extend their debt maturities after the initiation of CDS trading. In a theoretical setting, Danis and Gamba (2018) show that this increased financing capacity can allow firms to undertake investment projects that might otherwise be bypassed. Using simulated data, they show that the availability of CDSs increases both leverage and investments and results in an increase in firm value. This strand of the literature thus suggests that

the availability of CDSs is associated with an increase in investments that could increase firm value.

III. Data and Variables

A. Sample

To construct the sample for our study, we begin by identifying all U.S. industrial firms available in both the Center for Research in Security Prices (CRSP) and Compustat databases between 2001 and 2013. We start in 2001 because the earliest CDS activity we observe in the Bloomberg and Credit Market Analysis (CMA) combined CDS database occurs in 2001. We retain only those firms that have a positive book value of equity and nonmissing market value of equity, which are required to compute the market-to-book ratio used in the analysis, resulting in a sample of about 6,000 firms, of which 503 become CDS reference entities during the sample period.

We identify the date CDS contracts begin trading on a firm as the first date on which price quotes for those single-name contracts are reported in the Bloomberg and CMA databases. The Bloomberg and CMA databases provide daily consensus CDS price quotes contributed by dealers starting in 2001 and 2004, respectively. If the CDS contract is on a subsidiary, we include it at the parent level.[2] Following Ashcraft and Santos (2009), we identify the firm-quarters following the CDS initiation date by a CDS_TRADING variable, which equals 1 for quarters following the CDS initiation date, and 0 otherwise. We also define a CDS_TRADED dummy variable that equals 1 if the firm is referenced by a CDS contract at any time during the sample period, and 0 otherwise (see Figure IA-1 of the Internet Appendix, available at www.jfqa.org) for an illustration of how the CDS_TRADING and CDS_TRADED variables differ). We use the CDS_TRADED variable to control for unobserved time-invariant differences in the characteristics of CDS versus non-CDS firms.

Panel A of Table 1 reports the distribution of the 161,954 firm-quarters in our sample by year. There are 15,614 firm-quarters in 2001, and the number of firm-quarters monotonically declines to 10,397 observations in 2013. The declining trend in the number of observations is consistent with the anecdotal evidence that the number of public companies in the United States has declined in recent years.[3]

The "CDS Traded/All (%)" column in Table 1 reports the number of firm-quarters associated with a firm that has a CDS traded over our sample period as a percentage of all firm-quarters. On average, firms with a traded CDS contribute about 13% to all firm-quarters. These firms represent about 70% of the market capitalization of our sample firms. The presence of firms with CDSs traded in our sample gradually increases from 11.27% in 2001 to 13.68% in 2013.

The "CDS Trading/CDS Traded (%)" column in Table 1 reports the number of firm-quarters with CDS trading as a percentage of the number of firm-quarters

[2] As an example, we include the CDS listed on Ford Motor Credit Company (the subsidiary) under Ford Motor Company (the parent and ultimate guarantor). We do so because our firm-level variables are for the parent company. Our results are not sensitive to this classification (see Table IA-1 in the Internet Appendix for details).

[3] See "A Premature Eulogy for Public Companies" (Oct. 10, 2012), Knowledge@Wharton.

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TABLE 1
Sample Distribution

Table 1 presents the distributions for the sample of 161,954 firm-quarters by years, Standard & Poor's (S&P) long-term credit ratings, and the Fama–French (1997) industry classifications. The sample includes nonfinancial U.S. firms at the intersection of the Center for Research in Security Prices (CRSP) and Compustat databases between the years 2001 and 2013 with a positive book value of common equity and nonmissing market value of common equity. CDS_TRADING is a dummy variable that equals 1 for quarters following the credit default swap (CDS) initiation date, and 0 otherwise. CDS_TRADED is a dummy variable that equals 1 if there is a CDS traded on the firm's debt at any time during the sample period, and 0 otherwise.

	All	CDS Traded/All (%)	CDS Trading/CDS Traded (%)
Panel A. Distribution by Years			
2001	15,614	11.27	0.34
2002	14,458	12.10	10.23
2003	13,593	12.61	31.21
2004	13,470	12.91	48.76
2005	13,242	13.19	78.92
2006	13,008	13.10	90.67
2007	12,811	13.07	96.36
2008	12,209	13.29	97.78
2009	11,222	13.65	98.63
2010	10,891	13.85	98.94
2011	10,610	14.01	98.92
2012	10,429	13.78	99.23
2013	10,397	13.68	99.72
Panel B. Distribution by Ratings			
AAA	339	82.30	65.59
AA	1,037	74.93	68.73
A	6,722	72.34	69.67
BBB	13,583	63.01	75.50
BB	13,331	27.72	68.83
B	9,158	18.44	78.39
CCC	527	15.37	83.95
CC	32	62.50	45.00
D	124	13.71	17.65
Panel C. Distribution by Fama–French Industry Classification			
Durables	4,178	13.50	70.74
Non-durables	9,172	17.98	74.59
Manufacturing	18,375	15.13	71.76
Energy	8,031	23.00	71.58
Chemicals	4,432	26.99	75.17
Business equipment	40,184	4.70	68.04
Telecommunications	5,098	28.23	71.72
Utilities	5,881	38.70	73.37
Shops	18,586	13.45	71.08
Health	23,852	6.75	65.78

with CDSs traded. In 2001, 0.34% of the firm-quarters with CDSs traded involve firms that have CDS trading. By 2006, this percentage increases to over 90% of the firm-quarters, indicating that most the CDS initiations occur prior to 2006.

Panel B of Table 1 presents the sample distribution of firm-quarters by Standard & Poor's (S&P) long-term credit ratings. The percentage of observations with traded CDSs declines as the credit ratings deteriorate (except for the CC rating class). The proportion of AAA-rated firm-quarters with CDSs traded is 82.30%, whereas it is 13.71% for the D-rated firm-quarters.

Panel C of Table 1 presents the sample distribution of firm-quarters by the Fama–French (1997) 12-industry classification scheme. The utilities industry has the highest concentration of CDS traded firms (38.70%), and the business equipment industry has the lowest concentration of CDS traded firms (4.70%).

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B. Firm and CDS Activity Characteristics

This section presents the firm and CDS activity characteristics for the sample described earlier. The stock price, volume, and shares outstanding variables are from CRSP, and all other financial information is from Compustat. We compute two measures of firm value: Tobin's q (TOBINS_Q) and the market-to-book-equity ratio (MB_RATIO). Following Chung and Pruitt (1994), we estimate Tobin's q as a ratio of the sum of the market value of common equity, the book value of preferred equity, and the book value of total debt divided by the book value of total assets. We use TOBINS_Q as the primary valuation measure in our baseline regressions and MB_RATIO in our robustness checks.

We follow Roll, Schwartz, and Subrahmanyam (2009) in identifying variables that affect firm value. We use the market value of equity reported in the latest financial statements prior to a given quarter as a proxy for firm size (MVE) to control for firm characteristics that vary with size, such as scale economies. We also construct the following variables: stock liquidity (STOCK_TURNOVER), the quarterly average of daily share volume divided by shares outstanding, to control for the effects of stock trading activity on firm value; return on assets (ROA), the quarterly net income divided by the book value of assets, to control for firm profitability; annual capital expenditures divided by sales (CAPX_TO_SALES), to proxy for the firm's investment opportunities; leverage (DEBT_TO_ASSETS), the quarterly long-term debt divided by total assets, to control for capital structure; and a dividend indicator variable (DIVIDEND_DUM), which equals 1 if the firm pays dividends in a quarter, and 0 otherwise, to control for capital constraints and investment opportunities. In addition to these variables, we also control for firm age because Pastor and Veronesi (2003) show that the market-to-book ratio is predicted to decline over a firm's lifetime and that younger firms have higher market-to-book ratios. We define AGE as the age of a firm in years at the beginning of a quarter, assuming that the firm is born in the year of its first appearance in the CRSP database. Variable definitions are also provided in the Appendix.

Panel A of Table 2 reports the mean and median values of these firm-level variables for firm-quarters with and without CDS trading. TOBINS_Q is significantly lower for firms with CDS trading relative to firms without CDS trading. The mean (median) TOBINS_Q is 1.28 (1.06) for firms with CDS trading and 1.80 (1.25) for firms without CDS trading. Firms with CDS trading also have a significantly lower mean MB_RATIO but a similar median MB_RATIO relative to those without CDS trading. The mean (median) MB_RATIO is 4.97 (2.23) for the CDS and 9.37 (2.04) for the non-CDS sample. The summary statistics show that, relative to firms without CDS trading, firms with CDS trading are larger, more profitable, more likely to be dividend payers, more highly levered, and older, and they have more liquid stocks.

We construct two additional measures besides CDS_TRADING to capture CDS trading activity. First, we use CDS gross notional values from the Depository Trust & Clearing Corporation (DTCC) as a continuous measure of CDS activity. Gross notional represents the dollar amount of CDS protection bought (or sold) on a firm (see Table IA-2 in the Internet Appendix for an illustration of gross notional calculations). The DTCC reports gross notional values weekly

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TABLE 2
Firm and CDS Activity Characteristics

Table 2 presents firm and credit default swap (CDS) activity characteristics for the sample of 161,954 firm-quarters between 2001 and 2013. See Table 1 for the sample selection criteria and the Appendix for variable definitions. The "Firm-Quarters with CDS Trading" columns identify firm-quarters following the CDS initiation date (15,008 firm-quarters). The "Firm-Quarters without CDS Trading" columns identify firm-quarters prior to the CDS initiation date or without any CDS activity (146,946 firm-quarters). Panels A and B report the summary statistics for firm and CDS activity characteristics, respectively. The "Test of Differences" columns report the differences in mean and median firm characteristics. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, using a *t*-test for mean differences (*t*-value) and Wilcoxon rank-sum test for median differences (*z*-value).

