Credit Default Swaps and Corporate Cash Holdings*

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ABSTRACT

We examine the effects of credit default swaps (CDS), a major type of over-the-counter derivative, on the corporate liquidity management of the reference firms. CDS help firms to access the credit market since the lenders can hedge their credit risk more easily using these contracts. However, CDS-protected creditors can be tougher in debt renegotiations and less willing to support distressed borrowers, causing some firms to become more cautious. Consequently, we find that firms hold significantly more cash after the inception of CDS trading on their debt. The increase in cash holdings by CDS firms is more pronounced for financially constrained firms and firms facing higher refinancing risk. Moreover, bank relationships and outstanding credit facilities intensify the CDS effect on cash holding. Finally, firms with greater financial expertise hold more cash when their debt is referenced by CDS. These findings suggest that CDS, which are primarily a risk management tool for lenders, induce firms to adopt more conservative liquidity policies.

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I. Introduction

Credit default swaps (CDS), insurance-like derivative contracts on the credit risk of reference entities, are the main construct of the multi-trillion-dollar credit derivative market. While they were once labeled "financial weapons of mass destruction," CDS remain a robust and effective financial tool for hedging credit risk or taking on additional exposure. For example, banks' use of CDS has even expanded since the 2007-2009 financial crisis due to the implementation of Basel III norms. Therefore, it is important to understand the real effects of CDS trading on corporate financial decisions. Corporate finance executives such as CFOs and treasurers are becoming increasingly aware of the influence of CDS. "Like it or not, CFOs will increasingly be forced to deal with the default-swap gamblers."[1] In this study, we examine whether firms' liquidity management, especially their cash holdings, is affected by CDS trading on their debt.

Firms tend to build up their cash holdings to protect themselves against both expected financial constraints and unexpected financial shocks in the future. Almeida, Campello, Cunha, and Weisbach (2014) survey the literature on liquidity management and conclude that the dramatic increase in cash holding in recent years calls for further examination, especially to distinguish it from the time series patterns of other forms of liquidity management such as bank credit lines. CDS can affect corporate cash holdings in several ways, by influencing the availability of external financing. If the benefit of holding additional cash increases (due to an increase in bankruptcy risk, for example) or the cost decreases (due to cheaper credit, for example) after CDS trading, then the observed increase in cash holdings can be at least partially explained.

CDS provide a tool for creditors to use to protect themselves against adverse financial shocks to their borrowers. If creditors can hedge efficiently, then the borrowers may find it less necessary to follow conservative financial policies. Moreover, creditors with access to CDS may increase the supply of credit to the CDS-referenced firms. Given their CDS positions, the creditors' bargaining power is also enhanced, which, in turn, reduces the debtor firms' incentive for strategic default, and raises their holding of pledgeable assets. Both these effects cause the debtor firms' financial constraints to be relaxed after the inception of CDS trading on their debt. Consequently, they may hold less cash and rely more on the financial market to manage their liquidity needs. However, in contrast, CDS trading may change the incentives

[1] "Too Big to Ignore: Debt derivatives markets are encroaching on corporate finance decisions." *CFO Magazine*, September 26, 2007, available online at http://www.cfo.com/printable/article.cfm/-9821507?origin=archive (retrieved on May 11, 2014).

of creditors and increase the firms' refinancing risk, which is a key determinant of their cash holdings (Harford, Klasa, and Maxwell (2014)). When a firm is in financial distress, its CDS-protected creditors may be tougher in renegotiations. Thus, it may be hardest for firms to obtain capital from creditors when liquidity is most needed. Anticipating tougher CDS-protected creditors, firms may increase their cash holdings, *ex ante*, to ease the management of their liquidity needs in such an eventuality.

Bolton, Chen, and Wang (2014) show that financially constrained firms tend to build precautionary cash buffers to meet the expected *debt servicing cost*. The expected debt payments may drain the firms' valuable liquidity reserves. Therefore, the firms respond to this possibility by hoarding more cash. In Bolton, Chen, and Wang's (2014) model, when firms exhaust all available sources of internal cash and lines of credit, they can either raise new costly external funds or liquidate. Hence, as discussed above, firms' refinancing risk rises after the introduction of CDS trading on their debt. As a result, they are more concerned about the debt servicing cost, which generates additional precautionary demand for cash. Furthermore, the CDS spread is sensitive to changes in a firm's liquidity status. In particular, when corporate liquidity declines, the CDS market responds with a rising CDS spread. A sharp decline in cash holdings, resulting in a spike in the CDS spread, could undermine market confidence in the firm, and reinforce the negative view of it. Therefore, it may be judicious for a firm to keep more cash on hand, especially after the introduction of CDS trading on its debt.

We use a comprehensive CDS transaction data set for North American names to study the impact of CDS trading on cash holdings. Given the over-the-counter nature of the CDS market, it is hard to pin down the exact date of the introduction of CDS trading on a firm. Therefore, we rely on multiple data sources to identify this date for a firm, including GFI Inc., the largest global interdealer broker with the most extensive records of CDS trades and quotes, CreditTrade, a major intermediary, especially in the early stages of the CDS market, and Markit, a data disseminator and vendor, which provides daily quotes from major financial institutions. In our final sample, there are 901 CDS introductions from 1997 to 2009. We match these against the corporate cash holdings data from the Compustat database.

We analyze the level of cash holdings to identify the effect of CDS trading. However, the endogeneity of the effect of CDS introduction complicates the interpretation of this effect, since firms may be *selected* for CDS trading based on impending increases in their cash holdings. CDS firms may be fundamentally different from non-CDS firms, with regard to their decisions about cash holdings. Besides using fixed effects controls, we address the endogeneity concern through three alternative approaches: a difference-in-difference comparison, a propensity score

matching (PSM) analysis, and an instrumental variable (IV) approach. Following the previous literature (Saretto and Tookes (2013), and Subrahmanyam, Tang, and Wang (2014)), we use two IVs for CDS trading: the lenders' foreign exchange hedging positions and the lenders' Tier 1 capital ratio. We expect lenders with larger foreign exchange hedging positions to be more likely to trade the CDS of their borrowers. For the second instrument, we expect that lenders with a lower Tier 1 capital ratio would have a greater need to hedge the credit risk of their borrowers. Both these variables are less likely to directly affect a firm's cash-holding strategy, making them valid instruments.

Our main finding is that the introduction of CDS trading on a firm leads to an increase in its cash holdings, after controlling for variables suggested by alternative models of firms' demand for cash. This effect of CDS trading is both statistically significant and economically large. For our sample of CDS firms, the cash-to-assets ratio increases from 8.2% to 10.2% once the CDS starts trading, a 24.4% increase. We further confirm that this positive association between CDS trading and cash holdings is significant, even after controlling for the endogeneity of CDS introduction.

Having established the main finding that cash holdings increase after CDS trading begins, we next link firm characteristics to the CDS effect. Our objective is to identify firms that are more concerned about the CDS-induced "tough creditors", which is an intuitive explanation for the CDS effect. If the mitigation of tough-creditor-engendered refinancing risk drives the positive effect of CDS on cash holdings, then the increase in cash holdings should be more pronounced for these firms. In this spirit, we find that the cash holdings of unrated firms, and firms with non-investment grade ratings, are more affected by CDS trading. This finding relates to the implications financial constraints have for cash holdings, which can be captured by credit ratings. Unrated and non-investment-grade firms generally have less access to financial markets (more constrained), compared with investment grade firms. The financially constrained firms have fewer alternatives when their major debtors become tough CDS-protected creditors. Therefore, their precautionary motives for holding cash are higher than those of other less-constrained firms.

Firms with higher refinancing risk are more likely to renegotiate with tough creditors. As expected, we find that firms with higher refinancing risk hold more cash. Furthermore, given the reputational concerns of relationship lenders, firms with stronger lending relationships may be less affected by CDS trading. In addition, firms relying on lines of credit may be even more affected by the CDS introduction, since lines of credit are less reliable in the presence of tougher CDS-protected creditors. Our empirical evidence is consistent with above conjectures. Moreover, we find that the CDS effect is stronger for firms with larger notional amounts of

CDS in relation to debt outstanding, which would proxy for the expected incentives of tougher creditors.

The effectiveness of the tough-creditor mechanism depends on the firms' perception of CDS-protected tough creditors and refinancing risk. Anticipating the tough creditors and refinancing risk associated with CDS, firms will take preemptive action by increasing their cash holdings to protect themselves. Firms' financial expertise may affect their perception of the real effect of CDS. Firms with greater financial expertise will develop a better understanding of the derivatives markets and be more likely to take CDS into consideration in their corporate policies. Indeed, using the experience of the board of directors in finance as a proxy, we find that CDS firms with financial expertise exhibit a greater increase in their cash holdings.

Overall, we find that CDS trading can increase corporate cash holdings, an important corporate decision variable. Our paper provides a new perspective on the real effects of the credit derivatives market. Previous work has identified the impact of CDS on credit supply, the creditors' monitoring incentive, the reference entities' borrowing costs and default risk (see Bolton and Oehmke (2011), Parlour and Winton (2013), Ashcraft and Santos (2009), and Subrahmanyam, Tang, and Wang (2014)). We complement this prior research by showing that CDS can affect the strategic actions of reference entities. The combined evidence from our study and that of Saretto and Tookes (2013) is consistent with the model of Bolton, Chen, and Wang (2014), which suggests that, due to concerns about debt servicing costs, financially constrained firms issue more long-term debt and hold more cash.

Our study helps understand the trend of increasing cash holdings among U.S. firms, documented by Bates, Kahle, and Stulz (2009). Our finding is consistent with Harford, Klasa, and Maxwell (2014) in that firms hold more cash when their refinancing risk is higher. The underlying mechanism for the CDS effect on cash is consistent with Pinkowitz and Williamson's (2001) finding that cash holdings are higher in Japan due to greater bank power. Moreover, our empirical results support theories of corporate risk management such as those of Bolton, Chen, and Wang (2011, 2014). As firms become riskier after the inception of CDS trading, they rely on cash more than lines of credit for liquidity management (Acharya, Almeida, and Campello (2013)). The CDS trading explanation for cash holding is quantitatively important. The average cash holdings of large U.S. corporations approximately doubled from the mid-1990s to the early 2010s. The increase in the cash ratio for CDS firms two years after CDS introduction is approximately twice as large as that for matching non-CDS firms.

The paper proceeds as follows. Section II presents the related literature and the development of our hypotheses. In Section III, we describe our sample and empirical methods.

Section IV presents our main empirical results about the effect of CDS on cash holdings. Additional findings about the impact of firm characteristics and a discussion regarding the mechanism for the effects of CDS trading are presented in Section V. Section VI concludes.

II. Relevant Literature and Hypothesis Development

Since access to capital is a major concern for corporations, the availability of CDS may relax firms' financing constraints, due to their *risk mitigation effect*. Using CDS as an effective tool for credit risk transfer, lenders are more willing to lend after CDS inception (Minton, Stulz, and Williamson (2009), and Saretto and Tookes (2013)). Given the consequent relaxed credit supply constraints, firms' precautionary motives for holding cash may decrease.[2] However, debtor firms may face higher *refinancing risk* when there are CDS contracts referencing their debt, thus inducing them to hold more cash. On the one hand, CDS-protected "empty creditors" may ignore the continuation value of the firm due to their CDS position and not allow refinancing to take place. As argued by Hu and Black (2008), CDS permit such creditors who are fully hedged to retain an economic interest in the firm's cash flow, but with no risk alignment with the other creditors who do not have such credit protection. Empty creditors tend to be tougher in the renegotiation process due to the potential gain they would make from their CDS position in the event of default. They may even have an incentive to push a firm into inefficient default, or even bankruptcy, so as to obtain compensation from the payoff on their CDS holdings consequent to default (the "empty creditors" problem).[3] In such circumstances, it is harder for firms to obtain financing when it is most needed. Considering the potential effect of *tougher creditors*, firms rely more on cash holdings to manage their potential liquidity needs. Moreover, firms may take more risky projects and have more volatile cash flows after CDS trading has begun on their debt (Karolyi (2013)). Hence firms may hold more cash.

