Did Banks' Use of Credit Derivatives Improve Their (Real) Capital Adequacy?*

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Abstract

We examine the effects of credit default swaps (CDS) on bank capital adequacy and lending behavior. Banks use CDS to improve the appearance of their capital adequacy as stipulated by regulations while consequently engaging in more risky lending. While they appear resilient to internal shocks on loan portfolio, they are more vulnerable to external shocks in the CDS market. Banks that were active CDS users at the onset of the 2007-2009 credit crisis raised capital and reduced lending to a greater extent than non-CDS-using banks. CDS-using banks enjoyed better stock returns than their non-CDS-using peers during the pre-crisis period but suffered more stock price declines during the crisis. Our findings suggest that regulatory capital regulation on the use of CDS enabled banks to mask their real capital inadequacy, as they became more aggressive in lending and more vulnerable to shocks.

I. Introduction

A serious problem in the financial system is that the complexity of bank capital requirements can mask the true vulnerability of banks,[2] as nearly all failed banks had seemingly adequate capital levels, judged by regulatory requirements, right before their demise (Flannery 2014). One such example is banks' use of credit derivatives, especially credit default swaps (CDS). Basel capital accord allows banks to apply a lower risk weight, and effectively hold less capital, against the asset when they use CDS to hedge against the asset's credit risk. Therefore, banks with CDS hedges may appear sound in terms of risk-weighted capital ratio even though their actual equity positions are insufficient for weathering shocks. In this paper, we empirically examine the efficacy of banks' practice using CDS and its consequences.

Holding capital levels above the regulatory minimum is useful for banks to attract business in a competitive banking industry (Allen, Carletti, and Marquez, 2011), but it is an expensive proposition from the perspective of bank shareholders. Under the Basal II Capital Accord, however, banks are allowed to hold less capital without hurting their risk-weighted capital ratios when they use CDS to mitigate their credit risk exposure. This reflects the belief of bank regulators in CDS' risk management benefits, as the former chairman of the Federal Reserve Board Alan Greenspan articulates that CDS facilitate "the development of a far more flexible, efficient, and hence resilient financial system" (Greenspan 2004). With the blessing of bank regulators, the CDS market had grown from $180 billion in 1997 to $62 trillion in 2007. However, there are impediments for banks to widely employ CDS to hedge their loan exposures, as documented by Minton, Stulz, and Willianson (2009), and it remains an open question whether the use of credit derivatives like CDS makes banks sounder.

[2] Darrel Duffie, *BloombergView*, January 7, 2014 (http://www.bloombergview.com/articles/2014-01-07/is-keeping-it-simple-for-banks-stupid-).

Using data on U.S. banks over the period of 1997 to 2009, we find that, at the first sight, CDS-using banks and non-CDS-using banks are almost indistinguishable in their regulatory capital ratios. However, CDS usage is clearly a bank's choice. After factoring in the endogeneous selection of banks' CDS use using two independent and effective instrumental variables, we show that CDS-using banks have significantly lower risk-weighted capital ratios than non-CDS-using banks. The stronger relationship after instrumentation is consistent with the anticipation effect that poorly capitalized banks use CDS to boost their capital ratios, following the logic of Edmans, Goldstein, and Jiang (2012). This implies that CDS-using banks would on average have to hold greater amounts of capital without the usage of CDS in order to maintain required capital ratios. Moreover, our analysis indicates that their capital ratios also become less volatile with the usage of CDS.

Maintaining adequate capital ratios is important for banks as it keeps counterparties confident about their financial situations, leads to less regulatory scrutiny and helps banks attract and retain business relationships. As CDS effectively inflate capital ratios, CDS-using banks then have the incentive to increase risky lending for higher returns on capital, as modeled by Inderst and Mueller (2008). Increased risky lending is also predicted by the hedge-more/bet-more result of Simsek (2013) because CDS allow a "pure play" of credit risk, and it is further encouraged by the low collateral requirement of CDS (Shen, Yan, and Zhang 2014). Indeed, we find that CDS-using banks extend more commercial and industrial (C&I) loans than non-CDS-using banks. Moreover, at individual loan level, we find the size of loans scaled by the borrowing firm's assets is larger when the lead bank of a syndicated loan is an active user of CDS and when there is an active CDS market referencing the borrower's debt.