Panel A. Firm Characteristics

Sample:	Firm-Quarters with CDS Trading		Firm-Quarters without CDS Trading		Test of Differences	
Variables	Mean	Median	Mean	Median	*t*-value	*z*-value
TOBINS_Q	1.28	1.06	1.80	1.25	−65.01***	−6.84***
MB_RATIO	4.97	2.23	9.37	2.04	−1.19	2.02**
MVE (in $billions)	22.04	8.40	1.63	0.30	58.66***	31.18***
STOCK_TURNOVER	11.10	8.36	8.31	5.34	32.18***	13.19***
ROA	0.01	0.01	−0.02	0.01	63.46***	15.00***
CAPX_TO_SALES	0.10	0.04	0.84	0.03	−5.27***	0.58
DEBT_TO_ASSETS	0.27	0.26	0.15	0.07	98.64***	17.94***
DIVIDEND_DUM	0.73	1.00	0.23	0.00	130.65***	24.89***
AGE	36.89	34.56	15.05	11.00	105.87***	20.48***

Panel B. CDS Activity Characteristics

Sample:	Firm-Quarters with CDS Trading		
Variables	Mean	Median	Standard Deviation
NOTIONAL (in $billions)	8.05	4.89	9.40
CDS_LIQ	0.60	0.87	0.44

from Oct. 2008 for the 1,000 most active single-name CDS contracts registered in the Trade Information Warehouse. Given that gross notional values are available for the most active CDSs, we assume it is 0 when the value is not reported by the DTCC. We compute our NOTIONAL variable as the quarterly average of weekly gross notional values available from the DTCC. Panel B of Table 2 shows that the mean (median) NOTIONAL value for our sample of firms with trading CDSs is $8.05 ($4.89) billion, with a standard deviation of $9.40 billion.

Second, we follow Saretto and Tookes (2013) and compute CDS liquidity (CDS_LIQ) for each firm-quarter as the ratio of the total number of daily spreads on 5-year senior unsecured CDS contracts available in Bloomberg to the number of trading days in the quarter. The CDS spreads available on Bloomberg are consensus quotes, and hence their daily availability provides a measure of CDS activity. Panel B of Table 2 shows that the mean (median) CDS_LIQ for our sample of firms with trading CDSs is 0.60 (0.87), with a standard deviation of 0.44 (Figure IA-2 in the Internet Appendix shows the distributions of the NOTIONAL and CDS_LIQ variables).

IV. Analyses

A. Event Study

To analyze the changes in firm value surrounding the introduction of CDSs, we first conduct an event study by defining a RELATIVE_Q variable for a CDS

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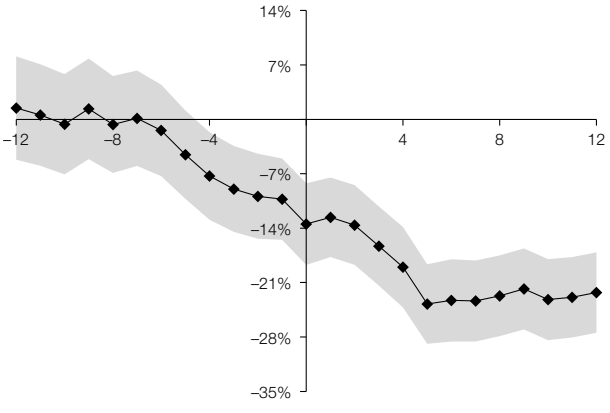
firm i in quarter t as:

$$(1) \quad \text{RELATIVE_Q}_{i,t} = \ln(\text{TOBINS_Q}_{i,t}) - \sum_{j=1}^{n_t} \ln(\text{TOBINS_Q}_{j,t})/n_t,$$

where j indicates a non-CDS firm, and n_t equals the number of non-CDS firms in quarter t. This RELATIVE_Q captures the average percentage difference in Tobin's q between a CDS firm and non-CDS firms in a quarter. Figure 1 plots the average value of RELATIVE_Q for a sample of 353 CDS firms that have nonmissing TOBINS_Q values over a 6-year window centered on the CDS initiation quarter. Figure 1 shows that RELATIVE_Q begins to decline about a year and a half before CDS initiation and continues to decline for another year, becoming statistically significant starting a year before CDS initiation. The change in RELATIVE_Q is about −3% over the quarter and −6% over the year surrounding CDS initiation. The Internet Appendix provides the values of average changes in RELATIVE_Q around the CDS initiation date and their significance levels (Table IA-3) and the RELATIVE_Q plot using all CDS firms, not just those without missing values in the sample (Figure IA-3). The Internet Appendix also presents a plot of cumulative abnormal equity returns (CAR) for CDS firms computed using the Fama–French (1993) 3-factor model over a 6-month period before and after CDS initiation (Figure IA-4). Like the trend observed using RELATIVE_Q, CAR starts to decline about a quarter before CDS initiation, is −2.5% at the time of CDS initiation, and is −4.5% in the 6 months after CDS initiation.

FIGURE 1
Event Study

Figure 1 presents the average RELATIVE_Q and its 95% confidence interval in each quarter over a 3-year event window around the initiation of credit default swap (CDS) trading. RELATIVE_Q is the difference between a CDS firm's ln(TOBINS_Q) and the average non-CDS firm's ln(TOBINS_Q) in a quarter. Accordingly, the average RELATIVE_Q measures the average percentage difference in Tobin's q between CDS and non-CDS firms in a quarter. The CDS sample includes 353 firms with CDSs that have nonmissing Tobin's q over the event-window period, and the non-CDS sample includes all firms without trading CDSs in the given quarter. Figure IA-3 in the Internet Appendix reports this figure for all CDS firms.



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The event-study results suggest that firm value declines upon CDS initiation but that the decline in firm value begins prior to CDS initiation. This declining trend in firm value prior to CDS initiation could either reflect a lag in the availability of CDS prices in databases (a database problem) or that CDS initiation follows a decline in firm value (an endogeneity problem). We examine these issues in more detail in Sections IV.C.4 and IV.D, respectively. We also examine our results by detrending TOBINS_Q in Section IV.D.3.

B. Baseline Specification

We next examine the relationship between CDS initiation and firm value in a multivariate setting. We run the following pooled ordinary least squares (OLS) regression with standard errors clustered at the firm level to account for the correlation in observations obtained for the same firm (Petersen (2009)):

$$(2) \quad \ln(Q_{i,t}) = \alpha + X'_{i,t}\beta + \gamma \text{CDS_TRADED}_i + \delta \text{CDS_TRADING}_{i,t} + \varepsilon_{i,t}.$$

In this specification, firms are indexed by i and quarters by t; Q is Tobin's q; α is the intercept; X is a vector of explanatory variables; β is a vector of coefficient estimates corresponding to the explanatory variables; γ and δ are the coefficient estimates on the CDS_TRADED and CDS_TRADING variables, respectively; and ε is the error term.

To reduce the skewness in TOBINS_Q, we use the natural logarithm of TOBINS_Q as the dependent variable (Figure IA-2 in the Internet Appendix shows how the log-transformation substantially reduces the skewness in TOBINS_Q). The explanatory variables include ln(MVE), STOCK_TURNOVER, ROA, CAPX_TO_SALES, DEBT_TO_ASSETS, DIVIDEND_DUM, and AGE_TRANS, along with fixed effects for credit rating, industry, and year.[4] The CDS_TRADED variable controls for the differences in time-invariant unobserved firm characteristics across firms with and without CDS. The coefficient of interest is the one on CDS_TRADING, δ, which captures the change in firm value associated with the initiation of CDS trading.

Regression 1 in Table 3 reports the baseline regression results. The sign and significance of the coefficient estimates on the control variables are broadly consistent with their expected effects. The coefficient estimate on CDS_TRADED is -0.180 and statistically significant, indicating that firms with CDSs have lower values relative to firms without CDSs. The coefficient on CDS_TRADING is -0.183 and statistically significant, indicating that when CDS trading is initiated, there is a further decline in firm value. Regression 2 is identical to regression 1 except that it controls for the time-invariant unobserved firm characteristics by replacing the CDS_TRADED variable in our baseline specification with firm fixed effects. The coefficient estimate on CDS_TRADING is -0.051 and significant using firm fixed effects, again indicating that the initiation of CDSs is associated with a decline in firm value.

[4]The AGE_TRANS variable equals the negative of the reciprocal of 1 plus firm age. This transformation is motivated by the model in Pastor and Veronesi (2003), which predicts that uncertainty about equity growth is proportional to $-1/(1 + \text{AGE})$. Table IA-4 in the Internet Appendix reports the correlation matrix for the variables used in the multivariate analyses.