Moreover, while refinancing, firms may also face a higher cost of debt due to the presence of CDS contracts. As a result of hedging their credit exposure with CDS, the creditors'

[2]Bates, Kahle, and Stulz (2009) identify four motives for corporate cash holding and classify the literature examining corporate cash holdings accordingly: (1) the transaction motive, (2) the precautionary motive, (3) the agency motive, and (4) the tax motive. Many recent papers focus on the precautionary motive for holding cash, which stems from expected financial constraints in the future, in situations where access to capital markets might become costly. To mitigate this risk, firms tend to build up their cash holdings to protect themselves against negative financial shocks in the future. Previous papers such as Opler, Pinkowitz, Stultz, and Williamson (1999), followed by many others, have found evidence in support of the precautionary motive for corporate cash holding.

[3]Bolton and Oehmke (2011) formally model the empty creditor problem. Consistent with its theoretical prediction, a number of papers empirically investigate the impact of CDS on a firm's probability of restructuring/bankruptcy (e.g. Subrahmanyam, Tang, and Wang (2014)).

monitoring incentive is weakened, which may further affect the cost of debt. Ashcraft and Santos (2009) argue that such reduced monitoring may ultimately lead to a higher cost of debt. Che and Sethi (2014) find CDS can crowd out debt investors and reduce firms' debt capacity. Potential lenders may choose to sell CDS protection instead of lending to firms, implying a reduction in the credit supply and an increase in the rollover risk for the firm. Besides the refinancing risk, CDS may increase the *power of bank lenders*. Pinkowitz and Williamson (2001) find that bank power may affect corporate cash holdings. Strong banks persuade firms to hold large cash holdings as a cushion rather than use it to pay down their debt.

Creditor monitoring may decline, especially for relatively safer borrowers, once they can protect themselves with CDS (Parlour and Winton (2013)). As a result, internal governance may strengthen, reducing the severity of free cash flow concerns in the spirit of Jensen (1986). Harford, Mansi, and Maxwell (2008) show that higher cash holdings are related to stronger corporate governance. Therefore, similar to the the refinancing risk and bank power engendered by CDS, the *agency issues* also suggest that there should be higher cash holdings after the inception of CDS trading. If the *refinancing risk effect*, the *bank power effect* and the *agency issues* outweigh the *risk mitigation* benefit, then we would expect firms to hold more cash after CDS trading has been introduced.

Hypothesis 1 (Baseline) *The cash holdings of a firm increase following the introduction of trading in CDS contracts referencing its default.*

The effect of CDS trading on the size of a firm's cash holdings may vary with its other characteristics, affecting the extent of CDS-engendered refinancing risk and bank power (and, therefore, the severity of the "empty creditors" problem). A firm should be more concerned with CDS-induced refinancing risk if it is a financially constrained firm. The credit rating, while noisy, is a conventional *ex ante* measure of a firm's *financing constraints*. Unrated firms and firms' with non-investment grade ratings generally have less access to the financial market. As a result, they have fewer financing alternatives, especially when their major creditors are tougher CDS-protected creditors. After finding that their major creditors tend to be tougher in the renegotiation process, these firms could exhibit a greater increase in their cash holdings. In addition, unrated/non-investment grade firms rely more on their bank lenders. In consequence, the CDS-induced increase in lender power might be more prominent after CDS inception. As a result, powerful lenders of unrated/non-investment-grade CDS firms are more likely to induce higher cash holdings of their borrowers.

Moreover, a firm should be more concerned with the CDS-induced tougher creditor effect if it has higher *refinancing risk*. Firms with higher refinancing risk are more likely to engage in further renegotiations with tougher creditors. Anticipating this, CDS firms with refinancing risk will tend to build up more cash to mitigate the costs of the refinancing risk. We further expect that a firm with less *relationship lending* will exhibit a larger increase in its cash holdings. The creditor relationships of companies may affect the effect of CDS on their cash holdings. Firms that use only one bank in the syndicated loan market tend to have stronger lending relationships than those relying on multiple banks (Carvalho, Ferreira, and Matos (2014)). Relationship lenders may choose not to become tough empty creditors due to their reputation concerns. In such cases, the cash holdings of firms with strong lending relationships (that is a smaller number of banks relationship) will be less affected by the CDS.

The *availability of bank credit lines* may also mitigate the extent of the CDS effect on cash holdings. Specifically, a firm can create a cushion for the contingency of an adverse shock to its operating cash flow in two ways: either by maintaining a cash buffer or by negotiating a line of credit, which may or may not actually be available when required. While holding cash has an opportunity cost in terms of foregone investment opportunities in real or financial assets, the line of credit also involves a commitment fee that must be paid, even if it is not tapped. In addition, the line of credit may not be available in some states in the future, if the free cash flow turns out to be extremely poor and the covenants attached to the line of credit are breached. Moreover, a line of credit may generate additional rollover risk, since many credit lines have short term tenors. The availability of liquidity from a line of credit will also depend on the bank's ability and willingness to supply funds when needed by the firm.[4] Therefore, while the firm may wish to reduce its reliance on cash due to the opportunity costs involved, it may at the same time wish to moderate its reliance on lines of credit so as to reduce the cost of the commitment fee, and more importantly the risk of non-availability of the line of credit when the firm is squeezed financially.[5] The impact of CDS trading will be accentuated when a firm has a line of credit, since its potential non-availability in the future may cause additional stress. Lines of credit, which are not unconditional sources of finance,

[4]Demiroglu and James (2011) document the limitations of using credit lines to manage firm liquidity. Besides financial covenants, rollover risk, and the bank's ability and willingness to lend, material adverse change (MAC) clauses and borrowing base formulae also affect the availability of credit lines, especially under conditions of stress.

[5]A number of studies investigate firms' liquidity management strategies. Acharya, Almeida, and Campello (2013) find that a firm's exposure to aggregate risk affects its choice between cash and lines of credit. Lins, Servaes, and Tufano (2010) investigate whether firms use lines of credit and cash to hedge different types of risks. They find that lines of credit are often used to allow the possibility of exploring business opportunities in good times in the future. On the other hand, firms use non-operational cash flows to hedge against potential future cash flow shocks in bad times.

may become less reliable after the inception of CDS trading, especially if bank lenders become tougher CDS-protected creditors. Therefore, we hypothesize that the impact of CDS will be more significant for firms with lines of credit.

Finally, the notional amount of *CDS outstanding* relative to a firm's debt outstanding can be used as a proxy for the CDS exposure of its creditors. For firms with a larger amount of CDS outstanding, creditors have a greater incentive to reject restructuring and push the firms into bankruptcy. Thus, we expect the effect of CDS trading to be larger for those firms with greater CDS exposure. Overall, the above discussion emphasizes that, if the mitigation of CDS-induced refinancing risk and bank power drive the positive effect CDS has on cash holdings, this effect should be more pronounced for firms with a more severe "empty creditors" problem. To test this hypothesis, we identify firm characteristics that affect the extent of the "empty creditors" problem: a) financing constraints; b) refinancing risk; c) relationship lending; d) availability of lines of credit; e) CDS outstanding. These findings provide additional evidence supporting the proposition that CDS firms try to mitigate the CDS-induced "empty creditors" problem by holding additional cash. Therefore, we expect:

Hypothesis 2 (Tough Creditors) *The increase in the cash holdings of a firm after the introduction of CDS trading is even higher for firms that are more affected by the presence of tougher CDS-protected creditors.*

The above two hypotheses emphasize firms' response to CDS-induced refinancing risk. Essentially, CDS affect firms' financing constraints by changing the debtor-creditor relationship. Firms respond to this by adjusting their liquidity management strategy. However, firms may fail to anticipate the potential effect of CDS on their financing constraints when making their decisions about cash holdings. Thus, the effect of CDS on cash holdings depends on a firm's perception of the "empty creditors" problem. Firms with greater financial expertise may have a better understanding of derivatives and their real effects, including those of CDS, on corporations. Therefore, we would expect CDS firms with financial expertise to be more likely to take preemptive action to protect themselves from CDS-induced refinancing risk.

Hypothesis 3 (Financial Expertise of Firms) *Cash holdings are more sensitive to CDS trading among firms with greater financial expertise.*

III. Data and Empirical Specification

A. Data

We use CDS transaction data to identify a sample of firms with CDS contracts referencing their debt. Our CDS transaction data are from CreditTrade and the GFI Group. In contrast to the CDS quote data used in the previous literature, our data contain *actual* trading records with complete contractual information.[6] Given the over-the-counter nature of CDS contracts, we use the first CDS trading date in our sample as the CDS introduction date, and compare the changes in corporate cash holdings upon the onset of CDS trading. We further cross-check this CDS sample against the Markit database, which provides end-of-day valuations based on a survey of broker-dealers. In our later analysis, we also utilize more detailed transaction information, and construct continuous measures of CDS exposures. The combined sample covers the period from June 1997 to April 2009 and includes 901 North American corporates that have CDS initiated on them at some time during the sample period. The industry coverage of the CDS firms in our sample is quite diversified. Most are in the manufacturing (SIC 2,3), transportation, communications, and utilities (SIC 4), and finance, insurance, and real estate (SIC 6) sectors.[7]

Our data on corporate cash holdings and firm characteristics are from the Compustat database. Following Bates, Kahle, and Stulz (2009), we measure the cash holdings by the ratio of cash and marketable securities to total assets.[8] We obtain credit rating data from Compustat and FISD, line of credit data from Dealscan, and financial expertise data from RiskMetrics.[9]

Table I presents the year-wise summary of CDS trading and cash ratios, from 1997-2009, for all firms in the Compustat database: the number of Compustat firms (column 2), the number of firms on which CDS are traded (CDS firms) (columns 3 and 4), and cash ratios for firms without and with CDS trading (columns 5 and 6). As the fourth column of the table

[6] A similar data set is used by Subrahmanyam, Tang, and Wang (2014). Similar, but much less extensive, data sources are used in Acharya and Johnson (2007), Blanco, Brennan, and Marsh (2005), and Nashikkar, Subrahmanyam, and Mahanti (2011).

[7] In our main analysis, we do *not* exclude financial firms. However, we drop financial firms from the sample as a robustness check. The results are quite similar in all cases and therefore we report our results only for the full sample.

[8] While the ratio of cash and marketable securities to assets is the most conventional measure of cash holdings, we also check alternative measures of the cash ratio. See footnote 11 below for further discussion.

[9] Line-of-credit data have been used by several researchers including, most recently, Acharya, Almeida, and Campello (2013).

shows, CDS trading was initiated on the greatest number of new firms during the period from 2000 to 2003. As shown in the fifth and sixth columns, similar to the finding in Bates, Kahle, and Stulz (2009), there is an increasing trend over time in the cash ratios for both non-CDS and CDS firms in our sample, but the increase is larger for CDS firms: The average cash ratio for non-CDS firms in 2009 is 116% of the ratio in 1997, while the corresponding comparison is 143% for CDS firms. Moreover, the overall level of cash ratio for non-CDS firms more than doubled compared with that of CDS firms. This partly stems from the size effect: As we will show later, CDS firms are relatively large firms, compared to their non-CDS counterparts. Large firms generally hold less cash due to their economies of scale: they incur lower transaction costs per unit in converting fixed assets into liquid assets (Baumol (1952)).