In addition, we find that loan loss provision increases in response to banks' CDS trading, suggesting that banks knowingly increase their supply of riskier credits. Furthermore, given that loss provisions can be added back to Tier 2 capital, a larger loss provision can help increase the total capital ratio, and the market-risk capital required by large CDS trading positions may be satisfied with Tier 3 capital. Consequently, the quality of capital in terms of the composition of equity capital (Tier 1 capital) will drop. Indeed, we find that capital quality is lower for CDS-using banks.

The CDS market was significantly disrupted by the bankruptcy of Lehman Brothers and the collapse of AIG in 2008. Our examination of this crisis period shows banks that used to rely on CDS to manage capital ratios and lending practice were negatively impacted due to market freeze. These banks were forced to raise additional capital and had to restrict lending during the crisis period. We also document that while CDS-using banks suffered larger stock price declines during the crisis than non-CDS-using banks, they enjoyed larger gains in stock prices before the crisis. This finding helps shed light on banks' motives for CDS use: lower effective capital and higher return on capital, both are good for shareholders when things go well. When disasters strike, however, these banks will suffer and cause negative externalities to the financial system at the expense of depositors, borrowers, and taxpayers.

Although regulatory failures concerning CDS and other financial securities have been regarded as a major cause of the 2007-2009 financial crisis,[3] a question has been raised as why the Fed did not prohibit banks from reducing regulatory capital via CDS (e.g., Levine (2012)) even though some prominent figures such as Rajan (2005) have expressed concerns about the potential risks of credit derivatives, such as CDS, to the financial system before the crisis. Our study indicates that the appearance of similar capital ratios between CDS-using banks and non-

[3] The Financial Crisis Inquiry Report prepared by the Financial Crisis Inquiry Commission, page 18.

CDS-using banks may have masked the vulnerability of the former as they engage in more risky lending to enhance their profitability, erstwhile in compliance with regulatory requirements. Regulators in turn misjudged the appearance of capital adequacy without spotting the inferior quality of capital, or its reduced loss-absorption ability, when CDS are employed. Even though banks' use of CDS for trading purpose is addressed by the Dodd-Frank Act (Section 619, the Volcker Rule), Basel III continues to allow banks to use CDS for capital relief. Our findings suggest that improvement is needed for the corresponding Basel capital regulation.

Banks have actively exploited the regulatory flexibility in capital rules associated with CDS.[4] However, the effect of CDS use on banks' capital adequacy and risk management appears to be duplicitous. J.P. Morgan, which was credited for creating CDS in 1994 to hedge its loan exposure to Exxon (Tett 2009), suffered a $6.2 billion loss in the 2012 "London Whale" CDS trading fiasco. We demonstrate that, through its effect on regulatory capital relief, CDS increase bank credit supply and reduce bank dependence on tangible capital. This effect is complementary to the hedging role of CDS. However, such use of CDS expose banks to the shocks of CDS market. Overall, CDS may help banks appear capital adequate but can weaken bank's resilience to systematic market shocks.

This study contributes to the emerging empirical literature examining the implications of CDS trading, which includes Ashcraft and Santos (2009) on the cost of debt, Saretto and Tookes (2013) on leverage, and Subrahmanyam, Tang, and Wang (2014) on bankruptcy risk. These studies focus on the effects of CDS on reference firms. The results in this study suggest that active engagement in the CDS market allows banks to hold less capital and to assume greater risk. While this finding is contrary to the perceived role of CDS in managing banks' credit risk

[4] AIG's 2007 Form 10-K, page 122, disclosed that 72% of the CDS sold by AIG Financial Products during that year were used by banks for capital relief (http://www.aig.com/Chartis/internet/US/en/2007-10k_tcm3171-440886.pdf).

exposure, it is consistent with the implications of a theoretical model developed by Yorulmaezer (2013), which predicts that banks take excessive risk in the presence of capital relief tied to CDS. Our study therefore provides a new perspective on bank risk taking, which has so far been linked to, for example, bank governance and executive compensation in the literature (Stulz, 2014). Our analysis of behavior and performance of banks also bolsters the view offered in Beltratti and Stulz (2012) that factors that are rewarded in normal periods may have adverse realizations during crisis periods.

The rest of the paper proceeds as follows: Section II provides the background of our study and reviews the relevant literature. Section III describes our datasets and sample selection. Section IV presents the empirical results on bank capital and lending. Section V concludes.