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TABLE 3
Baseline Regressions

Table 3 presents the results from the baseline regressions of ln(TOBINS_Q) on measures of credit default swap (CDS) activity. See Table 1 for the sample selection criteria and the Appendix for variable definitions. The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

CDS Activity Proxy:	CDS_TRADING		NOTIONAL		CDS_LIQ	
Variables	1	2	3	4	5	6
INTERCEPT	−0.588***	−1.786***	−0.723***	−1.987***	−0.596***	−1.788***
	(−12.43)	(−56.47)	(−10.74)	(−37.54)	(−12.68)	(−56.87)
ln(MVE)	0.168***	0.318***	0.170***	0.355***	0.170***	0.318***
	(40.37)	(60.73)	(29.36)	(45.77)	(40.86)	(60.82)
STOCK_TURNOVER	0.005***	0.004***	0.004***	0.003***	0.005***	0.004***
	(10.47)	(10.31)	(5.55)	(6.35)	(10.48)	(10.31)
ROA	−0.254***	0.121***	−0.638***	−0.074*	−0.262***	0.121***
	(−4.08)	(3.85)	(−5.73)	(−1.65)	(−4.20)	(3.86)
CAPX_TO_SALES	0.000	−0.000**	0.000	−0.000	0.000	−0.000**
	(0.56)	(−2.06)	(1.32)	(−0.07)	(0.58)	(−2.00)
DEBT_TO_ASSETS	−0.211***	0.032	−0.166***	−0.021	−0.208***	0.033
	(−5.76)	(1.03)	(−3.07)	(−0.52)	(−5.69)	(1.08)
DIVIDEND_DUM	−0.057***	−0.013	0.004	0.022**	−0.054***	−0.013
	(−3.42)	(−1.32)	(0.19)	(2.40)	(−3.27)	(−1.33)
AGE_TRANS	−0.523***	−0.255***	−0.697***	−0.444***	−0.518***	−0.255***
	(−12.57)	(−6.64)	(−10.20)	(−6.82)	(−12.46)	(−6.60)
CDS_TRADED	−0.180***	—	−0.223***	—	−0.210***	—
	(−6.86)	—	(−6.38)	—	(−8.93)	—
CDS_TRADING	−0.183***	−0.051***	—	—	—	—
	(−8.64)	(−3.10)	—	—	—	—
NOTIONAL_DUM	—	—	2.322***	0.872*	—	—
	—	—	(3.94)	(1.72)	—	—
ln(NOTIONAL)	—	—	−0.109***	−0.042*	—	—
	—	—	(−4.22)	(−1.73)	—	—
CDS_LIQ_DUM	—	—	—	—	−0.013	0.002
	—	—	—	—	(−0.43)	(0.13)
ln(CDS_LIQ)	—	—	—	—	−0.347***	−0.074**
	—	—	—	—	(−6.80)	(−2.31)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
No. of obs.	151,895	151,895	49,632	49,632	151,895	151,895
No. of clusters	5,660	5,660	3,350	3,350	5,660	5,660
No. of firms with CDS trading	468	468	411	411	468	468
Adj. R^2	0.337	0.345	0.337	0.324	0.339	0.345

Our results indicate that firm value declines by about 5% with the initiation of CDS trading. The magnitude of this decline is comparable to the net present value of distress costs for a BBB-rated firm (Almeida and Philippon (2008)) and the change in firm value observed with the introduction of equity options (e.g., Roll et al. (2009)).[5] We also generate estimates of the decrease in firm value that

[5]Roll et al. (2009) examine the relation between firm value and options trading activity. The authors report that in their sample, the average Tobin's q is 1.915, and the average options volume for firms with positive options volume is 6,487 (measured in $10,000 increments). Table 5 in their study reports the regression results for Tobin's q and shows that the coefficient estimate on option volume is 0.1297 $\times 10^{-4}$. Therefore, the average options trading volume increases Tobin's q by 0.0841 (6,487 $\times$ 0.1297 $\times 10^{-4}$), which is 4.39% of the average Tobin's q in their sample. Conrad (1989) investigates the stock price impact of option listing during 1973–1980 and reports a cumulative excess stock return of 2.75% in the 5 days (day −3 to day +1) and 3.48% in the 32 days (day −30 to day +1) around the introduction of options. However, Sorescu (2000) shows that the positive abnormal returns documented around

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could occur because the availability of CDSs increases the firm's credit risk and decreases its stock liquidity.

Subrahmanyam et al. (2014) find that CDS initiation increases the monthly probability of bankruptcy for an average firm from 0.14% to 0.47%. A back-of-the-envelope calculation using the financial distress model of Almeida and Philippon (2008) indicates that this increase in the probability of bankruptcy translates to a 4.73% decrease in firm value (see the Internet Appendix for details). Boehmer et al. (2015) find that CDS initiation increases the effective bid–ask spread on the firm's stock by 19.4%. An empirical estimation based on the model of Fang, Noe, and Tice (2009) indicates that a 19.4% increase in the effective bid–ask spread reduces firm value by 5.9%.[6] These estimates suggest that the CDS-related decline in firm value we observe is plausible.

C. Robustness Tests

1. Alternate Measures of CDS Trading

The CDS_TRADING variable in our baseline specification is a binary indicator of the initiation of CDS trading. To examine whether our results are robust to continuous proxies for CDS trading, we estimate the following model:

$$\ln(Q_{i,t}) = \alpha + X'_{i,t}\beta + \gamma \text{CDS_TRADED}_i + \theta \text{NOTIONAL_DUM}_{i,t} + \delta \ln(\text{NOTIONAL}_{i,t}) + \varepsilon_{i,t}, \quad (3)$$

where $\text{NOTIONAL_DUM}_{i,t}$ indicates whether NOTIONAL is greater than 0, and the remaining variables are the same as in equation (2). Although the availability of NOTIONAL restricts our analysis to the period 2009–2013, the advantage with this time period is that it mitigates the effects related to the financial crisis of 2008 and the clustering of CDS initiation dates pre-2006.[7] Regression 3 in Table 3 shows that the coefficient estimate on ln(NOTIONAL) is −0.109 and significant. Controlling for firm fixed effects, regression 4 shows that the coefficient estimate on ln(NOTIONAL) is −0.042 and significant. These negative coefficient estimates suggest that firm valuations decrease with an increase in gross notional.

Regression 5 of Table 3 reports the results from estimating equation (3) using CDS_LIQ as a measure of CDS activity. The coefficient estimate on ln(CDS_LIQ) is −0.347 and significant. Regression 6, which is similar to regression 5 except that it uses firm fixed effects, shows that the coefficient estimate on ln(CDS_LIQ) is −0.074 and significant. These negative coefficients indicate that firm valuations decrease as the liquidity of CDS contracts increases. Taken together, these findings indicate that firm value decreases with increases in CDS trading activity.

options listing in the 1970s disappear in the years following 1980, which he argues could be because the introduction of stock index options in 1982 effectively completed the markets.

[6] Fang et al. (2009) report in regression 1 of their Table 3 that when predicting Tobin's q, the coefficient estimate on ln(EFFECTIVE_BID_ASK_SPREAD) is −0.606. Therefore, a 19.4% increase in the effective bid–ask spread would lead to a 0.108 reduction in Tobin's q ($-0.108 = -0.606 \times \ln(1.194)$), which is 5.9% of the average Tobin's q in their sample.

[7] Table IA-5 in the Internet Appendix shows that our results are not driven by observations during the financial crisis of 2008 (from the fourth quarter of 2007 to the second quarter of 2009).

2. CDS Termination

If CDS trading influences firm value, we should observe changes in firm value not only when CDS trading is initiated on a firm but also when it is terminated. To examine whether this is the case, we define a dummy variable, CDS_REVERSAL, that takes the value of 1 if a firm with CDS trading has no CDS spread quotes and gross notional values in a quarter, and 0 otherwise. We then re-estimate regressions 1 and 2 in Table 3 by including CDS_REVERSAL as an additional regressor. Table IA-6 in the Internet Appendix presents these results. The coefficient estimate on CDS_REVERSAL is positive and significant, and its magnitude is similar to that of the coefficient estimate on CDS_TRADING. This finding indicates that CDS trading is associated with changes in firm value and that the change in firm value is not a permanent one.

3. Sensitivity to Tobin's q

Our measure of firm value is a proxy for the firm's true Tobin's q. Empirically estimating the firm's Tobin's q requires the market value of debt and the replacement value of assets. Given that we use book values of debt in computing Tobin's q, we reproduce Table 3 by replacing TOBINS_Q with MB_RATIO quad in our estimations to examine whether our results are sensitive to the use of book values of debt. Table IA-7 in the Internet Appendix presents the results. The results from the estimations using MB_RATIO are qualitatively similar to those reported in Table 3.

As an additional test, we follow Gompers et al. (2010) to further address the limitations of using an empirical Tobin's q to measure firm value. We estimate our baseline specifications with a transformed Tobin's q (-1/TOBINS_Q) and an industry-adjusted Tobin's q as dependent variables and using a median (quantile) regression method. Tables IA-8 through IA-10 in the Internet Appendix report the results of these regressions. The results indicate that our baseline findings are robust to these alternative approaches.

4. CDS Initiation

The first record of CDS trading we have using the Bloomberg and CMA matched database is in Sept. 2001. To address the concern that firms with CDS contracts prior to Sept. 2001 may be classified as having CDS contracts initiated in Sept. 2001, we retain only those firms whose CDS quotes first appear in Oct. 2001 and beyond, and we reproduce Table 3. Similarly, to avoid the possibility that firms that had CDS prior to Sept. 2001 are misclassified as non-CDS firms, we drop all observations prior to Sept. 2001 and reproduce Table 3. The reproduced tables, which are available as Tables IA-11 and IA-12 in the Internet Appendix, show that our baseline findings reported in Table 3 remain qualitatively unchanged.

D. Endogeneity

We have thus far assumed that CDS trading is exogenous. However, when the demand for credit insurance is linked to firm value (say, through a deterioration in credit quality) or when the selection of firms for CDS trading is non-random,

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CDS trading may be endogenous. In this section, we engage in a series of tests to examine the robustness of our results to these concerns.