B. Empirical Specification

We employ a model along the lines of Opler, Pinkowitz, Stultz and Williamson (1999) and Bates, Kahle, and Stulz (2009) to investigate the effect of CDS on corporate cash holdings.[10] We assume that corporate cash holdings are determined by:

$$Cash = \boldsymbol{\beta}\mathbf{X} + \gamma_1 CDS\ Trading + \boldsymbol{\delta}\mathbf{Y} + \epsilon \tag{1}$$

where *Cash* is the cash ratio measured as the ratio of cash and marketable securities to total assets, $\mathbf{X}$ is a vector of determinants of cash holdings, and $\mathbf{Y}$ is a vector of other controls such as firm fixed effects. The regression controls in our empirical specification are motivated by the transaction and precautionary explanations for cash holdings, presented in the previous section. We include a set of fundamental determinants of the firm's cash holdings, including the industry cash flow risk (*Industry Sigma*), the ratio of cash flow to total assets (*Cash Flow/Assets*), a measure of the investment opportunities (*Market to Book*), the logarithm of total assets (*Size*), the working capital ratio (*Net Working Capital/Assets*), the capital expenditure (*Capital Expenditure*), the leverage (*Leverage*), the ratio of research and development to sales (*R&D/Sales*), the dividend payment (*Dividend Dummy*), and the ratio of acquisitions to total assets (*Acquisition Activity*).

We estimate the impact of CDS trading on corporate cash holdings using an indicator variable in the model specification, similarly to Ashcraft and Santos (2009), Saretto and

[10]This model for the level of cash holdings has been used extensively in the literature, for example by Kim, Mauer, and Sherman (1998), Dittmar and Mahrt-Smith (2007), Foley, Hartzell, Titman, and Twite (2007), and Harford, Mansi, and Maxwell (2008).

Tookes (2013), and Subrahmanyam, Tang, and Wang (2014). *CDS Trading* is a dummy variable that equals one, for a CDS firm, after the inception of the firm's CDS trading, and zero before that. Therefore, the coefficient of interest is that of *CDS Trading*, which captures the impact of the inception of CDS trading on cash holdings.

The regression analysis is conducted on the sample including CDS firms and non-CDS firms. Given the unobservable differences between firms, we control for firm fixed effects in our panel data analysis. Our main challenge in establishing the relationship between CDS trading and corporate cash holdings is the potential endogeneity of CDS trading. It is possible that there is a third (unobservable) factor affecting both the introduction of CDS trading and corporate cash holdings. In that case, the observed effects might not be caused by the CDS contracts, but rather the impact of this third factor. We use three methods to address this endogeneity concern: difference-in-difference estimation, PSM analysis, and an IV approach, as well as the employment of continuous CDS exposure measures that are less affected by the selection issue, rather than the dummy variable *CDS Trading*. We expect firms with a larger CDS exposure to be more likely to be affected by CDS trading and, therefore, to have a greater precautionary motive for holding cash. We also control for other proxies for the severity of "empty creditors" problem and the financial expertise of the firms in assessing the nature of the relationship between CDS trading and cash holdings.

IV. CDS Trading and Cash Holdings: Empirical Results

In this section, we first report the baseline results regarding the effects of CDS on cash holdings, controlled for fixed effects, in the sample of CDS firms, with all non-CDS firms in the Compustat database serving as a control group. We then investigate whether these effects are robust to controlling for the endogeneity of CDS trading.

A. Changes in Cash Ratios around CDS Introduction

The summary statistics in Table I illustrate that there is an increase in the cash ratio for both CDS and non-CDS firms. To illustrate that CDS firms experience a more significant increase in this ratio, we focus on the changes in the cash ratio around the inception of CDS trading (defined as date 0). Figure 1 shows the changes in the cash ratios for CDS and non-CDS firms, from one year before the inception of CDS trading to zero (-1,0), one (-1,1), two (-1,2)

or three (-1,3) years after its inception. Non-CDS matching firms are selected from a sample of firms that do not have CDS trading at any time during the whole sample period. For each CDS firm, we find a non-CDS matching firm that is in the same industry (measured by the 4-digit SIC code) and has the closest size (measured by total assets) to the CDS firm. It is evident that the average cash ratio increases for both CDS and non-CDS firms. However, the increase is more pronounced for the CDS firms. We observe a 6% increase in the cash ratio, for both CDS firms and non-CDS matching firms, from year -1 to year 0. However, from year -1 to year +3, the increase in cash holdings for CDS firms is 0.7% more than that of the non-CDS matching firms. Given the mean cash ratio of 8% across the CDS firms and their non-CDS matching firms, the 0.7% additional increase in the cash ratio is economically significant. Therefore, from this figure, we obtain a preliminary indication that the increase in the cash ratio over the years is greater for CDS firms, subsequent to the initiation of CDS trading, than for their non-CDS counterparts.

B. Impact of CDS on Cash Holdings: Baseline Results

We next estimate the CDS effects on cash holdings with appropriate control variables. The baseline analysis is conducted on the sample of both CDS and non-CDS firms, using quarterly observations. We control for time and firm fixed effects in all our regressions. The variable of interest is *CDS Trading*, which equals one after the introduction of CDS trading on the firm's debt, and zero prior to that date. Therefore, the coefficient of *CDS Trading* captures the effect of CDS introduction on corporate cash holdings.

The baseline regression results are reported in Table II, which presents the evidence for the *level* of cash holdings. The first column lists the independent variables in the model specifications. The dependent variable for all specifications is the cash ratio, measured as the ratio of cash and marketable securities to total assets.[11] Specification 1 estimates the effects of CDS trading with only cash flow-related controls, including cash flow risk and the ratio of cash flow to total assets. Since firms may determine their leverage, cash holdings, payout policy, and investment policy simultaneously, we estimate a model of cash by including other determinants of cash holdings, but excluding leverage, dividends, capital expenditure,

[11] Although the most traditional measure of cash holdings is the ratio of cash and marketable securities to total assets, alternative measures include the ratio of cash and marketable securities to net assets, where net assets are measured as total assets minus cash, the ratio of cash and marketable securities to sales, and the ratio of cash and marketable assets to bonds outstanding. As a robustness check (in unreported results), we try all these alternative definitions of the cash ratio, and find that the qualitative nature of our results is not affected by the different definitions. Many other papers in the literature also use non-operational cash (excess cash). Lins, Servaes, and Tufano (2010) show that the correlation between the excess cash and the total cash is high, at about 0.75. Their findings are also quite similar when they use total cash.

acquisitions, and R&D from the set of explanatory variables in Specification 2.[12] Specification 3 includes additional firm characteristics as determinants of cash holdings.

CDS Trading has a positive coefficient in Specification 1, suggesting that the presence of CDS contracts leads to higher cash ratios. Moreover, the effect of *CDS Trading* is significant at the 1% level. The economic magnitude is also large: compared to the sample mean cash ratio of 8.2% for CDS firms, the 1.7% addition to the cash ratio after CDS introduction in Specification 1 represents a 20.7% increase in the sample mean cash ratio.[13] Controlling for more firm characteristics, Specifications 2 and 3 yield similar results, with the magnitude of the coefficient for *CDS Trading* being even higher.[14] Since firms can have different unobservable characteristics that may affect their corporate cash-holding policies, we control for firm fixed effects in all model specifications. CDS firms can differ from non-CDS firms on various dimensions. As a robustness check, instead of using firm fixed effects, we use *CDS Firm* as an additional control. Similar to in Ashcraft and Santos (2009), Saretto and Tookes (2013), and Subrahmanyam, Tang, and Wang (2014), *CDS Firm* is a dummy variable that equals one for firms with CDS trading at any point during our sample period. Hence, *CDS Firm* can be used to control for the unobservable differences between CDS and non-CDS firms. Since firms in different industries can vary from one another on many dimensions we also control for industry fixed effects in all model specifications that include the *CDS Firm* dummy.[15]

The coefficients of the control variables are consistent with prior findings. As predicted, the coefficient of *Cash Flow/Assets* is positive and significant in all model specifications except Specification 1, showing that firms with higher cash flows accumulate greater cash holdings. Firms with high cash flow risk, as measured by *Industry Sigma*, hold significantly more precautionary cash. Also, as expected, the *Market to Book* ratio has positive and significant coefficients, indicating that firms with greater investment opportunities have higher costs of being financially constrained and therefore tend to hold more cash. The negative sign of the coefficient of *Size* relates to the economies of scale in holding cash: large firms hold proportionately less cash. *Net Working Capital/Assets* decreases cash holdings, since the numerator represents assets that substitute for cash. The coefficient of *Capital Expenditure*

[12]This specification is in the spirit of Opler, Pinkowitz, Stulz, and Williamson (1999), Dittmar and Mahrt-Smith (2007), and Gao, Harford, and Li (2013).

[13]A related question is whether the 1.7% change in the cash ratio is enough for the firm to tackle the additional liquidity needs potentially generated by the tougher CDS-protected creditors. Unfortunately, it is difficult to measure this potential liquidity need *directly* due to data limitations: we do not have detailed information on the individual portfolios of the creditors.

[14]In Specifications 2 and 3, the presence of CDS trading increases corporate cash holdings by 2.4% and 2%, respectively.

[15]Since our results are not materially affected when we replace firm fixed effects with *CDS Firm* and industry fixed effects, we do not report them here in the interests of conserving space.

is negative and significant, because capital expenditure creates assets that can be used as collateral for future borrowing, thus reducing the precautionary demand for cash holdings. The sign of the coefficient of *Leverage* is negative since firms may use cash to reduce leverage. *R&D/Sales* is another measure of future growth opportunities. Firms with higher R&D have a greater cost of being financially constrained, since they need to plan for future investment opportunities, and therefore hold more cash. The coefficient of *Acquisition Activity* has the same sign as that of *Capital Expenditure*, which is as expected since acquisitions and capital expenditure are likely to be substitutes for each other. The only coefficient that differs from our expectation is that of the *Dividend Dummy*. Firms with dividend payments would be expected to hold less cash, because they are likely to be less risky and less financially constrained. However, in our sample, we find a positive sign for this coefficient. This may be due to the changes in the relationship between cash holdings and firm characteristics over time, as discussed in Bates, Kahle, and Stulz (2009).

Multinational firms may hold more cash for a variety of reasons, including the ability to reduce taxes by postponing the repatriation of overseas profits (as pointed out by Pinkowitz, Stulz, and Williamson (2013)). In Table A1, we include additional controls for multinational firms. We follow Pinkowitz, Stulz, and Williamson (2013) and define multinational firms as those making 25% of their sales abroad according to the Compustat Historical Segment data. Besides the dummy variable for multinational firms, we also directly include the ratio of *Foreign Sales/Total Sales* in our estimations. The results from Specifications 1 and 2 presented in Table A1 provide some evidence that multinational firms hold more cash. However, the coefficients for *Foreign Sales/Total Sales* and *Multinational* are not significant after including other firm characteristics as controls.[16] *CDS Trading* continues to be a significant determinant of cash holdings.

As a robustness check, we also conduct an analysis of the *change* in cash holdings (Δ *Cash/Assets*), the results of which we report in Table A2. Following Almeida, Campello, and Weisbach (2004) and Bates, Kahle, and Stulz (2009), we estimate a model of the annual change in cash.[17] In addition to the variables in the baseline model, we also include the lagged cash ratio to allow for partial adjustment of the cash ratio to its optimal level. As in the baseline results in Table II, Specification 1 in Table A2 includes only cash-flow-related variables, while Specifications 2 and 3 include other firm characteristics related to cash holdings. The coefficient of *CDS Trading* is positive and significant in all model specifications. These

[16]Bates, Kahle, and Stulz (2009) obtain a similar result. It is possible that these proxies for multinational operations are not sufficiently granular to discern the true drivers of additional cash held overseas. Further investigation of this issue is warranted.

[17]It is difficult to model changes in cash with quarterly data due to seasonality effects.

results indicate that, in a given year, firms with CDS trading on their debt augment their cash reserves by more than non-CDS firms. Moreover, an increase in the lagged cash ratio leads to a decrease in the change in cash holdings. Similarly to the findings in the prior literature, $\Delta Size$ is positively related to changes in cash holdings. The coefficients of the other factors are generally consistent with the baseline model for the level of cash reported in Table II.