II. Background

Right after the first CDS deal in 1994, the JPMorgan team wanted to industrialize the CDS deals on a large scale. One issue they were investigating was whether by removing the risk of its loans by purchasing CDS protection, the bank would be allowed to reduce its capital reserves. The team communicated with the U.S. regulators in 1995, at a time when U.S. bank regulators were calling for revisions of the 1988 Basel capital accord. In May 1996, then Fed Chairman Alan Greenspan publicly stated that the weaknesses of Basel I were becoming evident and suggested changes in capital regulation to incorporate market and modeling development.[5] U.S. Federal Reserve was receptive of credit derivatives since at least as early as 1996. Tett (2009, pages 56-58) provides the historical accounts of how credit derivatives got into bank capital regulations: "in August 1996, the Fed issued a statement suggesting that banks would be allowed

[5] "Greenspan Hints at Revisions in Capital Rules on Credit Risk", by Jaret Seiberg, *American Banker*, May 3, 1996.

to reduce capital reserves by using credit derivatives."[6] The abovementioned statement, SR 96-17, provides guidance on appropriate risk-based capital treatment for credit derivatives held in the banking book: "For purposes of risk-based capital, credit derivatives generally are to be treated as off-balance sheet direct credit substitutes." The documentation and the effectiveness of the credit derivative transaction are subject to examiner review.

An important development was the approval in January 1996 by the Basel Committee the market risk amendment for trading book assets which would become mandatory in 1998 (with optional implementation in 1997 subject to regulatory approval). Credit risk counts for about 90% of bank's total capital requirement and market risk takes much less capital. Applications of market risk requirement on credit risk trading positions were discussed in SR 97-18 released in June 1997.[7] SR 97-18 provides guidance on how credit derivatives held in the trading account should be treated under the market risk capital requirements. JPMorgan saw the opportunity of moving assets on banking book to trading book to be charged with market risk rather than credit risk which is much higher. In December 1997, JPMorgan marketed the Broad Index Secured Trust Offering ("Bistro"), which was a synthetic collateralized loan obligation (CLO). The deal uses CDS contracts referencing 307 loans totaling $9.7 billion then structured into three tranches. The middle, mezzanine tranche is sold to outside investors. The riskiest tranche is kept with the highest risk weight. The safest, "super senior" tranche is also kept but JPMorgan also bought CDS from AIG on it. JPMorgan wanted to move the safest, also the largest, tranche to the trading book and apply market risk capital requirement. The regulators from Federal Reserve rejected the proposal of moving the "super senior" tranche to trading book as such change requires

[6] "Supervisory Guidance for Credit Derivatives", Division of Banking Supervision and Regulation, Board of Governors of the Federal Reserve System, August 12, 1996: http://www.federalreserve.gov/boarddocs/srletters/1996/sr9617.htm
[7] "Application of Market Risk Capital Requirements to Credit Derivatives", June 13, 1997: http://www.federalreserve.gov/boarddocs/srletters/1997/sr9718.htm

approval from accounting, tax, and other bank regulators. However, the Fed allowed JPMorgan to use a much lower risk weight on the security remained on banking book with CDS protection in early 1998 so that the bank can secure regulatory capital relief.[8] Such practice became widespread afterwards. JPMorgan did more such Bistro deals and other banks followed suit. The Fed praised that "such transactions allow economic capital to be more efficiently allocated, resulting in, among other things, improved shareholder returns."[9]

ISDA lobbied for credit derivatives to be included into capital regulation. In March 1998, it published a 62-page paper titled "Credit Risk and Regulatory Capital", page 24 states: "ISDA believes it is crucial that the current regulatory capital regime is reformed to recognize that long and short credit risk positions (including credit derivatives) can be considered together for capital purposes." Then President William McDonough of Federal Reserve Bank of New York, which was a big proponent for both the market risk amendment and the overall Basel capital rule reform, became the chairman of Basel committee in June 1998. This change of power accelerated the process of incorporating credit derivatives into bank capital regulations given the more friendly stand of U.S. Fed towards this new instrument. Credit derivatives were proposed to be counted as credit exposure hedges, either fully or partially, similar to guarantees, in June 1999 in the first Basel II consultative paper. Basel II was partly motivated by "the recent development of credit risk mitigations such as credit derivatives has enabled banks to substantially improve their risk management".[10] The proposal eventually became a part of Basel II which was approved in 2004 and started implementation in 2006.