1. CDS Sample Test

Our baseline comparisons involve firms that have CDSs against those that do not have CDSs. If firms are selected for CDS trading based on certain characteristics, then comparing them against a group of firms not selected for CDS trading could bias our results. To mitigate this bias, we restrict our analysis to only those firms that have CDS trading anytime from 2001 to 2013, and we study the change in firm value upon the initiation of CDS trading. Table 4 reports these results. Regression 1 shows that the coefficient estimate on CDS_TRADING is −0.228 and significant, and regression 2, which is the firm fixed effects counterpart of regression 1, shows that it is −0.072 and significant. We also conduct another test by

TABLE 4
Baseline Regressions for Firms with CDS

Table 4 presents the results from regressions of ln(TOBINS_Q) on measures of credit default swap (CDS) activity for firms with CDS contracts. See Table 1 for the sample selection criteria and the Appendix for variable definitions. The sample in regressions 1 and 2 includes firms that eventually have CDS contracts traded during the analysis period (CDS_TRADED = 1). The sample in regressions 3–6 includes firms with active CDS contracts (CDS_TRADING = 1). The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Sample:	CDS Traded		CDS Trading			
CDS Activity Proxy:	CDS_TRADING		NOTIONAL		CDS_LIQ	
Variables	1	2	3	4	5	6
Intercept	−0.648***	−2.412***	−1.110***	−2.169***	−0.994***	−2.156***
	(−4.44)	(−11.32)	(−6.25)	(−12.41)	(−6.42)	(−11.74)
ln(MVE)	0.118***	0.290***	0.116***	0.273***	0.127***	0.271***
	(8.75)	(15.45)	(7.60)	(16.03)	(8.74)	(13.72)
STOCK_TURNOVER	0.001	0.001	−0.000	−0.002***	0.000	−0.002**
	(1.14)	(0.91)	(−0.22)	(−3.74)	(0.28)	(−2.53)
ROA	3.263***	1.388***	4.059***	0.878***	3.655***	1.245***
	(6.44)	(8.84)	(7.99)	(5.87)	(10.35)	(9.85)
CAPX_TO_SALES	0.000***	−0.000***	0.021	−0.161**	0.030	−0.001
	(7.11)	(−5.92)	(0.28)	(−2.58)	(0.48)	(−0.02)
DEBT_TO_ASSETS	0.390***	0.349***	0.887***	0.341***	0.594***	0.330***
	(3.74)	(3.16)	(6.80)	(4.13)	(5.77)	(3.97)
DIVIDEND_DUM	−0.054	−0.045**	0.015	0.009	−0.030	−0.056**
	(−1.63)	(−2.01)	(0.37)	(0.45)	(−0.87)	(−2.31)
AGE_TRANS	−0.109	0.050	0.199	−0.101	0.086	0.087
	(−0.87)	(0.42)	(1.12)	(−0.63)	(0.62)	(0.85)
CDS_TRADING	−0.228***	−0.072***	—	—	—	—
	(−7.99)	(−4.10)	—	—	—	—
NOTIONAL_DUM	—	—	2.156***	1.341***	—	—
	—	—	(4.86)	(2.94)	—	—
ln(NOTIONAL)	—	—	−0.104***	−0.063***	—	—
	—	—	(−5.33)	(−2.89)	—	—
CDS_LIQ_DUM	—	—	—	—	0.011	0.002
	—	—	—	—	(0.35)	(0.11)
ln(CDS_LIQ)	—	—	—	—	−0.394***	−0.093***
	—	—	—	—	(−7.63)	(−2.87)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
No. of obs.	20,503	20,503	7,102	7,102	14,624	14,624
No. of clusters	494	494	411	411	468	468
Adj. R^2	0.463	0.358	0.523	0.382	0.501	0.390

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limiting the sample to firm-quarters with CDS trading and estimate the impact of CDS on firm valuations using continuous variables of CDS activity. Table 4 also presents these results. Regressions 3 and 5 show that the coefficient estimates on ln(NOTIONAL) and ln(CDS_LIQ) are negative and significant, respectively. Regressions 4 and 6 report similar coefficients when firm fixed effects are included. These results show that CDS trading is associated with a decline in firm value within firms that were selected for CDS trading.

2. Instrumental Variable Regressions

Saretto and Tookes (2013) and Subrahmanyam et al. (2014) use the average foreign exchange hedging positions (scaled by assets) of financial institutions affiliated with a firm as an instrument for CDS trading. They argue that institutions that hedge against foreign exchange risk are also likely to hedge against their borrowers' credit risk. However, the institutions' foreign exchange hedging positions are unlikely to be correlated with their borrowers' value, making it a valid instrument for CDS trading.[8] Following this literature, we instrument for CDS trading using the foreign exchange hedging position of affiliated institutions.

We consider a financial institution to be affiliated with a firm in a quarter if the institution serves as a lender or bond underwriter for the firm in the preceding 5 years. To identify lending relationships and bond underwriters, we use DealScan and the Mergent Fixed Income Securities Database (FISD), respectively.[9] We consider a firm's lender to be the lead arranger of the syndicate. When a lead arranger is not available on DealScan, we follow the methodology of Cai, Saunders, and Steffen (2011) to assign the lead arranger role to one of the institutions in the lending syndicate. We are able to identify lending relationships and bond underwriters for 60% and 25% of our sample firms, respectively. We combine the lenders and underwriters to create a list of affiliated institutions at the parent-company level for each firm-quarter. Using the Y-9C reports maintained by the Federal Reserve, we obtain the foreign exchange hedging (nontrading) positions and assets for these affiliated institutions on a quarterly basis to construct our instrument, BANK_FOREX, which is measured as the average of affiliated institutions' hedging positions divided by their assets.

BANK_FOREX is available for 76,263 firm-quarters and varies quarterly because the list of affiliated institutions changes based on a 5-year rolling window, and the scaled foreign exchange hedging positions of banks change quarterly. It is available for 95% of the CDS sample (14,232 observations) and 43% of the non-CDS sample (62,031 observations). The mean value of BANK_FOREX is 2.23%, with a standard deviation of 2.24%. On average, a firm with nonmissing BANK_FOREX is affiliated with two banks. The mean value of BANK_FOREX is 3.03% for firms with trading CDSs and 2.05% for firms without trading CDSs, and

[8] It is possible that borrowers' credit risk is correlated with their lenders' foreign exchange hedging positions because the match between lenders and borrowers is nonrandom. However, Saretto and Tookes (2013) argue that this is unlikely and show that the in-sample correlation between borrowers' characteristics (e.g., leverage, debt maturity) and their lenders' hedging positions is negligible.

[9] We use the identifier links from Michael Roberts's Web site (http://finance.wharton.upenn.edu/~mrrobert/) to match the DealScan and Compustat databases. See Chava and Roberts (2008) for details on constructing the identifier links.

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the difference in the means is statistically significant at the 1% level, indicating that banks affiliated with CDS firms have significantly higher foreign exchange hedging positions than banks not affiliated with CDS firms.

We employ the 2-stage least squares (2SLS) method described by Wooldridge (2002) to instrument for CDS trading. First, we run a probit regression predicting CDS_TRADING using the independent variables in the baseline model and BANK_FOREX. We also include a dummy variable as a regressor that indicates whether the firm has senior unsecured bonds outstanding (SEN_UNSEC_DUM) because they are the most common reference obligations in the single-name CDS market (Schneider, Sögner, and Veža (2010)). Regression 1 in Table IA-13 of the Internet Appendix reports the marginal effects from the probit regression. The coefficient estimate on BANK_FOREX is positive and significant, indicating that firms affiliated with institutions that have higher foreign exchange hedging positions are more likely to have CDSs on their debt. The inclusion of BANK_FOREX significantly improves the model fit with an incremental chi-square statistic of 76.46 that is significant at the 1% level, indicating that BANK_FOREX is not a weak instrument.

We next use the fitted values of CDS_TRADING (EST_CDS_TRADING) from the probit regression as the instrument for CDS_TRADING in a 2SLS regression of ln(TOBINS_Q). Regression 1 in Table 5 reports the results from the second-stage regression and shows that EST_CDS_TRADING has a statistically significant coefficient estimate of −0.085, indicating that the initiation of CDS trading is associated with a decline in firm value.

To ensure that the selection bias due to unobservables is not driving our results, we also follow Maddala (1983), (1991) and estimate an endogenous selection model, which incorporates the estimation procedure of Heckman (1979).[10] We compute the inverse Mills ratio for both CDS and non-CDS firms using the coefficient estimates from the probit regression (regression 1 in Table IA-13 of the Internet Appendix) and use it as a control variable in equation (2). In this framework, the inverse Mills ratio controls for the selection bias. Regression 2 in Table 5, which reports the regression results, shows that the coefficient estimate on CDS_TRADING is −0.134 and significant, once again indicating that firm value declines upon CDS initiation.

3. Propensity Score Matching

We use a propensity-score-matching (PSM) method to examine whether the selection bias due to observable firm characteristics is driving our results. We identify a subsample of non-CDS firms that have characteristics similar to those of CDS firms, and we use these firms as a control group against which to examine the valuation effects associated with CDS trading. We first predict the probability of CDS trading using a probit model that includes the regressors in the baseline model, BANK_FOREX, and SEN_UNSEC_DUM. We lag the independent variables by a quarter to reduce the effects that contemporaneous firm characteristics have on CDS initiation. Furthermore, we include the lagged value of the dependent variable, ln(TOBINS_Q_{t-1}), and the change in ln(TOBINS_Q_{t-1}) from the

[10] See Maddala ((1983), pp. 223–228, (1991), pp. 797–799) for details on the selection model.