In summary, Table II presents our baseline analysis of the determinants of corporate cash holdings. Consistent with our expectation, the results indicate that corporate cash holdings increase after CDS introduction. However, to establish the *causal* relationship between CDS trading and cash holdings, it is critical to control for the endogeneity of the former appropriately. In the following subsections, we formally address the endogeneity issue, using three alternative econometric approaches.

C. Endogenizing CDS Trading

C.1. Determinants of CDS Trading

The endogeneity of CDS trading complicates the interpretation of the impact of CDS trading on cash holdings. It is possible that investors may anticipate a firm's increase in cash holdings, and initiate CDS trading on it as a result. If this selection effect is valid, our baseline finding may be contaminated by the endogeneity of CDS trading. Of course, we control for firm fixed effects in all model specifications, which accounts for the time-invariant differences in characteristics between CDS and non-CDS firms, and may partially address this issue. However, it is still necessary to address the endogeneity directly. To that end, we implement alternative econometric methodologies suggested by Li and Prabhala (2007) and Roberts and Whited (2012) to control for endogeneity by including IVs. We use difference-in-difference estimation, PSM, and the IV approach, using two-stage least squares (2SLS) regression to re-estimate the CDS effect, after controlling for the selection of firms into the CDS sample.[18]

To implement these approaches, we first need to estimate a model for the selection of firms for CDS trading. Following Ashcraft and Santos (2009), Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2014), the prediction model is estimated using a probit specification with a dependent variable that equals one after the introduction of CDS trading, and zero otherwise. We use data from 1997 until the first month of CDS trading for CDS

[18]Our approach is similar to those of Ashcraft and Santos (2009), Saretto and Tookes (2013), and Subrahmanyam, Tang, and Wang (2014), who address similar endogeneity concerns in the context of the introduction of CDS trading.

firms, and all observations for non-CDS firms, to predict the introduction of CDS trading for a firm.

We employ two IVs: FX hedging activities by banks and underwriters, *Lender FX Usage*, and the Tier 1 capital ratio of the lenders, *Lender Tier 1 Capital*. Both IVs relate to the lenders' hedging interest, but are not expected to affect the firms' liquidity policies directly. Specifically, lenders with a larger FX hedging position are more likely, in general, to trade the CDS of their borrowers; banks with lower capital ratios have a greater need to hedge the credit risk of their borrowers via CDS. Therefore, those instruments seem to satisfy both the exclusion and relevance conditions.[19]

To construct the IVs, we first identify lenders and bond underwriters for our sample firms based on DealScan (for lenders) and FISD (for bond underwriters) data. We then obtain, from Federal Reserve call reports, data on the foreign exchange derivatives positions of these lenders and bond underwriters. For each firm in each quarter, *Lender FX Usage* is constructed as the average amount of foreign exchange derivatives usage for hedging purposes relative to the bank's total assets, across those banks that have either served as a lender or a bond underwriter to the firm, over the previous five years. To construct the instrument *Lender Tier 1 Capital* we further link the identities of the lenders and bond underwriters with the Compustat Bank file, which contains the lenders' Tier 1 capital ratio data. For each firm in each quarter the *Lender Tier 1 Capital* ratio is defined as the average of the Tier 1 capital ratios across all banks that have either served as lenders or bond underwriters to this firm over the previous five years. Besides these IVs, we include other firm characteristics such as size, leverage, and other controls in the CDS prediction models. Furthermore, we use lender size and the lender's total credit derivative position as the other explanatory variables that determine CDS trading.

The CDS trading prediction results are reported in Table A3. First, we confirm that larger firms are more likely to have CDS contracts trading on them. In addition to size, CDS trading is more likely for firms with high leverage, but with investment grade ratings. Also, unrated firms are less likely to have CDS traded on them. Firms with high profitability, tangibility, and working capital are all more likely to have CDS trading on them. Overall, it appears that firms typically have relatively high credit quality and visibility (a stronger balance sheet and larger size) at the time of CDS inception. The presence of CDS contracts for firms also relates to the lenders' characteristics. Large lenders and lenders with more credit derivative

[19]The instruments, lender FX hedging activities and capital adequacy, could both be affected by local and/or industry business conditions, which in turn will be likely to have an impact upon cash policy. However, unless their lenders are also buffeted by the same local factors, this is unlikely to be a serious concern.

trading activity are, generally, more likely to trade the CDS of their borrowers. Furthermore, the results indicate that our IVs, *Lender FX Usage* and *Lender Tier 1 Capital*, appear to be relevant, as they jointly predict CDS trading, even after we control for other variables.

Table A3 shows that CDS trading can be explained reasonably well by the explanatory variables, with a pseudo-R^2 of around 38.9%. In the following analysis, we will use these CDS trading prediction models to conduct our difference-in-difference analysis, PSM analysis, and IV approach estimation, to re-examine the relationship between CDS trading and cash holdings. Specifically, we first construct our PSM sample based on the CDS prediction model: for each CDS firm, we find one non-CDS matching firm with a similar propensity score for CDS trading. We use the PSM sample in two different ways. First, after constructing the sample, we conduct a difference-in-difference analysis to identify the treatment effect, i.e., the effect of the introduction of CDS trading. Second, we run the cash holdings analysis, along the lines discussed in the previous section, on this matched sample. In constructing our PSM sample, we use all three prediction models in Table A3 for CDS trading as a robustness check. Additionally, we use three different PSM criteria to choose matching firms: (1) the one non-CDS firm nearest, in terms of propensity score, to the CDS firm; (2) the one firm with the nearest propensity score, but within a difference of 1%; and (3) the two firms with propensity scores closest to the CDS firm. Finally, we implement the IV approach based on the CDS trading prediction model.

C.2. Difference-in-Difference Analysis

In this analysis, we compare the changes in the ratio of cash and marketable assets to total assets, from before to after the introduction of CDS trading, for CDS firms against their propensity-score-matched non-CDS firms. The results are shown in Table A4. They indicate that the difference-in-difference estimates of the cash ratio are both statistically and economically significant for the $(t-1, t+1)$ and $(t-1, t+2)$ event windows, in all three model specifications, and whether one or two matching firms are used. For example, when we use Model 3 to choose the "nearest-one" propensity-score-matched firm, the cash ratio is 1.7% higher after CDS introduction, relative to the non-CDS matching firm in the $(t-1, t+2)$ event window, a substantial increase over the cash ratio of the average CDS firm of 8.2%. While indicative of the effect of CDS trading on the cash holdings of firms, the results have to be interpreted with caution, since the event itself, CDS introduction, may be endogenous. We address this issue directly in the sub-sections below.

C.3. Propensity Score Matching

As distinguished from the baseline model that uses all non-CDS firms in the Compustat sample as the control group, firms in the restricted PSM sample are more comparable with each other. Table III presents the regression results.[20] In all specifications, the coefficient estimates for *CDS Trading* are significantly positive. This indicates that corporate cash holdings increase after CDS trading has been introduced. The economic magnitudes are also large: For example, compared to the sample mean cash ratio of 8% for this restricted sample, the 2.6% change in cash after CDS introduction in the results using "nearest one" matching represents a 32.5% increase in the mean cash ratio.

However, the PSM approach is only effective in controlling for the *observable* differences in firm characteristics between the treatment and control groups. It is possible that there is an unobservable variable that drives both the introduction of CDS trading and corporate cash holdings. If this were true, then PSM would not effectively address the endogeneity in this setting. In the next section, to alleviate this concern, we use the IV approach to address the endogeneity issue directly.

C.4. The Instrumental Variable Approach

Since it is possible that firms expected to have greater *future* cash holdings are selected for CDS trading, there could also be unobserved omitted variables that drive both the selection of firms for CDS trading and their cash holdings. To allow for the possibility of time-varying unobserved heterogeneity across firms, we estimate a 2SLS model with IVs, where the indicator variable, *CDS Trading*, is treated as endogenous. Specifically, the cash holdings and the CDS contract status of a firm can be modeled as follows:

$$
\begin{aligned}
&Cash = \boldsymbol{\beta}\mathbf{X} + \gamma_1 \, CDS\ Trading + \boldsymbol{\delta}\mathbf{Y} + \epsilon, \\
&CDS\ Trading^{*} = \boldsymbol{\lambda}\mathbf{Z} + \omega, \\
&CDS\ Trading = 1, if\ CDS\ Trading^{*} > 0; CDS\ Trading = 0, otherwise.
\end{aligned}
\tag{2}
$$

Similarly to in the baseline model, the dependent variable here is the cash ratio, measured

[20] We use all three alternative PSM criteria discussed in the previous section to assess the robustness of our PSM results. However, only CDS prediction Model 3 in Table A3 is used to calculate the propensity scores in the results reported in Table III.

by the ratio of cash and marketable securities to total assets. $\mathbf{X}$ is a vector of determinants of cash holdings, and $\mathbf{Y}$ is a vector of other controls such as firm fixed effects. The coefficient of interest is γ_1, which captures the impact of CDS on corporate cash holdings. The instrumented variable *CDS Trading** represents the *latent* propensity of a firm to have CDS trading initiated on its debt. In the above specification, *CDS Trading* is allowed to be endogenous, since $corr(\epsilon, \omega) \neq 0$. For identification, we include IVs that affect a firm's propensity for CDS introduction, but do not affect its cash holdings directly, other than through the impact of CDS introduction. Therefore, $\mathbf{Z}$ in equation (2) includes the IVs.

Our choice of IVs is motivated by both econometric and economic considerations. In this analysis, we use both *Lender FX Usage* and *Lender Tier 1 Capital* as instruments. Econometrically, the instruments need to satisfy the relevance and exclusion restrictions. The relevance condition is met as the results in Table A3 show that CDS trading is significantly associated with lender FX hedging and the Tier 1 capital ratio. The instruments we use are economically sound, because they are associated with the overall hedging interest of the lenders or credit suppliers. Specifically, lenders with a larger hedging position are more likely, in general, to trade the CDS of their borrowers. Moreover, banks with lower capital ratios have a greater need to hedge the credit risk of their borrowers via CDS. It is worth noting that the instruments we use are not weak: From Table A3, we find that the Sargan F-test statistics are above 10 for both IVs, thus strongly rejecting the hypothesis of weak instruments.

The fitted value of *CDS Trading* is included in the second-stage analysis of the determinants of cash holdings. Table IV presents the results of the second-stage estimation. We find that *Instrumented CDS Trading* has a positive and significant coefficient estimate. In other words, the result that firms hold more cash after the introduction of CDS trading is confirmed, even after we ensure that the variable is identified.

The results, so far, suggest that there are economically and statistically significant effects of CDS trading on corporate cash holdings. The CDS effect is robust to controlling for the endogeneity of CDS trading using a variety of econometric approaches, including the difference-in-difference analysis, PSM and IV approaches. In the next section, we examine this issue further by constructing a continuous economic measure of CDS exposure, which is less affected by the selection concern. We also investigate further the cross-sectional differences in the CDS effect on cash holdings.

V. Channels and Mechanisms for the Increase in Cash Holdings after CDS Trading

Having established the main finding that the reference firm's cash holdings increase after CDS trading begins, in this section we investigate the potential mechanisms for this effect. An important explanation is that CDS trading may exacerbate the capital market frictions faced by firms. One possible mechanism lies in the tougher CDS-protected "empty creditors". We first document that the increase in the holding of cash by CDS firms is more pronounced for financially constrained firms, those with higher refinancing risk, and entities with less relationship lending. We further find that firms with lines of credit hoard more cash. In addition to the presence of CDS trading, cash holdings increase with the amount of CDS contracts in relation to the total debt outstanding. Moreover, CDS firms with greater financial expertise on their boards respond to tougher CDS-protected creditors with larger increases in their cash holdings.