[8] "1997: JP Morgan's US$700m Bistro Bond: the first CDO", by Christopher Whittall, *International Financing Review*: http://www.ifre.com/1997-jp-morgans-us700m-bistro-bond-the-first-cdo/21102932.fullarticle
[9] "Capital Treatment for Synthetic Collateralized Loan Obligations", November 17, 1999: http://www.federalreserve.gov/boarddocs/srletters/1999/SR9932.HTM
[10] http://www.bis.org/publ/bcbs50.pdf

Basel II is rather flexible in recognizing CDS as a hedge for banks. For example, a mismatch between the underlying obligation and the reference obligation under CDS is permissible if the reference obligation is junior to the underlying obligation. In other words, bond CDS can be counted as a loan risk hedge. Basel II also allows a maturity mismatch and partial hedging (for credit event definitions and coverage). The role of CDS in bank capital regulation in Basel III has been maintained, albeit with some modification.[11] The Dodd-Frank Act of the U.S. requires central clearing for CDS starting 2013. The effect of such mandate is yet to observe.

One recent, influential example of bank active management capital ratios using CDS is demonstrated by the JPMorgan "London Whale" trading incident in the first half of 2012.[12] Basel 2.5 requires banks to apply the comprehensive risk measure (CRM) to correlation trades such as securitization and index products. U.S. banks must run their correlation trading positions through the standardized model, but then take 8% of the standardized charge and add it to their modelled capital requirement. This surcharge will stay in place until the model has been running for at least a year. At that point, it can be removed, subject to regulatory approval. The CRM rules dramatically inflate JPMorgan CIO's RWAs as the CIO mainly conducts correlation trades. In fact, the bank expected risk-weighted assets (RWA) at the chief investment office (CIO) to triple when the new capital rules came into force. CIO was told in late 2011 to reduce RWA consumption. However, instead of reducing the size of its positions, the CIO put on new, partially offsetting trades because Basel 2.5 allows banks to reduce the RWA consumption from

[11] Gary Gensler, Commodity Futures Trading Commission Chairman said on 9 March, 2010, that bank capital regulation should be modified to allow *only* CDS that are subject to collateral requirements if they are being used for bank's capital-relief purposes. (Source: "3rd update: CFTC chief calls for new credit-derivatives rules", *Dow Jones Global FX & Fixed Income News*, 9 March 2010)

[12] "JP Morgan and the CRM: How Basel 2.5 beached the London Whale", by Michael Watt, *Risk Magazine*, October 5, 2012.

the CRM by rehedging using a correlated instrument.[13] When the CIO was told to reduce RWAs, it started selling more CDS index protection in the first quarter of 2012 in order to keep the capital burden light without giving up too much profit. The desire to reduce RWAs attached to the CRM metric seems to have blinded the bank's traders to the market risk they were piling up. (The trading book rules may fix the problems.) RWA reduction strategy is employed to exploit the capital rules.

Banks' use of CDS for capital relief is indirectly confirmed by protection seller statements. For example, AIG disclosed in its 2007 annual report that 72% of the CDS protection it sold was used by banks for capital relief.[14] It is necessary for the protection seller to make such claim in order to be counted as capital relief for protection buyers. Moreover, CDS are not regulated as insurance according to the U.S. Commodity Futures Modernization Act of 2000. In this way, banks can save capital but insurance companies are not required to hold the additional capital. Non-banks such as insurance companies may not need to hold capital as they are outside of bank regulator's reach.

Given such regulatory and industry background, it is puzzling that Minton, Stulz, and Williamson (2009) find little CDS usage by banks for hedging purpose. Our reconciliation is as follows. First, banks use basket or index CDS to more effectively reduce capital requirement, since the Bistro deal and the industrialization of CDS. They may first securitize the loans to generate CDO tranches, then buy CDS on those tranches referencing the pool of loans to get capital relief. But bank statement may refer to single-name CDS on individual loans. Second,

[13] According to an interpretive document on the IRC and CRM published by the Basel Committee on Banking Supervision in November 2011, a CDS can be used to hedge another CDS. Capital requirement for doing so will be lower when banks use internal models as banks decide the amount of offset for hedges with basis risk. Banks can get an RWA reduction by using two instruments from the same index with potentially very different maturities, but open the door to basis risk.

[14] http://www.ezodproxy.com/AIG/2008/AR2007/images/AIG_10K2007.pdf

banks have no incentive to admit that they use CDS for capital relief. Public statement about using CDS for capital relief may imply that the bank has difficulty meeting capital requirements. Hence, banks may not have incentive to admit so and would rather blame market imperfection or accounting difficulty/regulatory hurdle.