TABLE 5
Instrumental Variable Regressions

Table 5 reports the results from a 2-stage least squares (2SLS) regression and an endogenous selection model of ln(TOBINS_Q) for the subsample of firms with an available BANK_FOREX variable. See Table 1 for the sample selection criteria and the Appendix for variable definitions. Regression 1 in Table IA-13 of the Internet Appendix reports the results from a probit regression that predicts the initiation of credit default swap (CDS) trading, where BANK_FOREX is the instrumental variable. Regression 1 reports the second-stage regression results from a 2SLS model that instruments CDS_TRADING with the fitted CDS_TRADING values (EST_CDS_TRADING) from the probit regression, as in Wooldridge (2002). Regression 2 reports the results from the selection model of Maddala (1983) estimated using the 2-step procedure of Heckman (1979). INVERSE_MILLS_RATIO is calculated using the estimates from the probit regression (regression 1 in Table IA-13) and included as an independent variable in the selection regression. The t-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Regression Model:	2SLS	Selection
Variables	1	2
INTERCEPT	−0.968***	−0.968***
	(−23.14)	(−15.53)
ln(MVE)	0.181***	0.180***
	(31.44)	(31.50)
STOCK_TURNOVER	0.004***	0.004***
	(6.69)	(6.56)
ROA	1.257***	1.255***
	(9.22)	(9.24)
CAPX_TO_SALES	0.000***	0.000***
	(2.64)	(2.82)
DEBT_TO_ASSETS	0.149***	0.147***
	(3.47)	(3.42)
DIVIDEND_DUM	−0.050***	−0.050***
	(−3.01)	(−3.00)
AGE_TRANS	−0.259***	−0.257***
	(−4.42)	(−4.37)
SEN_UNSEC_DUM	−0.042**	−0.043**
	(−2.53)	(−2.56)
CDS_TRADED	−0.258***	−0.228***
	(−5.89)	(−8.33)
EST_CDS_TRADING	−0.085*	—
	(−1.65)	—
INVERSE_MILLS_RATIO	—	0.031*
	—	(1.70)
CDS_TRADING	—	−0.134***
	—	(−5.89)
Year fixed effects	Yes	Yes
Credit-rating fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
No. of obs.	73,492	73,492
No. of clusters	3,005	3,005
Adj. R^2	0.381	0.381

previous quarter ($\ln(\text{TOBINS_Q}_{t-1}) - \ln(\text{TOBINS_Q}_{t-2})$) to control for trends in Tobin's q.[11] Regression 2 in Table IA-13 of the Internet Appendix reports the marginal effects from this probit regression.

We then use the coefficient estimates from the probit regression to predict the probability of CDS trading for each firm-quarter and select (with replacement) a non-CDS benchmark firm whose predicted probability of CDS trading is closest to that of the CDS firm in the quarter of CDS initiation. When there are multiple candidates for a benchmark firm, we select the one whose Tobin's q is closest

[11] Table IA-14 in the Internet Appendix shows that our results are similar when we include $(\ln(\text{TOBINS_Q}_{t-1}) - \ln(\text{TOBINS_Q}_{t-6}))$ as a regressor to control for long-term trends in Tobin's q.

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to that of the CDS firm against which it is being matched. Using this matching procedure, we are able to identify benchmark firms for 398 CDS firms.

Panel A of Table 6 reports the key characteristics for the CDS firms and their benchmark firms. The average predicted probability of CDS trading is around 40% for both CDS and benchmark firms. Both sets of firms are of similar size in the quarter before CDS initiation. The average market value of equity is $16.42 billion for CDS firms and $15.08 billion for benchmark firms, and the difference in these values is statistically insignificant. Table IA-15 in the Internet Appendix reproduces all firm characteristics reported in Table 2 for both CDS and

TABLE 6
Propensity-Score-Matching Method

Table 6 presents the results from a propensity-score-matching (PSM) method. See Table 1 for the sample selection criteria and the Appendix for variable definitions. Regression 2 in Table IA-13 of the Internet Appendix predicts the initiation of credit default swap (CDS) trading. The benchmark firm (selected with replacement) has the predicted probability of CDS trading closest to that of the firm with CDSs in the quarter of CDS initiation. When there are multiple benchmark firms that meet the criteria, benchmark firm is the one with Tobin's q closest to that of the firm with CDSs. Panel A reports the summary statistics (measured relative to the CDS initiation quarter, t) for PROPENSITY_SCORE$_t$, TOBINS_Q$_{t-1}$, change in ln(TOBINS_Q$_{t-1}$), and MVE$_{t-1}$ across the CDS and benchmark firms followed by their tests of differences in means (t-value from a t-test) and medians (z-value from a Wilcoxon rank-sum test). See Table IA-15 in the Internet Appendix for detailed summary statistics on firm characteristics. Panel B reports the regression results using the matched sample where the dependent variable is ln(TOBINS_Q). The t-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Matching Characteristics

Sample:	CDS Firms			Benchmark Firms			Test of Differences	
Variables	*N*	Mean	Median	*N*	Mean	Median	*t*-Value	*z*-Value
PROPENSITY_SCORE$_t$	398	0.395	0.361	398	0.393	0.360	0.81	0.09
TOBINS_Q$_{t-1}$	398	1.369	1.096	398	1.325	1.065	0.75	0.39
ln(TOBINS_Q$_{t-1}$) – ln(TOBINS_Q$_{t-2}$)	398	−0.019	−0.003	398	−0.008	0.002	−1.27	−0.89
MVE$_{t-1}$ (in $billions)	398	16.421	5.882	398	15.082	5.185	0.56	0.51

Panel B. Regression Results

Variables	1	2
Intercept	−0.786***	−2.044***
	(−6.51)	(−14.08)
ln(MVE)	0.118***	0.254***
	(10.51)	(18.21)
STOCK_TURNOVER	0.001*	−0.000
	(1.72)	(−0.20)
ROA	3.805***	1.513***
	(11.57)	(11.65)
CAPX_TO_SALES	0.000***	−0.000***
	(12.90)	(−6.36)
DEBT_TO_ASSETS	0.498***	0.427***
	(6.83)	(4.95)
DIVIDEND_DUM	−0.025	−0.043***
	(−1.03)	(−2.69)
AGE_TRANS	−0.056	−0.047
	(−0.51)	(−0.60)
CDS_TRADED	−0.022	—
	(−0.75)	—
CDS_TRADING	−0.187***	−0.052***
	(−9.53)	(−3.65)
Year fixed effects	Yes	Yes
Credit-rating fixed effects	Yes	Yes
Industry fixed effects	Yes	No
Firm fixed effects	No	Yes
No. of obs.	35,526	35,526
No. of clusters	796	796
Adj. R^2	0.458	0.348

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benchmark firms. The only differences are in the STOCK_TURNOVER and the DIVIDEND_DUM variables. Panel A also shows that the differences in TOBINS_Q_{t-1} and the change in ln(TOBINS_Q_{t-1}) are insignificant across the CDS and benchmark groups, indicating that the valuations of CDS and benchmark firms exhibit similar trends prior to CDS initiation, supporting the "parallel trends" assumption of the PSM method. These results indicate that the benchmark firms produced using PSM are well matched with CDS firms prior to CDS initiation.

Finally, we use the PSM sample (CDS and benchmark firms) to estimate our baseline model. The results are presented in Panel B of Table 6. Regression 1 shows that the coefficient estimate on CDS_TRADED is insignificant, implying that CDS and benchmark firms have similar valuations prior to CDS initiation. Regression 1 also shows that the coefficient estimate on CDS_TRADING is negative and significant, indicating that firm value declines upon CDS initiation. Regression 2, which includes firm fixed effects, shows that the coefficient estimate on CDS_TRADING continues to be negative (−0.052) and significant.

We also use the PSM sample to examine whether the declining trend in firm value prior to CDS initiation we observe in Figure 1 influences our findings. The PSM sample allows us to detrend TOBINS_Q using a time variable measured relative to CDS initiation for both the CDS and non-CDS firms. We create a time variable as the difference between the observation quarter and CDS initiation quarter. This time variable equals 0 in the CDS initiation quarter, and it increases (decreases) in the quarters following (preceding) CDS initiation. We regress ln(TOBINS_Q) as a linear, quadratic, and cubic function of this time variable using the CDS and benchmark firm samples individually, as well as using the combined PSM sample, to obtain the detrended ln(TOBINS_Q), which we then use to estimate our baseline model.

Table IA-16 in the Internet Appendix shows that the coefficient estimate on CDS_TRADING is negative and significant, indicating that when accounting for the declining trend in value prior to CDS initiation, CDS initiation is still associated with a decrease in firm value. The economic significance of the CDS effect, however, drops by around 2 percentage points when the trend is measured as a cubic function of time, suggesting that a portion of the CDS effect comes from the decline in valuations that occurs before CDS initiation.

4. Quasi-Experiment

On Apr. 8, 2009, the International Swaps and Derivatives Association implemented the BBP, which standardized contract terms in the North American CDS market by eliminating debt restructuring as a credit event. Prior to the BBP, CDS contract terms on investment-grade firms typically included a "modified-restructuring" clause under which debt restructuring was considered a credit event, whereas CDS contracts on high-yield firms mostly traded with a "no-restructuring" clause under which debt restructurings were not considered a credit event. The BBP eliminated the "modified restructuring" clause, and hence

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after the BBP, CDS contracts across the credit-grade spectrum traded with a "no-restructuring" clause.[12]

We use the BBP as a quasi-experiment to identify the effect of CDS initiation on firm value. In contrast to a contract with a modified-restructuring clause, a contract with a no-restructuring clause gives the CDS-hedged creditors incentives to resist out-of-court debt renegotiations (which is not a credit event) and favor bankruptcy (which is a credit event), thereby increasing the expected costs of financial distress. The BBP, by eliminating the modified-restructuring clause, provided incentives for hedged creditors in investment-grade reference entities to resist distressed debt renegotiations but left such incentives mostly unchanged for hedged creditors in high-yield reference entities.

If the availability of CDS increases the expected distress costs and hence decreases firm value, we should observe CDS trading to reduce valuations more for investment-grade firms relative to high-yield firms following the implementation of the BBP. To examine if this is the case, we define a POST_BIGBANG variable that equals 1 for periods after Apr. 8, 2009, and 0 otherwise, and include its interaction with an investment-grade dummy (INV_GRADE_DUM) and our proxies for CDS activity in our baseline regressions. The coefficient on this triple-interaction term (THREE_WAY_INT) indicates whether CDS activity reduces the value of investment-grade firms more than the value of high-yield firms following the implementation of the BBP.