A. Financing Constraints

The effect of CDS on corporate cash holdings may vary with the credit rating of the issuing firm. Almeida, Campello, and Weisbach (2004) find that firms facing greater capital market frictions, i.e., financially constrained firms, are more likely to retain more cash from their free cash flows. Similarly, financially constrained firms have fewer alternative external financing options when their lenders become tougher CDS-protected creditors. Consequently, they tend to build up greater cash holdings after the introduction of CDS trading on their debt.[21] Therefore, we expect the cash holdings of financially constrained firms to be more heavily affected by CDS trading. This prediction is also consistent with the argument regarding the tougher creditor mechanism.

Table V examines the impact of CDS trading on cash holdings, conditional on firm characteristics. Following the previous literature, credit ratings are used as the measure of the tightness of financial constraints. Specification 1 includes *Unrated* and *CDS Trading*Unrated* as explanatory variables. Firms are divided into unrated and rated categories, based on their rating status during the current quarter. Unrated firms are expected to be more financially

[21]For firms without credit ratings, the CDS spread provides valuable information about the firm's credit quality. Consequently, it is even more valuable for these firms to maintain liquidity, so as to maintain a reasonable CDS spread. Thus, the CDS feedback effect argument also predicts that unrated firms will be more heavily affected by CDS trading.

constrained. The variable of interest is *CDS Trading*Unrated*, which captures the CDS trading impact, conditional on a firm's rating status. The results indicate that the impact of CDS trading on the cash holdings of firms is even more significant for firms without a credit rating. Moreover, *CDS Trading* continues to be significant after we control for the firms' rating status. Specification 2 divides firms into non-investment-grade and investment-grade categories. Non-investment-grade firms tend to be more financially constrained. As in the results of Specification 1, *CDS Trading* Non-investment Grade* is positive and significant. As a robustness check, Specification 3 employs both *Unrated* and *Non-investment Grade* as proxies for the financial constraints on firms. In sum, the results in this table suggest that the cash holdings of financially constrained firms, as defined by their credit rating status, are more heavily affected by CDS trading.

B. Refinancing Risk

Corporations often rollover their outstanding debt, i.e., they issue new debt to redeem existing debt. Such refinancing of existing debt may involve rollover risk, particularly in future states in which the firms' credit situation changes adversely, when new debtholders are reluctant to lend. One way to mitigate this rollover risk is for firms to hold additional cash in anticipation of this contingency. Harford, Klasa, and Maxwell (2014) provide empirical support for this conjecture when they show that debt rollover risk is a key determinant of corporate cash holdings. Along the same lines, in our setting, if CDS trading affects the firms' financial policy decisions, we would expect CDS firms with higher rollover risk to exhibit correspondingly larger increases in their respective cash holdings, compared with those without CDS traded on them.

We follow Gopalan, Song, and Yerramilli (2014) and measure rollover risk as the long-term debt payable within a year, as defined in the Compustat data base. *Long-Term Debt Due in One Year* is a dummy variable that equals one for firms with debt due in one year. Table VI presents the results after this rollover risk is controlled for. As expected, we find that the coefficient on *Long-Term Debt Due in One Year* is positive and significant, which implies that a firm's rollover risk has a positive effect on its cash holdings. This finding is consistent with Harford, Klasa, and Maxwell (2014). To examine whether the CDS effect on firms' financial policy is larger for firms with higher rollover risk, we further incorporate an interaction variable, *CDS Trading*Long-Term Debt Due in One Year*, into our specification. We find that the coefficient of the interaction variable is significantly positive, indicating that, consistent with our prediction, CDS have a more pronounced, positive effect on cash holdings for firms with greater refinancing risk. Based on the model, CDS lead to an extra

1.9% increase in cash holdings. However, for firms with higher refinancing risk, CDS lead to a 2.6% increase in cash holdings, an economically significant increase.

C. Relationship Lending

The creditor relationships of companies may also influence the effect CDS trading has on their cash holdings. Firms with multiple creditor relationships may have better access to the financial market. As a result, they may tend to hold less cash and rely more on external financing to manage their liquidity needs. However, the *number* of such creditor relationships may also represent the extent of relationship lending to the firm. Firms using only one bank in the syndicated loan market tend to have stronger lending relationships than those relying on multiple banks (as argued by Carvalho, Ferreira, and Matos (2013)). Relationship lenders may choose not to become tough empty creditors due to their reputation concerns. Therefore, we expect the cash holdings of firms with strong lending relationships (albeit a smaller number of such relationships) to be less strongly affected by the presence of CDS trading.[22]

The overall creditor relationship is represented in our analysis by the number of bank relationships, obtained from Dealscan LPC. For each firm in a given quarter, we examine the prior five-year period for any syndicated loan facilities the firm has. Summing over all such active facilities, we compute the number of unique banks. Then we re-estimate the baseline cash-holding model including this bank relationship information. The estimation results are presented in Table VII. Specification 1 shows the baseline results for reference. In Specification 2, *Number of Banks* is included as an additional control. As expected, the negative and statistically significant sign for *Number of Banks* shows that firms with more bank relationships hold less cash. However, the effect of CDS on cash holdings is even more significant for firms with a greater number of bank relationships (signifying less relationship lending), as evidenced by the significant positive coefficient for *CDS Trading*Number of Banks*. Firms with less relationship lending are expected to be more heavily affected by the "empty creditors" problem, resulting in higher refinancing risk as discussed above. In addition, *CDS Trading* continues to be a significant determinant of cash holdings.

[22]Firms with multiple creditor relationships may have multiple avenues through which to access funding and increase their cash holdings. From the funding perspective, we also expect the increase in cash holdings to be more pronounced for CDS firms with multiple creditors.

D. *Lines of Credit*

Firms can choose liquidity in the form of cash and/or credit lines. Banks monitor borrowers and may revoke credit lines if they breach covenants or take unusual actions (Acharya, Almeida, Ippolito, and Perez (2014)). CDS referencing may increase the firm's precautionary demand for cash and force it to rely less on bank lines of credit. Firms with high refinancing risk are likely to use cash instead of credit lines.

Firms' access to bank lines of credit may complicate the interpretation of the effect of CDS on cash holdings. A firm's use of its lines of credit is related to the level of its cash flows.[23] For firms with high predictable cash flows, credit lines are a good liquidity substitute for cash. This is because the high, predictable cash flows allow them to reduce the likelihood of financial covenant violations that are usually defined in terms of cash flows. For firms with low cash flows, with the possibility of shocks, the line of credit may not be available when it is most needed, due to the possibility of a financial covenant violation. Hence, there may be a substitution effect between cash holdings and lines of credit, and the effect of CDS trading on cash holdings may be muted.

In measuring the impact of CDS trading on cash holdings, a valid concern, therefore, is that firms may substitute lines of credit for cash. As a consequence, the predicted increase in cash holdings due to CDS trading may be muted. To address this possibility, we re-estimate the model of the determinants of cash, *after* controlling for the direct effect of lines of credit. *Line of Credit* is a dummy that equals one if the firm has a line of credit. The results from this estimation are reported in Table VIII. Specification 1 lists the baseline cash results from Table II for comparison. Specification 2 includes *Line of Credit* as an additional control in the cash ratio regression. As expected, *Line of Credit* has a negative and significant sign. This indicates that firms with a line of credit rely less on cash to manage their liquidity needs. However, the coefficients of other variables are similar to those from Specification 1. In particular, *CDS Trading* continues to be a significant determinant of cash holdings. The positive and significant sign of its coefficient in Specification 2 indicates that CDS trading causes an increase in corporate cash holdings, even after the direct effect of lines of credit is controlled for. In addition, CDS trading may affect corporate cash holdings by affecting the reliability of the lines of credit. The access to bank credit lines may be state-contingent. Covenant violation, MAC clauses, and even a lender's willingness/ability to supply funds can limit firms' access to credit lines, especially in periods of financial stress. Moreover, the

[23] See Sufi (2009).

short-term nature of credit lines exposes firms to rollover risk.[24] Lines of credit may become less reliable after the introduction of CDS, especially if bank lenders become tougher CDS-protected creditors as a result.[25] Thus, firms rely more heavily on cash to manage corporate liquidity, in anticipation of this eventuality. To account for this, Specification 3 includes the cross-term of *CDS Trading* and *Line of Credit*. The positive and significant sign for *CDS Trading*Line of Credit* indicates that the effect of CDS trading on cash holdings is more significant for firms with a line of credit. Moreover, after the adding of the cross-term, *CDS Trading* is not significant.

These results indicate that the effect of CDS trading on cash holdings may operate primarily through its impact on the reliability of existing lines of credit. These findings are again consistent with the "tougher creditor" mechanism, i.e., indicating that bank lines of credit are less reliable when bank lenders protect themselves with CDS contracts. Firms with credit lines may draw on these lines in order to increase their cash positions (while other firms do not have such an expeditious option). Ivanshina and Scharfstein (2010) document that "at least some firms drew on their lines because of concerns about financial stability. Commonly this is interpreted as (precautionary) cash hoarding." Therefore, from the perspective of sources of cash, we also expect CDS firms with credit lines to hoard more cash, to avoid the contingency of unreliable lines of credit. Hence, our evidence is also consistent with the scenario that firms draw on a part of the line of credit and hold the proceeds as cash.

E. Outstanding CDS Positions

Instead of using the regime variable, *CDS Trading*, which equals one after the introduction of CDS trading, we utilize detailed information about the notional amount of CDS contracts outstanding to construct a continuous measure of CDS exposure. Continuous economic variables also help further address the self-selection concern in analyzing the effect of CDS trading. As pointed out by Li and Prabhala (2007), the magnitude of the selection variable (for CDS trading) introduces an independent source of variation and aids the identification of the treatment effect, while ameliorating the self-selection concern. In addition, the continuous CDS outstanding measure is also a proxy for the severity of the CDS effect: The larger is the

[24]As argued by Demiroglu and James (2011), bank credit lines are typically short-term; for example, during the 1996-2009 period, about 21% of new credit lines had a stated maturity of less than 365 days.

[25]Sufi (2009) shows that "cash flow and leverage ratios are the most common component of financial covenants, and they are also the most powerful predictors of covenant violations." Moreover, when a firm violates its debt covenants, the reduction in the availability of lines of credit is significant. Given the increase in leverage (as documented by Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2014)) after CDS introduction, CDS firms might be more likely to violate existing covenants.

amount of CDS outstanding, the greater will be the benefits to the CDS-protected creditors, and therefore the tougher the empty creditors are likely to be in the process of re-negotiation. Moreover, the amount of CDS outstanding is a proxy for CDS market liquidity; hence, the CDS spread of a firm with more CDS outstanding and, hence, with a more liquid CDS market, will be more sensitive to new information, such as the firm's credit and liquidity status. Therefore, the feedback effect from the CDS market to the bond market will be more severe for firms with larger amounts of CDS outstanding. Thus, both the tougher creditor mechanism and the CDS feedback mechanism predict that firms have a greater incentive to hold cash reserves when there are proportionately more CDS contracts outstanding on their debt.

We measure the level of corporate CDS outstanding by the ratio of the notional dollar amount of CDS contracts outstanding to the total dollar amount of debt outstanding at the same time, *CDS Notional Outstanding/Total Debt*. We scale the CDS position by total debt in order to relate the dollar amount of CDS outstanding to the potential total demand of the creditors. We conjecture that firms with greater relative proportions of CDS outstanding are likely to be more vulnerable to the CDS effect. This measure of CDS exposure measure may be endogenous, since market participants choose the amount of CDS to trade based on their assessment of the firms credit status and vulnerability. To address this concern, we model *CDS Notional Outstanding/Total Debt*, and use *Instrumented CDS Notional Outstanding/Total Debt* in the cash holdings analysis.[26]

Our estimation results are presented in Table IX. Specification 1 uses *CDS Notional Outstanding/Total Debt* as the measure of CDS exposure. The positive and significant coefficient of this variable indicates that CDS trading increases cash holdings. Specification 2 uses *Instrumented CDS Notional Outstanding/Total Debt*. Again, we find a significant positive coefficient. These findings suggest that, the greater is the CDS exposure, the higher are the corporate cash holdings. This effect is robust after controlling for the potential endogeneity of the amount of CDS outstanding.