U.S. bank regulations consist of main three elements: Tier 1 risk-weighted capital ratio, total risk-weighted capital ratio, and Tier 1 unweighted capital ratio ("leverage ratio"). The leverage ratio is based on adjusted assets on the balance sheet and does not include off-balance sheet assets. Leverage ratio is not in the Basel capital accord therefore falls into the category of supervisory review. The leverage ratio (relative to non-risk weighted total assets) requirement effectively limits how much banks can use the capital rules to reduce capital. CDS affect capital ratios through both the denominator and the numerator. They affect the denominator by changing risk-weights of credit risk and positions of market risk. CDS facilitate the process of moving assets out of balance sheet without risk transfer, effectively increase bank size without increasing regulatory capital. (The denominator for risk-based capital ratio also includes the credit equivalent amount of off-balance sheet items and CDS may help moving assets off balance sheet and get a lower credit equivalent amount.) They also affect the numerator as now Tier 3 capital can be counted against market risk of CDS trading positions. Moreover, loan loss provisions, possibly associated with CDS-related loans, can also be counted as Tier 2 capital.

Banks manage their portfolio in the interest of their shareholders subject to the constraints imposed by regulations, evaluating the trade-off between the costs and benefits of banking activity. Though capital requirements are a key instrument in bank regulation (Bernanke and Lown (1991)), banks' strategic response to this mechanism erodes its efficacy in monitoring bank risk. There are situations when banks' compliance with capital regulation is imperfect.

Banks may use risk management to cheat in relation to capital requirement. Pillar 2 of Basel II, supervisory review, gives regulators power to discipline the banks "when Pillar 1 rules cannot be effectively enforced" (Pelizzon and Schaefer (2006)). Indeed, the recognition of credit derivatives as off-balance sheet guarantee in regulatory capital requirement was on supervisory guidance basis subject to the examiner's discretion, since the initial practice in 1996.

Banks hold capital more than regulatory minimum. From liability side, more capital helps attract deposit. On the asset side, more capital attracts loan business and fosters relationship lending. Capital is important for lending efficiency. (Effect of capital on bank stock performance is mixed. Not much effect during normal time but helpful during crisis.) As loan exposures become easier to be hedged and capital requirements easier to meet, credit supply has become less sensitive to changes in bank's financial condition. Banks with loan hedging opportunity/capital management therefore seem to sever the link from a bank's financial condition to its willingness to supply credit. Hence, we provide a new channel (different from the hedging channel, studied by Saretto and Tookes 2013) for increased credit supply by banks after CDS trading, that is, capital requirements become easier to meet. We also find that it is bank's use of CDS that drives the credit supply increase. When the lender does not use CDS, even if CDS market exists, credit supply is not affected. Saretto and Tookes (2013) use a sample of S&P 500 firms whose lenders are mostly CDS-using banks. Therefore, our finding is consistent with theirs. However, we also document that credit supply does not increase for CDS-referenced firms when the lending banks are not active users of CDS. The lending analysis helps us understand whether banks or the market are the driving force for CDS effects because non-banks such as bond investors and hedge funds can also trade CDS.

Even though banks seem to maintain capital ratios above regulatory minimum requirement, banks use different approaches to maintain their capital levels and the regulatory requirement is likely to be binding (Berger et al. 2008). Different banks are also under different regulatory constraints. When regulatory constraints are binding, banks may not be able to choose the optimal cost-benefit strategy, hence, they have incentive to use CDS to evade the constraint. Had some banks not used CDS, they might have breached the regulatory requirements. However, capital ratios aided by CDS are not equivalent to true capital adequacy. One reason is counterparty risk as the insurance sellers such as AIG turned out to be not reliable. Moreover, the quality of bank capital may be affected by CDS as well. Under 1996 amendment, market risk can be covered by Tier 3 capital. CDS trading may generate substantial market risk exposure.