Table 7 reports the coefficient estimate on THREE_WAY_INT using CDS_TRADING and CDS_LIQ to proxy for CDS activity. The analysis excludes NOTIONAL as a CDS activity variable because it is available for only one quarter in the pre-BBP period. The regression results in Table 7 show that the coefficient estimates on the triple-interaction term are negative and significant, and the results are robust to controlling for firm fixed effects. This finding indicates that following the implementation of BBP, CDS activity decreases firm value more so for investment-grade firms than for high-yield firms, which is consistent with the prediction that CDS trading increases the expected distress costs.

The analysis of the three-way interaction term reveals whether CDS activity affects firm value differently for investment-grade and high-yield firms following the BBP. To understand what fraction of the overall CDS effect is due to the BBP, we run the baseline regressions for investment-grade firms, the firms primarily affected by the BBP, during the entire analysis period and the pre-BBP period separately and compare the coefficient estimates on the CDS activity variables. Table IA-17 in the Internet Appendix reports that the coefficient estimate on CDS_TRADING is −0.047 during the entire period and −0.033 during the pre-BBP period. The difference in the coefficient estimates shows that excluding the post-BBP period from the analysis weakens the CDS effect by 1.40 percentage points, suggesting roughly 30% of the overall CDS effect can be due to the BBP.

[12] "The CDS Big Bang: Understanding the Changes to the Global CDS Contract and North American Conventions," Markit (Mar. 13, 2009).

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TABLE 7
Quasi-Experiment

Table 7 presents the results from regressions of ln(TOBINS_Q) on measures of credit default swap (CDS) activity using the implementation of the Big Bang Protocol (BBP) on Apr. 8, 2009, as a quasi-experiment. Prior to the BBP, CDS contract terms on investment-grade firms typically included a "modified-restructuring" clause under which debt restructuring was considered a credit event, whereas CDS contracts on high-yield firms mostly traded with a "no-restructuring" clause under which debt restructurings were not considered a credit event. The BBP eliminated the modified-restructuring clause, and hence after the BBP, CDS contracts across the credit-grade spectrum traded with a no-restructuring clause. In contrast to a contract with a modified-restructuring clause, a contract with a no-restructuring clause gives the CDS-hedged creditors incentives to resist out-of-court debt renegotiations (which is not a credit event) and favor bankruptcy (which is a credit event), thereby increasing the expected costs of financial distress. The BBP, by eliminating the modified-restructuring clause, provided incentives for hedged creditors in investment-grade reference entities to resist distressed debt renegotiations but left such incentives mostly unchanged for hedged creditors in high-yield reference entities. POST_BIGBANG equals 1 for periods after Apr. 8, 2009, and 0 otherwise. In regressions 1–4, the coefficient on THREE_WAY_INT (POST_BIGBANG × INV_GRADE_DUM × CDS_ACTIVITY) estimates the value impact of CDS on investment-grade firms relative to high-yield firms following the implementation of the BBP. We run the corresponding baseline regression models for the CDS activity proxies of CDS_TRADING and CDS_LIQ presented in Table 3. NOTIONAL is not a proper CDS activity proxy for this experiment because it is available quarterly since 2009. See Table 1 for the sample selection criteria and the Appendix for definitions of the remaining variables. Table IA-17 in the Internet Appendix reports the regression results for the sample of investment-grade firms that are primarily affected by the BBP. The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

CDS Activity Proxy:	CDS_TRADING		CDS_LIQ	
Variables	1	2	3	4
THREE_WAY_INT	−0.088*	−0.082**	−0.308***	−0.112*
	(−1.94)	(−2.41)	(−3.33)	(−1.86)
Determinants of firm value	Yes	Yes	Yes	Yes
Components of the three-way interaction term	Yes	Yes	Yes	Yes
Two-way interaction terms of the components	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes
No. of obs.	151,895	151,895	151,895	151,895
No. of clusters	5,660	5,660	5,660	5,660
Adj. R^2	0.317	0.350	0.315	0.350

E. Free Cash Flows and the Cost of Capital

Given that we observe firm value to decline with the initiation of CDS trading, we further investigate whether this decline traces to a decrease in free cash flows or an increase in the cost of capital. Using annual financial statements, we compute free cash flows (FCFs) as net income plus depreciation and amortization, minus capital expenditures and changes in working capital. We regress FCFs scaled by assets on our proxies for CDS activity and the independent variables in our baseline specifications. We use the annual averages of our NOTIONAL and CDS_LIQ variables as proxies for CDS activity. Table 8 presents these results. Regressions 1–3 show that the coefficient estimates on the CDS activity variables are statistically insignificant, indicating that CDS activity does not influence firm value through financial performance.

To investigate whether CDS activity influences a firm's cost of capital, we estimate the cost of equity and debt and regress these costs on our proxies for CDS activity and the independent variables in our baseline regressions. These results are also presented in Table 8. We obtain the cost of equity using the capital asset pricing model (CAPM). For each firm-year, we estimate a stock market beta by regressing monthly excess stock returns (stock returns minus the corresponding 1-month Treasury bill rate) on monthly excess market returns (value-weighted CRSP market index minus the 1-month Treasury bill rate) during the 5-year

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TABLE 8

Effect of CDS Activity on Free Cash Flows and Cost of Capital

Table 8 presents the results from regressions of free cash flows, cost of equity, cost of loans, and cost of bonds on measures of credit default swap (CDS) activity. See Table 1 for the sample selection criteria and the Appendix for variable definitions. For each CDS activity proxy, we run the corresponding baseline regression model with firm fixed effects presented in Table 3. FCF_TO_ASSETS and COST_OF_EQUITY are measured in annual frequency. Hence, the NOTIONAL and CDS_LIQ variables in regressions 1–6 are the averages of their quarterly values in a year. Loan characteristics are loan maturity and dummy variables for loan purposes (corporate purposes, acquisition related, debt repayment, working capital, and commercial paper backup). Bond characteristics are bond maturity and dummy variables indicating bond security level and the embedded options. The regressions of cost of equity, cost of loans, and cost of bonds exclude credit-rating fixed effects to allow the coefficient estimates on the CDS activity variables to reveal the influence of CDS on credit risk. The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	FCF_TO_ASSETS			ln(COST_OF_EQUITY)			ln(COST_OF_LOANS)			ln(COST_OF_BONDS)		
Variables	1	2	3	4	5	6	7	8	9	10	11	12
CDS Activity												
CDS_TRADING	0.019	—	—	0.069***	—	—	0.076***	—	—	0.081*	—	—
	(0.03)	—	—	(4.34)	—	—	(2.76)	—	—	(1.75)	—	—
ln(NOTIONAL)	—	−2.065	—	—	0.030*	—	—	0.003	—	—	−0.032	—
	—	(−0.87)	—	—	(1.74)	—	—	(0.64)	—	—	(−0.29)	—
ln(CDS_LIQ)	—	—	0.209	—	—	0.136***	—	—	0.397***	—	—	0.159*
	—	—	(0.20)	—	—	(3.43)	—	—	(3.91)	—	—	(1.70)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Loan characteristics	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No
Bond characteristics	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
No. of obs.	36,319	12,047	36,319	34,533	11,563	34,533	7,814	1,887	7,814	2,576	1,442	2,576
No. of clusters	5,090	3,101	5,090	4,776	2,916	4,776	2,585	1,218	2,585	506	384	506
Adj. R^2	0.121	0.103	0.121	0.223	0.235	0.224	0.487	0.490	0.491	0.575	0.534	0.576

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period preceding the given year.[13] We use Bloomberg's forward-looking estimate of market excess returns (derived from analysts' consensus estimates) and estimate the cost of equity for every firm at the end of a year as the interest rate on a 10-year Treasury bond plus beta times expected excess market return. Regressions 4–6 report the results from the cost-of-equity regressions and show that the coefficients on the CDS activity variables are positive and significant. The coefficient estimate in regression 4 suggests that CDS initiation is associated with a 7% increase in the cost of equity.

We estimate the cost of debt for a firm as the offering (at-issue) spreads of its loans and bonds. Following Ashcraft and Santos (2009), we obtain the all-in-drawn spread over the London Interbank Offered Rate (LIBOR) at issue date for the revolver loans denominated in U.S. dollars issued during the sample period. Our loan sample consists of 8,417 loans, 1,449 of which are issued by 451 CDS firms and 6,968 of which are issued by 2,636 non-CDS firms. In regressions involving loan spreads, we also control for loan maturity and include dummy variables that indicate the purpose of the loan (corporate purposes, acquisition related, debt repayment, working capital, and commercial paper backup). Regressions 7–9 in Table 8 show that the coefficient estimates on CDS_TRADING and ln(CDS_LIQ) variables are positive and significant, indicating that loan spreads increase with CDS activity. On average, CDS initiation is associated with an 8% increase in loan spreads.

We identify non-convertible fixed-coupon bonds issued by our sample firms from FISD and compute the at-issue bond spread as the difference between the offering yield and the maturity-matched risk-free rate estimated using the linearly interpolated Treasury bond yields from Bloomberg. Our bond sample contains 2,677 bonds, 1,843 of which are issued by 290 CDS firms and 834 of which are issued by 368 non-CDS firms. In addition to the independent variables in the baseline regressions, our bond spread regressions also control for bond maturity and include dummy variables for secured status and embedded options. Regressions 10–12 in Table 8 show that the coefficient estimates on CDS_TRADING and ln(CDS_LIQ) are positive and significant. The coefficient estimate on CDS_TRADING implies an 8.4% increase in bond spreads with the initiation of CDS trading.