F. Firms' Financial Expertise

The background of senior corporate executives and board members can greatly influence a firm's financial policies. For example, firms run by CEOs who have experienced financial difficulties in the past save more cash (Dittmar and Duchin (2013)). Banks take more risk when independent board directors have more financial expertise (Minton, Taillard, and Williamson

[26]The prediction model used for *CDS Notional Outstanding/Total Debt* is similar to that used in Table A3. *Lender FX Usage* and *Lender Tier 1 Capital Ratio* are again used as IVs.

(2014)). There is also evidence that firms with CEOs who are financial experts hold less cash and more debt (see Custodio and Metzger (2014)). In this spirit, firms with greater financial expertise among their board members and senior managers may have a better understanding of the potential effect of CDS on their firms' creditor relationships. Therefore, they are more likely to take preemptive actions to protect themselves from the CDS-induced "tougher" creditors. If such creditors are indeed a major concern for borrowers, we expect the increase in cash holdings exhibited by CDS firms to be more pronounced for those with more financial expertise.

We measure the financial expertise of firms based on information from RiskMetrics. The Directors Data in Riskmetrics include a range of variables related to the individual board directors of firms, including their names, ages, whether they have financial expertise etc. In our regression analysis, we define *Financial Expertise* as a dummy equal to one if the firm has at least one financial expert among its board members. *Number of Financial Experts* is the log of the number of financial experts on the board. The interaction terms of *CDS Trading*Financial Expertise* and *CDS Trading*Number of Financial Experts* capture the effect of CDS trading on cash holdings for firms with financial expertise. We conduct the cash holdings analysis on the sample of CDS firms after controlling for their financial expertise. The results in Table X indicate that firms with financial expertise hold less cash, a finding similar to that of Custodio and Metzger (2014). Moreover, the positive and significant coefficients for the interaction variables imply that CDS firms with financial expertise hold more cash.

VI. Conclusion

This paper investigates the impact of CDS on corporate cash holdings. We find evidence that the inception of CDS trading on firms' debt increases their cash holdings. To estimate the CDS effect, we use a comprehensive data set of North American corporate CDS introductions between 1997 and 2009. We estimate the cash-holding model among a sample of CDS firms, using all non-CDS firms in the Compustat data base as the control group. The cash ratios for firms with CDS traded on them increase by 2%, on average, after the introduction of CDS trading. Given the mean cash ratio of 8.2% for CDS firms, this increase is economically significant. We then control for the endogeneity of CDS introduction using three different econometric methods: the difference-in-difference, PSM and IV approaches. Moreover, the impact of CDS on cash holdings is greater for firms with limited access to the financial market and for firms with refinancing risk. We further find that CDS firms with financial expertise hoard more cash. The empirical results are consistent with the predictions of a model

motivated by the idea of tougher CDS-protected creditors: Creditors tend to be excessively tough after the introduction of CDS trading (as argued by Hu and Black (2008) and Bolton and Oehmke (2011)). Anticipating the potential actions of these tougher creditors, firms hold more cash *ex ante* so that they will be able to manage their future liquidity needs.

Our research contributes to the ongoing debate about the real effects of CDS. In contrast to the redundant security argument that is the basis of derivatives pricing, growing empirical evidence suggests that CDS increase the credit supply, and the reference firms' leverage, borrowing costs, and bankruptcy risk (as in Ashcroft and Santos (2009), Saretto and Tookes (2013), and Subrahmanyam, Tang, and Wang (2014)). In contrast to this earlier research, we delve further into the *firms'* responses to the increase in credit risk by showing that CDS trading affects corporate liquidity policies. These findings have implications for policy discussions of the welfare effects of CDS markets. On the one hand, CDS trading can increase the credit supply and help increase the reference firms' leverage. This increase could be welfare-enhancing if the additional funding is used to finance valuable new investment projects, benefiting shareholding interests. On the other hand, firms could simply keep the funds raised in the form of corporate cash reserves to satisfy their precautionary motive. In that case, the increased borrowing capacity may not necessarily translate into higher welfare benefits for the economy.[27] In addition, by identifying the channels by which CDS trading affects corporate cash holdings, market regulators could develop relevant policies to improve the efficiency of capital usage. Future work might investigate the demand for cash reserves and the impact of CDS on corporate investment.

[27]For example, in the current context of industrialized economies suffering anemic growth, the strong motive for holding additional cash could further complicate government efforts to stimulate the economy by lowering corporate borrowing costs through fiscal and monetary measures. It is often argued that firms tend to postpone valuable investments, not because of the higher cost of borrowing, but because of the need to satisfy their precautionary motives for additional liquidity.

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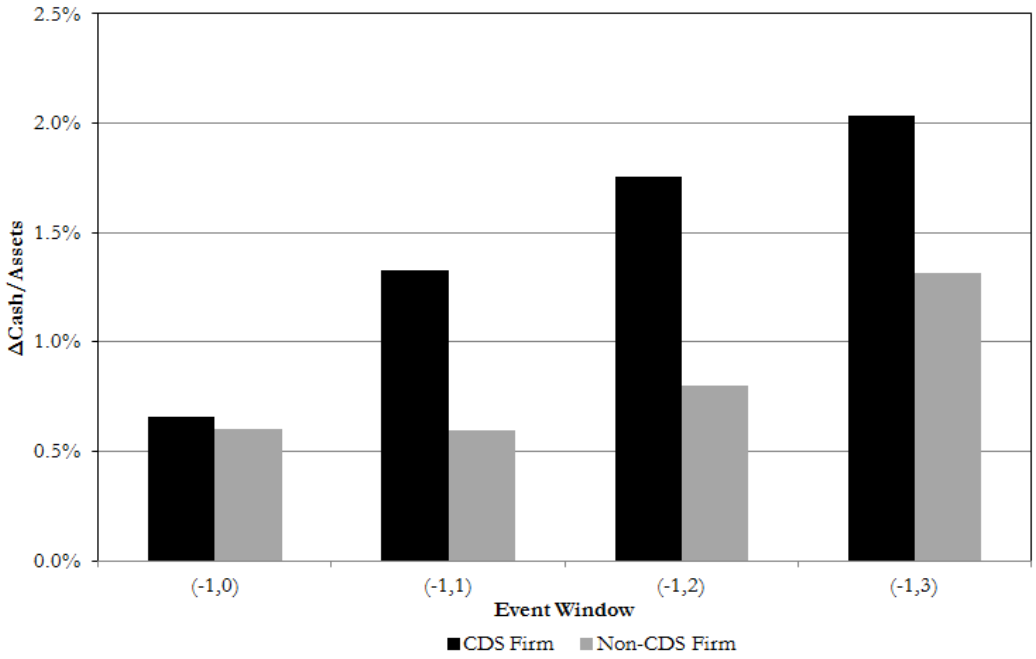

Figure 1: Changes in Cash Ratios Around the Introduction of Credit Default Swaps. This figure plots the changes in cash ratios for firms with credit default swaps (CDS) and their corresponding matching firms, from one year before the inception of CDS trading to zero, one, two or three years after the inception of CDS trading. Matching firms are selected based on industry and size. The cash ratio is measured as the ratio of cash and marketable securities to total assets. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in our sample that have CDS traded at some point during the sample period of June 1997 to April 2009.

Table I
Credit Default Swaps Trading and Cash Ratios by Year

This table reports the distribution of firms in our sample, including those with credit default swaps (CDS) traded, and their average cash ratios, by year, between 1997 and 2009. The overall sample of firms is taken from Compustat, and includes all companies in that database during 1997-2009. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. We measure the cash ratio as cash and marketable securities divided by total assets. The first column in the table is the year. The second column shows the total number of U.S. companies included in the Compustat database. The third column reports the number of firms for which CDS trading was initiated during that year. The fourth column presents the number of firms with active CDS trading during each year. The last two columns report average cash ratios for non-CDS and CDS firms respectively. († from June 1997, ‡ until April 2009)

(1)	(2)	(3)	(4)	(5)	(6)
Year	Total # of Firms	# of New CDS Firms	# of Active CDS Firms	Non-CDS Firm Cash Ratio	CDS Firm Cash Ratio
1997†	9366	22	22	0.187	0.072
1998	9546	58	72	0.191	0.070
1999	9545	55	106	0.202	0.068
2000	9163	102	196	0.200	0.064
2001	8601	172	334	0.201	0.072
2002	8190	221	547	0.203	0.081
2003	7876	93	582	0.221	0.090
2004	7560	58	593	0.221	0.095
2005	7318	73	629	0.224	0.092
2006	6993	28	533	0.226	0.089
2007	6651	9	418	0.225	0.084
2008	6223	9	375	0.205	0.088
2009‡	5686	1	234	0.216	0.103
Total/Average		901		0.209	0.082

Table II
Impact of Credit Default Swaps Trading on Cash Holdings

This table presents estimates of the effect of credit default swaps (CDS) on corporate cash holdings. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on the corporate cash holdings, we include CDS variables in the model specifications. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt, one year before month t. The coefficient of interest is that of *CDS Trading*, which captures the impact of CDS trading on cash holdings after the inception of CDS trading. The sample period is from 1997 to 2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in that database during 1997-2009. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets		
	(1)	(2)	(3)
CDS Trading	0.017***	0.024***	0.020***
	(0.003)	(0.003)	(0.003)
Industry Sigma	0.072***	0.084***	0.076***
	(0.017)	(0.017)	(0.016)
Cash Flow/Assets	−0.004	0.063***	0.066***
	(0.009)	(0.010)	(0.009)
Market to Book		0.007***	0.008***
		(0.001)	(0.001)
Size		−0.010***	−0.009***
		(0.001)	(0.001)
Net Working Capital/Assets		−0.013***	−0.046***
		(0.004)	(0.004)
Capital Expenditure			−0.211***
			(0.012)
Leverage			−0.084***
			(0.005)
R&D/Sales			0.194***
			(0.015)
Dividend Dummy			0.007***
			(0.002)
Acquisition Activity			−0.197***
			(0.013)
Time Fixed Effect	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
N	327863	315029	308510
R^2	73.69%	74.20%	75.04%

Table III
Credit Default Swaps Trading and Cash Holdings: Propensity Score Matching

This table presents the estimates of the effect of credit default swaps (CDS) on corporate cash holdings in a sample including firms with CDS and non-CDS propensity score-matched firms. Propensity score-matched firms are selected based on propensity scores estimated from model 3 of the probability of CDS trading presented in Table A3. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on the corporate cash holdings, we include CDS variables in the model specifications. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt one year before month t. The coefficient of interest is that of *CDS Trading*, which captures the impact of the inception of CDS trading on cash holdings. The sample period is 1997-2009, based on quarterly observations. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets		
	Nearest One Matching	Nearest One PS Diff<1%	Nearest Two Matching
CDS Trading	0.026***	0.026***	0.027***
	(0.006)	(0.006)	(0.006)
Industry Sigma	0.072	0.066	0.101*
	(0.046)	(0.041)	(0.054)
Cash Flow/Assets	−0.001	−0.038	0.001
	(0.077)	(0.069)	(0.088)
Market to Book	−0.000	−0.001	0.000
	(0.002)	(0.002)	(0.002)
Size	−0.026***	−0.022***	−0.027***
	(0.007)	(0.006)	(0.008)
Net Working Capital/Assets	−0.056	−0.052	−0.042
	(0.057)	(0.051)	(0.063)
Capital Expenditure	−0.173***	−0.177***	−0.182***
	(0.026)	(0.027)	(0.031)
Leverage	−0.043	−0.057	−0.049
	(0.039)	(0.036)	(0.049)
R&D/Sales	0.225*	0.235**	0.217
	(0.123)	(0.119)	(0.146)
Dividend Dummy	−0.021	−0.023	−0.024
	(0.022)	(0.024)	(0.024)
Acquisition Activity	−0.177***	−0.147***	−0.184***
	(0.059)	(0.056)	(0.069)
Time Fixed Effect	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
N	40668	36426	57684
R^2	74.94%	74.38%	73.21%