These results show that the decline in firm value associated with the introduction of CDS trading arises from an increase in the firm's cost of capital and not from a reduction in its FCFs.

F. Increase in the Cost of Capital

The cost-of-capital increase we observe with the initiation of CDS trading could occur because of an increase in credit risk or a decrease in stock liquidity. In this section, we examine how CDS trading influences the firm's credit risk and stock liquidity.

[13] Stock market returns and Treasury bill rates are from Kenneth French's Web site (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). We require firms to have at least 24 nonmissing monthly stock returns during the estimation period and nonmissing monthly stock returns in the CDS initiation year. We winsorize our beta estimates at the 5th and 95th percentiles to reduce the influence of outliers.

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1. Credit Risk Channel

To analyze the change in credit risk associated with the introduction of CDS trading, we compute the expected default frequency (EDF) and the probability of a rating downgrade (RATING_DOWN), and we regress these measures on the CDS activity variables as in equations 2 and 3. We compute EDF following the methodology of Bharath and Shumway (2008) (see the Internet Appendix for details). The average EDF in the sample is 5.97%, and it is within the range reported in the literature.[14] We create a RATING_DOWN variable that indicates whether a firm's credit rating is downgraded in a quarter. In creating this dummy, we require firms to have nonmissing credit ratings for two consecutive quarters. The average of the RATING_DOWN variable is 4.28% in the sample.

Table 9 reports the results of these regressions, which are identical to our baseline regressions except for the absence of credit-rating fixed effects. The dependent variable in regressions 1–3 is EDF. The coefficient estimate on CDS_TRADING in regression 1 is 0.01 and significant, suggesting that the initiation of CDS trading increases default probability by 1 percentage point. Given that the average default probability is 6.33% for non-CDS firms in the sample, this translates into a 15.8% increase in the probability of default when CDS trading is initiated. In regressions 2 and 3, the coefficient estimates on ln(NOTIONAL) and ln(CDS_LIQ) are positive, respectively, but statistically insignificant. Regressions 4–6 are probit regressions where the dependent variable

TABLE 9
Credit Risk Channel

Table 9 reports the results from regressing measures of credit risk on measures of credit default swap (CDS) activity. See Table 1 for the sample selection criteria and the Appendix for variable definitions. Regressions 1–3 are ordinary least squares (OLS) models where the dependent variable is expected default frequency (EDF), computed using the method of Bharath and Shumway (2008). Regressions 4–6 are probit models where the dependent variable is RATING_DOWN, which indicates a credit rating downgrade. Table IA-18 in the Internet Appendix reports the marginal effects from these probit regressions. For each CDS activity proxy, we control for the independent variables in the corresponding baseline regression model presented in Table 3. Regressions exclude credit-rating fixed effects because the dependent variables measure credit risk. The *t*-values and *z*-values reported in parentheses for regressions 1–3 and regressions 4–6, respectively, are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	EDF			RATING_DOWN		
Variables	1	2	3	4	5	6
CDS Activity						
CDS_TRADING	0.010**	—	—	0.192***	—	—
	(2.04)	—	—	(3.75)	—	—
ln(NOTIONAL)	—	0.000	—	—	0.208***	—
	—	(0.19)	—	—	(3.34)	—
ln(CDS_LIQ)	—	—	0.004	—	—	0.279*
	—	—	(0.57)	—	—	(1.79)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	No	No	No
Industry fixed effects	No	No	No	Yes	Yes	Yes
No. of obs.	128,386	41,163	128,386	42,602	15,302	42,602
No. of clusters	5,308	2,997	5,308	1,557	1,019	1,557
Adj. R^2	0.189	0.209	0.189	—	—	—
Pseudo-R^2	—	—	—	0.077	0.132	0.075

[14] Vassalou and Xing (2004) estimate that the average default probability is 4.21% for the period 1971–1999, and Bharath and Shumway (2008) estimate that it is 10.95% for the period 1980–2003.

is the RATING_DOWN variable. In all three regressions, the coefficient estimates on the CDS activity variables are positive and significant. The coefficient estimate on CDS_TRADING in regression 4 indicates a 1.6-percentage-point increase in the probability of a rating downgrade with the onset of CDS trading (Table IA-18 in the Internet Appendix provides the marginal effects associated with the CDS activity variables). These results, which are consistent with Subrahmanyam et al.'s (2014) findings, provide evidence that a source of the decline in firm value associated with CDS trading is the increase in the firm's credit risk.

2. Liquidity Channel

To test whether CDS trading is associated with a decrease in stock liquidity, we compute two stock (il)liquidity measures, RELATIVE_BIDASK (Amihud and Mendelson (1986)) and AMIHUD_ILLIQ (Amihud (2002)), and regress these measures on the independent variables in our baseline regressions. For each firm-quarter, we compute RELATIVE_BIDASK as the median of daily dollar spread divided by the stock price, and we compute AMIHUD_ILLIQ as the median of the following:

$$\text{AMIHUD_ILLIQ}_{i,t} = 10^6 \times \frac{|r_{i,t}|}{(P_{i,t} \times \text{VOL}_{i,t})}, \tag{4}$$

where $r_{i,t}$ is stock return on day t, $P_{i,t}$ is stock price, and $\text{VOL}_{i,t}$ is stock volume.

Table 10 reports the regression results. The dependent variables in regressions 1–3 and 4–6 are RELATIVE_BIDASK and AMIHUD_ILLIQ, respectively. In these regressions, the coefficient estimate on CDS_TRADING is positive and significant for both stock liquidity measures. The coefficients on the other two CDS activity measures are also positive for both stock liquidity measures, but they are insignificant. Regression 1 reports that the coefficient estimate on

TABLE 10
Liquidity Channel

Table 10 reports the results from regressing measures of stock (il)liquidity on measures of credit default swap (CDS) activity. See Table 1 for the sample selection criteria and the Appendix for variable definitions. For each CDS activity proxy, we run the corresponding baseline regression model with the firm fixed effects presented in Table 3. The dependent variables in regressions 1–3 and 4–6 are RELATIVE_BIDASK and AMIHUD_ILLIQ, respectively. Regressions exclude STOCK_TURNOVER as a control variable because RELATIVE_BIDASK and AMIHUD_ILLIQ also proxy for stock liquidity. The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	RELATIVE_BIDASK			AMIHUD_ILLIQ		
Variables	1	2	3	4	5	6
CDS Activity						
CDS_TRADING	0.002***	—	—	0.194***	—	—
	(5.32)	—	—	(2.82)	—	—
ln(NOTIONAL)	—	0.000	—	—	0.000	—
	—	(1.47)	—	—	(0.02)	—
ln(CDS_LIQ)	—	—	0.000	—	—	−0.094
	—	—	(1.02)	—	—	(−0.91)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	154,639	51,109	154,639	154,877	51,108	154,877
No. of .clusters	5,796	3,466	5,796	5,797	3,466	5,797
Adj. R^2	0.211	0.100	0.210	0.020	0.005	0.020

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CDS_TRADING is 0.002. Given that the relative bid–ask spread for the average firm without trading CDSs is 1.12%, this translates into a 17.80% increase in the relative bid–ask spreads when CDS trading is initiated. These results, which are consistent with those of Boehmer et al. (2015), provide evidence that the decline in stock liquidity is also a source for the reduction in firm value observed with CDS trading.

G. Increase in Firm Value

The literature also argues that CDS trading can increase firm value because CDS trading provides incremental information that lowers the cost of capital or because the ability of creditors to hedge against credit risk alleviates credit constraints, allowing the firm to increase investments. We examine these possibilities as well.

1. Information Channel

The value of incremental information produced in the CDS market depends on the information produced in the bond market, given that both markets provide information on the underlying firm's credit risk. When the information produced in the bond market decreases, the value of incremental information produced in the CDS market increases. Hence, to test whether the information production in the CDS market contributes to an increase in firm value, we compute a measure of bond turnover (BOND_TURNOVER) to proxy for the information produced in the bond market and interact it with the CDS activity variables in our baseline regressions. A negative coefficient on the interaction term between BOND_TURNOVER and the CDS activity variables would suggest that firm value declines less with CDS trading as bond turnover decreases, indicating the presence of an informational role for the CDS market.

We identify bonds issued by our sample firms from FISD and obtain their trading data from Trade Reporting and Compliance Engine (TRACE) of the Financial Industry Regulatory Authority (FINRA). TRACE data are available only from July 2002, and hence we start our analysis from the fourth quarter of 2002. In each quarter and for each firm's outstanding bond(s), we compute turnover as the sum of bond volume divided by its outstanding amount. We use the average turnover in each firm-quarter as the bond turnover at the firm level. We identify 1,455 firms with bonds outstanding between the fourth quarter of 2002 and the end of 2013, of which 400 are CDS firms. Table 11 presents the regression results. Regressions 1–3 show that the interaction terms between BOND_TURNOVER and the CDS activity variables are negative and significant (except when the CDS activity variable is NOTIONAL), indicating that firm value declines less because of CDS trading when bond market activity is low.