Table IV
Credit Default Swaps Trading and Cash Holdings: An Instrumental Variable Approach

This table presents the second-stage estimation of the two-stage instrumental variable (IV) estimation results. The second-stage analysis looks at the impact of credit default swaps (CDS) on corporate cash holdings in a sample including firms with CDS and all non-CDS firms. *Lender FX Usage* and *Lender Tier 1 Capital* are instruments. *Lender FX Usage* is a measure of the FX hedging activities carried out by the firm's lending banks and underwriters. *Lender Tier 1 Capital* is the Tier 1 capital ratio of the bank lenders. The coefficient of interest is that of *Instrumented CDS Trading*, which captures the impact of the inception of CDS trading on cash holdings. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. The sample period is 1997-2009, based on quarterly observations. The overall sample of firms is taken from Compustat, and includes all companies in that database during 1997-2009. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997-April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets
Instrumented CDS Trading	0.045^{**}
	(0.019)
Industry Sigma	0.075^{***}
	(0.016)
Cash Flow/Assets	0.068^{***}
	(0.009)
Market to Book	0.008^{***}
	(0.001)
Size	-0.010^{***}
	(0.001)
Net Working Capital/Assets	-0.046^{***}
	(0.004)
Capital Expenditure	-0.208^{***}
	(0.012)
Leverage	-0.084^{***}
	(0.005)
R&D/Sales	0.194^{***}
	(0.015)
Dividend Dummy	0.007^{***}
	(0.002)
Acquisition Activity	-0.192^{***}
	(0.013)
Time Fixed Effect	Yes
Firm Fixed Effect	Yes
Clustered Standard Error	Yes

Table V
Credit Ratings and CDS Effect

This table investigates credit ratings and the effect of credit default swaps (CDS) on corporate cash holdings. *Unrated* equals one if there is no credit rating on the firm. *Non-investment Grade* equals one if the firm's credit rating is of non-investment grade. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on the corporate cash holdings, we include CDS variables in the model specification. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt one year before month t. The coefficients of interest are those of *CDS Trading*, *CDS Trading*Unrated*, and *CDS Trading*Non-investment Grade*, which capture the impact of the inception of CDS trading on cash holdings. The sample period is 1997-2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in that database during 1997-2009. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets		
	(1)	(2)	(3)
CDS Trading	0.018***	0.015***	0.016***
	(0.003)	(0.003)	(0.003)
Unrated	0.004		0.002
	(0.003)		(0.003)
*CDS Trading*Unrated*	0.017***		0.014***
	(0.004)		(0.005)
Non-investment Grade		0.011***	0.009***
		(0.003)	(0.003)
CDS Trading Non-investment Grade*		0.007**	0.002
		(0.003)	(0.004)
Industry Sigma	0.076***	0.076***	0.076***
	(0.016)	(0.016)	(0.016)
Cash Flow/Assets	0.066***	0.067***	0.067***
	(0.009)	(0.009)	(0.009)
Market to Book	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)
Size	−0.009***	−0.009***	−0.009***
	(0.001)	(0.001)	(0.001)
Net Working Capital/Assets	−0.046***	−0.046***	−0.046***
	(0.004)	(0.004)	(0.004)
Capital Expenditure	−0.211***	−0.211***	−0.211***
	(0.012)	(0.012)	(0.012)
Leverage	−0.083***	−0.084***	−0.083***
	(0.005)	(0.005)	(0.005)
R&D/Sales	0.194***	0.194***	0.194***
	(0.015)	(0.015)	(0.015)
Dividend Dummy	0.008***	0.007***	0.008***
	(0.002)	(0.002)	(0.002)
Acquisition Activity	−0.197***	−0.195***	−0.196***
	(0.013)	(0.013)	(0.013)
Time Fixed Effect	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
N	308510	308510	308510
R^2	75.05%	75.05%	75.05%

Table VI
Refinancing Risk and CDS Effect

This table presents the estimates of the effect of credit default swaps (CDS) on corporate cash holdings after controlling for the rollover risk. *Long-Term Debt Due in One Year* is a dummy that equals one for firms with debt due in one year at time t. We expect the CDS effect to be more significant for firms with long term debt due in one year (higher refinancing risk). *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on the corporate cash holdings, we include CDS variables in the model specification. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt one year before month t. The coefficients of interest are those of *CDS Trading* and *CDS Trading*Long-Term Debt Due in One Year*, which capture the impact of the inception of CDS trading on cash holdings. The sample period is 1997-2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in the database during 1997-2009. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets
CDS Trading	0.019***
	(0.003)
Long-Term Debt Due in One Year	0.003***
	(0.001)
*CDS Trading*Long-Term Debt Due in One Year*	0.007***
	(0.001)
Industry Sigma	0.076***
	(0.016)
Cash Flow/Assets	0.068***
	(0.009)
Market to Book	0.008***
	(0.001)
Size	−0.009***
	(0.001)
Net Working Capital/Assets	−0.046***
	(0.004)
Capital Expenditure	−0.220***
	(0.013)
Leverage	−0.084***
	(0.005)
R&D/Sales	0.195***
	(0.015)
Dividend Dummy	0.007***
	(0.002)
Acquisition Activity	−0.197***
	(0.013)
Time Fixed Effect	Yes
Firm Fixed Effect	Yes
Clustered Standard Error	Yes
N	308510
R^2	75.05%

Table VII
Bank Relationships and CDS Effect

This table investigates bank relationships and the effect of credit default swaps (CDS) on corporate cash holdings. The bank relationships are from Dealscan LPC. For each firm on a given date, we look back five years for any syndicated loan facilities extended to this firm. Summing over all such active facilities, we compute, on each date, the number of unique bank relationships. *Number of Banks* is the number of existing bank relationships. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on corporate cash holdings, we include CDS variables in the model specifications. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt, one year before month t. The coefficients of interest are those of *CDS Trading* and *CDS Trading*Number of Banks*, which capture the impact of CDS trading on cash holdings after the inception of CDS trading. The sample period is from 1997-2009, based on quarterly observations. The overall sample of firms is from Compustat, and includes all companies in that database during 1997-2009. The CDS data are from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the June 1997 to April 2009 sample period. (*** significant at 1% level, ** significant at 5% level, and * significant at 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets	
	(1)	(2)
CDS Trading	0.020***	0.013***
	(0.003)	(0.004)
Number of Banks		−0.011***
		(0.001)
*CDS Trading*Number of Banks*		0.002**
		(0.001)
Industry Sigma	0.076***	0.078***
	(0.016)	(0.016)
Cash Flow/Assets	0.066***	0.067***
	(0.009)	(0.009)
Market to Book	0.008***	0.008***
	(0.001)	(0.001)
Size	−0.009***	−0.009***
	(0.001)	(0.001)
Net Working Capital/Assets	−0.046***	−0.044***
	(0.004)	(0.004)
Capital Expenditure	−0.211***	−0.206***
	(0.012)	(0.012)
Leverage	−0.084***	−0.082***
	(0.005)	(0.005)
R&D/Sales	0.194***	0.194***
	(0.015)	(0.015)
Dividend Dummy	0.007***	0.008***
	(0.002)	(0.002)
Acquisition Activity	−0.197***	−0.191***
	(0.013)	(0.013)
Time Fixed Effect	Yes	Yes
Firm Fixed Effect	Yes	Yes
N	308510	308510
R^2	75.04%	75.10%

Table VIII
Lines of Credit and CDS Effect

This table presents the estimates of the effect of credit default swaps (CDS) on corporate cash holdings after controlling for the line of credit. Line-of-credit data are drawn from Dealscan. *Line of Credit* is a dummy equal to one if the firm has a line of credit. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on corporate cash holdings, we include CDS variables in the model specification. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt one year before month t. The coefficients of interest are those of *CDS Trading* and *CDS Trading*Line of Credit*, which capture the impact of the inception of CDS trading on cash holdings. The sample period is 1997-2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in the database during 1997-2009. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets		
	(1)	(2)	(3)
CDS Trading	0.020***	0.021***	0.008
	(0.003)	(0.003)	(0.006)
Line of Credit		−0.026***	−0.027***
		(0.002)	(0.002)
*CDS Trading*Line of Credit*			0.014***
			(0.005)
Industry Sigma	0.076***	0.077***	0.077***
	(0.016)	(0.016)	(0.016)
Cash Flow/Assets	0.066***	0.065***	0.065***
	(0.009)	(0.009)	(0.009)
Market to Book	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)
Size	−0.009***	−0.009***	−0.009***
	(0.001)	(0.001)	(0.001)
Net Working Capital/Assets	−0.046***	−0.045***	−0.045***
	(0.004)	(0.004)	(0.004)
Capital Expenditure	−0.211***	−0.211***	−0.211***
	(0.012)	(0.012)	(0.012)
Leverage	−0.084***	−0.081***	−0.081***
	(0.005)	(0.005)	(0.005)
R&D/Sales	0.194***	0.193***	0.193***
	(0.015)	(0.015)	(0.015)
Dividend Dummy	0.007***	0.008***	0.008***
	(0.002)	(0.002)	(0.002)
Acquisition Activity	−0.197***	−0.191***	−0.191***
	(0.013)	(0.013)	(0.013)
Time Fixed Effect	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
N	308510	308510	308510
R^2	75.04%	75.14%	75.14%

Table IX
Active Credit Default Swaps Outstanding and CDS Effect

This table presents the estimates of the effect of credit default swaps (CDS) on corporate cash holdings, in a sample including firms with CDS and all non-CDS firms. The CDS impact is measured as the total notional CDS outstanding, scaled by the book value of the total debt (*CDS Notional Outstanding/Total Debt*) or the *Instrumented CDS Notional Outstanding/Total Debt*. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. The sample period is 1997-2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in that database during 1997-2009. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets	
	(1)	(2)
CDS Notional Outstanding/Total Debt	0.006***	
	(0.002)	
Instrumented CDS Notional Outstanding/Total Debt		0.205***
		(0.019)
Industry Sigma	0.053***	0.060***
	(0.015)	(0.019)
Cash Flow/Assets	0.055***	0.035***
	(0.009)	(0.013)
Market to Book	0.007***	0.008***
	(0.001)	(0.001)
Size	−0.006***	−0.008***
	(0.001)	(0.002)
Net Working Capital/Assets	−0.039***	−0.073***
	(0.004)	(0.007)
Capital Expenditure	−0.149***	−0.158***
	(0.011)	(0.013)
Leverage	−0.050***	−0.084***
	(0.004)	(0.007)
R&D/Sales	0.198***	0.243***
	(0.016)	(0.027)
Dividend Dummy	0.009***	−0.011
	(0.002)	(0.007)
Acquisition Activity	−0.129***	−0.140***
	(0.012)	(0.015)
Time Fixed Effect	Yes	Yes
Firm Fixed Effect	Yes	Yes
Clustered Standard Error	Yes	Yes
N	308510	308510
R^2	73.92%	74.09%