Acharya and Johnson (2007) argue and provide evidence that information revelation through the CDS market increases when firms have a large number of banking relationships because banks use their private information to trade in the CDS market. Hence, as an added test, we examine if the information benefits of CDS trading are more pronounced for firms with more lending relationships. We construct a variable that indicates the number of banking relationships (BANK_RELATION) using DealScan to identify the lead lenders, and we interact

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TABLE 11
Information Channel

Table 11 reports the results from regressing ln(TOBINS_Q) on measures of credit default swap (CDS) activity interacted with BOND_TURNOVER and ln(BANK_RELATION). The information channel predicts that CDS would reduce valuations more when the underlying firm's bond turnover is higher and its number of banking relationships is lower. See Table 1 for the sample selection criteria and the Appendix for variable definitions. For each CDS activity proxy, we run the corresponding baseline regression model with the firm fixed effects presented in Table 3. The t-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Information Proxy:	BOND_TURNOVER			BANK_RELATION		
Variables	1	2	3	4	5	6
CDS Activity						
CDS_TRADING	−0.039**	—	—	−0.104***	—	—
	(−2.13)	—	—	(−4.28)	—	—
ln(NOTIONAL)	—	−0.050**	—	—	−0.047*	—
	—	(−2.37)	—	—	(−1.83)	—
ln(CDS_LIQ)	—	—	−0.094***	—	—	−0.193***
	—	—	(−2.64)	—	—	(−4.24)
Interaction Variable						
BOND_TURNOVER	−0.001	0.563***	−0.001	—	—	—
	(−1.13)	(9.89)	(−1.05)	—	—	—
ln(BANK_RELATION)	—	—	—	−0.087***	−0.056***	−0.086***
	—	—	—	(−9.82)	(−5.17)	(−10.12)
CDS Activity × *Interaction Variable*	−0.011**	−2.338	−0.063**	0.055***	0.002***	0.101***
	(−2.09)	(−1.41)	(−2.45)	(3.13)	(3.08)	(3.30)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	35,243	14,952	35,243	151,895	49,632	151,895
No. of clusters	1,436	1,036	1,436	5,660	3,350	5,660
Adj. R^2	0.364	0.367	0.364	0.343	0.322	0.343

it with CDS activity variables in our baseline regressions. The average number of lead-bank relationships is 1.02 for our sample firms. A positive coefficient on the interaction variable would indicate that firm value declines less with CDS trading when the firm has more lending relationships and that the CDS market plays an informational role. Table 11 also presents these regression results. Regressions 4–6 show that the coefficient estimates on the interaction terms between ln(BANK_RELATION) and the CDS activity variables are all positive and significant, indicating that firm value declines less with CDS trading when firms have a larger number of lending relationships.

These findings suggest that information production associated with CDS trading has a positive effect on firm value but that this positive effect, on average, is not sufficient to outweigh the value-decreasing effects associated with CDS trading.

2. Investment Channel

We also examine how firms' investments change following the initiation of CDS trading. To do so, we define annual investments as the sum of research and development (R&D) expenditure, capital expenditure, and acquisition expenditure less sale of property, plant, and equipment (PP&E). The sample average investment as a ratio of assets is 13.47%. We regress this investment ratio on the independent variables in our baseline fixed effects regression models. Table 12 presents the regression results. Regression 1 shows that the coefficient estimate

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TABLE 12
Investment Channel

Table 12 presents the results from regressions of annual investments (INVESTMENTS) scaled by assets on measures of credit default swap (CDS) activity. See Table 1 for the sample selection criteria and the Appendix for variable definitions. For each CDS activity proxy, we run the corresponding baseline regression model with the firm fixed effects presented in Table 3. Because the regression data are in annual frequency, the NOTIONAL and CDS_LIQ variables are averages of their quarterly values in a year. The control variables exclude CAPX_TO_SALES because the dependent variable is investments scaled by assets. The *t*-statistics reported in parentheses are computed using robust standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Variables	1	2	3
CDS Activity			
CDS_TRADING	−0.009***	—	—
	(−2.71)	—	—
ln(NOTIONAL)	—	−0.004	—
	—	(−0.57)	—
ln(CDS_LIQ)	—	—	−0.006
	—	—	(−0.81)
Firm characteristics	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Credit-rating fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
No. of obs.	36,808	12,185	36,808
No. of clusters	5,110	3,093	5,110
Adj. R^2	0.046	0.042	0.046

on CDS_TRADING is −0.009 and significant, suggesting that the initiation of CDS trading is associated with a 0.9-percentage-point reduction in investments. The coefficient estimates on the CDS activity variables in regressions 2 and 3 are insignificant. Although we observe no change in FCFs, the decline in investments following CDS initiation suggests that the availability of CDS affects the deployment of cash into productive investments. This interpretation is consistent with the finding of Subrahmanyam et al. (2017) that firms increase their cash holdings after CDS initiation as a precautionary measure to protect themselves from being held up by hedged creditors.

V. Conclusion

The literature argues that the availability of CDSs introduces externalities that can increase or decrease firm value. We find that, on average, firm value decreases upon the introduction of CDS trading and that the effect is more pronounced for firms with higher CDS trading activity. This decline in firm value occurs because of an increase in the firm's cost of capital, rather than a decrease in its free cash flows. Moreover, we show that CDS trading increases the firm's credit risk and lowers its stock liquidity, both of which increase the firm's cost of capital. We also find that firm value declines less when CDS trading is more likely to provide incremental information, indicating that there are informational benefits associated with CDS trading. However, we do not find evidence that CDS trading increases investments by relaxing financing constraints.

Our evidence indicates that there are negative real effects associated with CDS trading. In Danis and Gamba's (2018) theoretical model, the real effects of CDS trading depend on how CDS trading alters the balance between bankruptcy costs and creditor bargaining power. Our evidence suggests that the negative real effects of CDS trading arise because the increased costs associated with

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bankruptcy outweigh the benefits associated with increased creditor bargaining power. In addition, our finding that CDS trading is associated with a decline in firm value through increasing credit risk supports the empty creditor hypothesis (Hu and Black (2008)), which argues that creditors with CDS protection face incentives to resist debt renegotiations in favor of bankruptcy.

Appendix. Variable Definitions

AGE: Age of a company in years, assuming the firm is born in the year it first appears in the CRSP data.

AGE_TRANS: $-1/(1 + \text{AGE})$.

AMIHUD_ILLIQ: The median absolute value of daily stock return divided by its dollar volume in a quarter.

BANK_FOREX: The average of affiliated institutions' hedging positions divided by their assets. An institution is affiliated with a firm in a quarter if it is the lead arranger in the firm's syndicated loan or serves as an underwriter for the firm's bond issues within the preceding 5 years.

BANK_RELATION: The number of lead banking relationships of a firm in a quarter identified using the outstanding syndicated loan facilities.

BOND_TURNOVER: For each bond and quarter, turnover equals the sum of bond volume divided by its outstanding amount. BOND_TURNOVER equals bond turnovers averaged at the firm-quarter level.

CAPX_TO_SALES: (Capital expenditures/sales) from the latest annual report preceding a quarter.

CDS_LIQ: (Number of daily 5-year CDS contract quotes in a quarter)/(number of trading days in the quarter).

CDS_LIQ_DUM: Indicates whether CDS_LIQ is greater than 0 in a quarter.

CDS_REVERSAL: Equals 1 if a firm with CDS trading has no CDS spread quotes and gross notional values in a quarter, and 0 otherwise.

CDS_TRADED: Equals 1 if there is a CDS market on the firm's debt at any time during the sample period, and 0 otherwise.

CDS_TRADING: Equals 1 for quarters following the CDS initiation, and 0 otherwise. CDS initiation is the earlier of the first date a firm appears in the Bloomberg and CMA CDS databases.

COST_OF_BONDS: Bond spread measured as offering yield minus the maturity-matched risk-free rate.

COST_OF_EQUITY: Equals the interest rate on a 10-year Treasury bond plus STOCK_BETA times expected excess market return from Bloomberg.

COST_OF_LOANS: Loan spread (all-in-drawn spread) over LIBOR at issue date.

DEBT_TO_ASSETS: Long-term debt/assets.

DIVIDEND_DUM: Indicates whether a firm pays dividends in a quarter.

EDF: Expected default frequency; the implied probability of default derived from Merton's (1974) distance-to-default model following the estimation method of Bharath and Shumway (2008).

EST_CDS_TRADING: Predicted CDS_TRADING computed using the estimates from regression 1 in Table IA-13.

FCF: Free cash flows; (net income + depreciation and amortization − CAPX − Δ working capital) (computed using annual financial data).

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FCF_TO_ASSETS: FCF/assets.

INVESTMENTS: (R&D expenditures + CAPX + acquisition expenditures − sale of PP&E) (computed using annual financial data).

INV_GRADE_DUM: Equals 1 for firms with investment grade credit ratings, and 0 otherwise.

INVERSE_MILLS_RATIO: Inverse Mills ratio calculated using the estimates from regression 1 in Table IA-13.

MB_RATIO: Market value of common equity/book value of common equity.

MVE: Market value of common equity from the latest financial statement preceding a quarter.

NOTIONAL: Average of weekly CDS gross notional values in a quarter (available since Oct. 2008).

NOTIONAL_DUM: Indicates whether gross notional is greater than 0 in a quarter.

POST_BIGBANG: Equals 1 for periods after Apr. 8, 2009, and 0 otherwise.

PROPENSITY_SCORE: Probability of CDS trading estimated using regression 2 in Table IA-13.

RATING_DOWN: Indicates whether a firm's credit rating is downgraded in a quarter.

RELATIVE_BIDASK: The median daily stock spread divided by stock price in a quarter.

RELATIVE_Q: Difference between a CDS firm's ln(TOBINS_Q) and the average non-CDS firm's ln(TOBINS_Q) in a quarter.

ROA: Net income/assets.

SEN_UNSEC_DUM: Indicates whether a firm has senior unsecured bonds outstanding in a quarter.

STOCK_BETA: Measured using the CAPM. For each firm-quarter, monthly excess stock returns are regressed on monthly excess market returns (value-weighted CRSP market index minus the 1e-month Treasury bill rate) during the 5-year period preceding a quarter. STOCK_BETA is the coefficient estimate on excess market returns.

STOCK_TURNOVER: Average of (daily share volume/shares outstanding) in a quarter.

THREE_WAY_INT: POST_BIGBANG × INV_GRADE_DUM × CDS_ACTIVITY.

TOBINS_Q: (Market value of common equity + book value of preferred equity and debt)/assets.

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