Table X
Financial Expertise and CDS Effect

This table presents the estimates of the effect of credit default swaps (CDS) on corporate cash holdings after controlling for the financial expertise of board members. The analysis is conducted in the sample of CDS firms. We expect firms with financial expertise to be more aware of the CDS effect, and therefore to hoard more cash. The measure of Financial Expertise is from Riskmetrics. *Financial Expertise* is a dummy equal to one if the firm has financial expertise. *Number of Financial Experts* is the number of financial expert board members of the firm. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on the corporate cash holdings, we include CDS variables in the model specification. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt one year before month t. The coefficients of interest are those of *CDS Trading*, *CDS Trading*Financial Expertise* and *CDS Trading*Number of Financial Experts*, which capture the impact of the inception of CDS trading on cash holdings. The sample period is 1997-2009, based on quarterly observations. The CDS data are taken from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets	
CDS Trading	0.021***	0.021***
	(0.002)	(0.002)
Financial Expertise	−0.012***	
	(0.002)	
*CDS Trading*Financial Expertise*	0.006***	
	(0.002)	
Number of Financial Experts		−0.005***
		(0.001)
*CDS Trading*Number of Financial Experts*		0.003***
		(0.001)
Industry Sigma	0.040***	0.042***
	(0.006)	(0.006)
Cash Flow/Assets	−0.183***	−0.183***
	(0.018)	(0.018)
Market to Book	0.015***	0.015***
	(0.001)	(0.001)
Size	−0.012***	−0.012***
	(0.000)	(0.000)
Net Working Capital/Assets	−0.132***	−0.132***
	(0.005)	(0.005)
Capital Expenditure	−0.152***	−0.148***
	(0.015)	(0.015)
Leverage	−0.138***	−0.136***
	(0.003)	(0.003)
R&D/Sales	0.699***	0.697***
	(0.012)	(0.012)
Dividend Dummy	−0.009**	−0.009**
	(0.004)	(0.004)
Acquisition Activity	−0.216***	−0.218***
	(0.014)	(0.014)
Time Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
Clustered Standard Error	Yes	Yes
R^2	37.77%	39.75%
N	29120	29120

Internet Appendix to "Credit Default Swaps and Corporate Cash Holdings"

(not to be included for publication)

Table A1
Robustness Check for Baseline Model: Multinational Firms and CDS Effect

This table presents estimates of the effect of credit default swaps (CDS) on corporate cash holdings. *Foreign Sales/Total Sales* is the ratio of export sales to total sales. Following Pinkowitz, Stulz, and Williamson (2013), we define *Multinational* as a dummy variable that equals one if the firm makes 25% of its sales abroad. Foreign sales data are drawn from the Compustat historical segment file. *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Size* is the logarithm of total assets. *Net Working Capital/Assets* is measured as net working capital minus cash, divided by total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Dividend Dummy* is a dummy variable that equals one if the firm pays a common dividend. *Acquisition Activity* is the ratio of acquisitions to total assets. To estimate the impact of CDS trading on corporate cash holdings, we include CDS variables in the model specifications. *CDS Trading* is a dummy variable that equals one if the firm has CDS traded on its debt, one year before month t. The coefficient of interest is that of *CDS Trading*, which captures the impact of CDS trading on cash holdings after the inception of CDS trading. The sample period is from 1997 to 2009, based on quarterly observations. The overall sample of firms is drawn from Compustat, and includes all companies in that database during 1997-2009. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Cash/Assets			
	(1)	(2)	(3)	(4)
Foreign Sales/Total Sales	0.002***		−0.000	
	(0.000)		(0.000)	
Multinational		0.039***		−0.007
		(0.003)		(0.005)
CDS Trading			0.020***	0.020***
			(0.003)	(0.003)
Industry Sigma			0.076***	0.076***
			(0.016)	(0.016)
Cash Flow/Assets			0.067***	0.067***
			(0.009)	(0.009)
Market to Book			0.008***	0.008***
			(0.001)	(0.001)
Size			−0.009***	−0.009***
			(0.001)	(0.001)
Net Working Capital/Assets			−0.046***	−0.046***
			(0.004)	(0.004)
Capital Expenditure			−0.211***	−0.211***
			(0.012)	(0.012)
Leverage			−0.084***	−0.084***
			(0.005)	(0.005)
R&D/Sales			0.194***	0.195***
			(0.015)	(0.015)
Dividend Dummy			0.007***	0.008***
			(0.002)	(0.002)
Acquisition Activity			−0.197***	−0.197***
			(0.013)	(0.013)
Time Fixed Effect	No	No	Yes	Yes
Firm Fixed Effect	No	No	Yes	Yes
Clustered Standard Error	No	No	Yes	Yes
N	327865	327865	308510	308510
R^2	0.01%	0.07%	75.04%	75.05%

Table A2
Change in Cash Ratio and CDS Effect

This table presents the estimates of the effect of credit default swaps (CDS) on changes in cash holdings. Δ Cash/Assets is the change in the ratio of cash to total assets. *Lagged Cash/Assets* is the lagged value of the cash to total assets ratio. *Industry Sigma* is the industry cash flow risk, which is the mean cash flow volatility across the two-digit SIC code. Δ *Cash Flow/Assets* is the change in the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. Δ *Market to Book* is the change in the market to book ratio, which is measured as the book value of assets minus the book value of equity plus the market value of equity divided by the book value of assets. Δ*Size* is the change in the logarithm of total assets. Δ *Net Working Capital/Assets* is measured as the change in the ratio of net working capital to total assets, which is measured as net working capital minus cash divided by total assets. Δ *Capital Expenditure* is the change in the ratio of capital expenditure to total assets. Δ *Leverage* is the change in leverage, which is measured as long-term debt plus debt in current liabilities divided by total assets. Δ *R&D/Sales* is the change in the ratio of R&D to sales. *Dividend Dummy* is a dummy variable equal to one if the firm pays a common dividend. Δ *Acquisition Activity* is the change in the ratio of acquisitions to total assets. To estimate the impact of CDS trading on corporate cash holdings, we include CDS variables in the model specification. *CDS Active* is a dummy variable that equals one if the firm has CDS traded on its debt, one year before month t. The coefficient of interest is that of *CDS Active*, which captures the impact of CDS trading on the change in cash holdings after the inception of CDS trading. The sample period is from 1997-2009, based on annual observations. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Δ Cash/Assets		
	(1)	(2)	(3)
CDS Trading	0.010***	0.009***	0.008***
	(0.002)	(0.002)	(0.002)
Lagged Cash/Assets	−0.629***	−0.609***	−0.585***
	(0.007)	(0.007)	(0.008)
Industry Sigma	0.048***	0.044***	0.039***
	(0.012)	(0.013)	(0.012)
Δ*Cash Flow/Assets*	0.005*	0.018***	0.012***
	(0.003)	(0.003)	(0.003)
Δ*Market to Book*		0.005***	0.005***
		(0.001)	(0.001)
Δ*Size*		0.005**	0.009***
		(0.002)	(0.002)
Δ*Net Working Capital/Assets*		−0.025***	−0.047***
		(0.004)	(0.004)
Δ*Capital Expenditure*			−0.033***
			(0.009)
Δ*Leverage*			−0.116***
			(0.006)
Δ*R&D/Sales*			0.051***
			(0.011)
Dividend Dummy			0.006
			(0.009)
Δ*Acquisition Activity*			−0.177***
			(0.010)
Time Fixed Effect	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
N	106216	82218	78894
R^2	39.63%	40.00%	42.70%

Table A3
Probability of Credit Default Swaps Trading

This table presents the estimates of the probability of credit default swaps (CDS) trading, obtained using a probit model. Propensity scores are estimated based on the model parameters. *ln(Assets)* is the logarithm of the firm's total asset value. *Leverage* is defined as the ratio of book debt to the sum of book debt and market equity, where book debt is the sum of short-term debt and 50% of long-term debt, and market equity is the number of common shares outstanding multiplied by the stock price. *ROA* is the firm's return on assets. $r_{it-1} - r_{mt-1}$ is the firm's excess return over the past year. *Equity Volatility* is the firm's annualized equity volatility. *PPENT/Total Asset* is the ratio of property, plant and equipment to total assets. *Sales/Total Asset* is the ratio of sales to total assets. *EBIT/Total Asset* is the ratio of earnings before interest and tax to total assets. *WCAP/Total Asset* is the ratio of working capital to total assets. *RE/Total Asset* is the ratio of retained earnings to total assets. *Cash/Total Asset* is the ratio of cash to total assets. *CAPX/Total Asset* is the ratio of capital expenditure to total assets. *Rated* is a dummy variable that equals one if the firm is rated. *Senior Unsecured Debt* is the ratio of senior unsecured debt to total debt. *Lender Size* is a measure of the size of the lending banks and underwriters. *Lender Credit Derivatives* measures the credit derivative activities of the lenders. *Lender FX Usage* is a measure of the FX hedging activities of the lending banks and underwriters, and *Lender Tier 1 Capital* is the Tier 1 capital ratio of the lenders. The sample period is 1997-2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. The numbers in parentheses are standard errors.)

	Probability of CDS Trading		
	CDS Prediction Model 1	CDS Prediction Model 2	CDS Prediction Model 3
Ln(Assets)	0.790***	0.804***	0.797***
	(0.006)	(0.006)	(0.006)
Leverage	0.429***	0.440***	0.431***
	(0.025)	(0.025)	(0.026)
ROA	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)
$r_{it-1} - r_{mt-1}$	−0.104***	−0.104***	−0.104***
	(0.011)	(0.011)	(0.011)
Equity Volatility	0.063***	0.069***	0.067***
	(0.017)	(0.017)	(0.017)
PPENT/Total Asset	0.306***	0.321***	0.307***
	(0.031)	(0.031)	(0.031)
Sales/Total Asset	−0.026***	−0.027***	−0.026***
	(0.009)	(0.003)	(0.003)
EBIT/Total Asset	0.315***	0.375***	0.338***
	(0.064)	(0.064)	(0.064)
WCAP/Total Asset	0.142***	0.145***	0.143***
	(0.024)	(0.024)	(0.024)
RE/Total Asset	0.022***	0.023***	0.024***
	(0.005)	(0.005)	(0.005)
Cash/Total Asset	0.290***	0.302***	0.294***
	(0.023)	(0.023)	(0.023)
CAPX/Total Asset	−1.611***	−1.677***	−1.604***
	(0.122)	(0.122)	(0.122)
Rated	0.667***	0.645***	0.638***
	(0.203)	(0.205)	(0.205)
Senior Unsecured Debt	0.375***	0.377***	0.375***
	(0.014)	(0.014)	(0.014)
Lender Size	0.369***	0.378***	0.385***
	(0.011)	(0.011)	(0.011)
Lender Credit Derivatives	1.006***	1.013***	1.019***
	(0.024)	(0.024)	(0.025)
Lender FX Usage	8.979***		9.104***
	(0.788)		(0.789)
Lender Tier 1 Capital		−3.865***	−4.000***
		(0.756)	(0.757)
F-statistic (instruments)	129.89	26.13	159.74
p-value (F-statistic)	0.000	0.000	0.000
Credit Rating Controls	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
Clustered Standard Error	Yes	Yes	Yes
Pseudo R^2	38.96%	38.79%	38.99%
N	690111	690111	690111

Table A4
Changes in Cash Holdings Around the Introduction of Credit Default Swaps: Difference-in-Difference Analysis

This table presents a univariate analysis of the changes in firm cash holdings due to the inception of credit default swaps (CDS) trading, i.e., from one year before the inception of CDS trading to one or two years after its inception. The changes in the cash holdings of CDS trading firms are compared with those of matching firms. Matching firms are selected based on propensity scores estimated from the model of the probability of CDS trading presented in Table A3. The change in the cash ratio is defined as the change in the ratio of cash and marketable securities to total assets. The overall sample of firms is drawn from Compustat, and includes all companies in that database during 1997-2009. The CDS data come from CreditTrade and the GFI Group. There are 901 firms in the sample that have CDS traded at some point during the sample period of June 1997 to April 2009. (*** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.)

	Year t-1 to t+1			Year t-1 to t+2		
	Nearest One	Nearest One PS Diff <1%	Nearest Two	Nearest One	Nearest One PS Diff <1%	Nearest Two
CDS Prediction Model 1	0.010***	0.009**	0.010***	0.013***	0.010**	0.013***
CDS Prediction Model 2	0.013***	0.012***	0.013***	0.020***	0.017***	0.020***
CDS Prediction Model 3	0.016***	0.013***	0.016***	0.017***	0.011**	0.017***