The reform of capital rules leading to Basel II suggests capital relief can be one important reason for banks to take CDS positions. Parlour and Winton (2013) also suggests the cost of holding capital can be a motive for banks to use CDS to transfer credit risk. Because banks which face higher cost of capital tend to use CDS to boost capital ratios, this selection of CDS banks may cover other bank activities that result in deteriorating capital position. We illustrate in Figure 1 the expected structural changes in banks' on- and off-balance-sheet items after CDS trading starts. Banks' on- and off-balance-sheet activities may both increase, as CDS may expand both trading and banking assets and facilitate securitization, and the latter appears in the off-balance-sheet activities. The component on the right side of the balance sheet affected by CDS is the core capital ratio. On the asset side, apart from trading assets, other components that are affected include C&I loans and loan loss provision. We examine both bank-level outstanding loan amount and firm-level new loan initiation to provide robust evidence. We exploit the shock to CDS market during the 2007-09 credit crisis and show how banks react to the crisis by altering their capital and lending decisions. If banks substantially reduce their capital ratios during normal periods because of CDS, they may become more vulnerable to crises.

III. Data and Sample Description

We employ three main datasets on banks, syndicated loans, and corporate borrowers. The first dataset concerns bank data and includes bank CDS positions, regulatory capital ratios and other characteristic variables, and stock prices for publicly listed banks. The second dataset contains information on individual syndicated corporate loans with loan contract terms at origination, including the loan size, interest rate, maturity and lender identities. The third dataset provides CDS market information for *individual* U.S. publicly listed corporate borrowers.

3.1 Bank CDS Position Data

Our primary source of bank CDS position data for the period from 1994 to 2009 is the Federal Reserve Consolidated Financial Statements for Holding Companies ("FR Y-9C").[15] Banks with more than $150 million in assets are required to file FR Y-9Cs (the threshold increased to $500 million in 2006). We focus on banks that act as syndicate lead arrangers in Loan Pricing Corporation's Dealscan database, although we also conduct robustness checks with a broader set of banks. We manually match an RSSD ID in the bank dataset to the name of a lead lender in Dealscan to identify the list of lending banks that use CDS in a given quarter. We refer to a field in Dealscan called "Lead Arranger Credit", which can take values of "Yes" or "No" for every bank, to identify syndicate lead arrangers. We ensure that the match is made in the same year to account for bank name changes. Finally, we restrict the sample to the period from 1994 to 2009 because Dealscan only began providing relatively complete loan information in 1994 and because our borrower CDS dataset ends in 2009, when a substantial change also occurred in the

[15] http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm.

CDS market. FR Y-9C filers include 7,646 banks, and 121 banks act as syndicate lead lenders in Dealscan.

CDS position data for foreign banks are not available from FR Y-9C filings. We collect additional bank CDS position data from the Quarterly Report on Bank Derivatives of the Office of the Comptroller of the Currency (OCC) to include large foreign banks. The OCC reports list the top banks, including the U.S. subsidiaries of foreign banks, with the largest credit derivative positions every quarter beginning in 1998. Both the FR Y-9C filings and the OCC reports provide aggregate CDS positions and positions held by banks as beneficiaries ("bought") or guarantors ("sold"). We crosscheck the CDS position data covered by the two datasets. Based on the quarterly CDS positions held by banks reported in the FR Y-9C and OCC reports, we define banks that have a nonzero CDS position in a given quarter, either a long position or a short position as "CDS-using banks".[16] Banks with zero CDS positions are denoted as "non-CDS-using banks".

For consistency between our bank-level and loan-level analysis, we restrict our sample banks to Dealscan syndicate lead lenders, which can be matched with bank identifiers in Compustat. We use the full sample of all Compustat banks for robustness checks. Other bank-level control variables are extracted from Compustat. Our base sample includes 84 banks with complete financial information, 43 of which ever took nonzero CDS positions at some point during the sample period.

3.2 Corporate Loan and Borrower Financial Data

At the loan level, we are interested in the effects of CDS trading on the initial contract terms of loans issued by firms whose debt is referenced in CDS. We sum the loan amount, take a

[16] The banks act as the beneficiary for long positions, which are specified by the variable BHCKC969 in the FR Y-9C report or the "CDS bought" column in the OCC report. The banks act as the guarantor for the short positions, which are specified by the variable BHCKC968 in the FR Y-9C report or the "CDS sold" column in the OCC report.

simple average of the all-in-drawn spread and maturity to aggregate tranches (also called facilities) from the same loan deals (also called packages), and conduct our analysis at the deal level. We use other deal-level information in Dealscan, including the security of the issue, loan purpose, and number of syndicate lenders as control variables. We merge Compustat/CRSP with Dealscan loan records by using borrower identifiers in Compustat to obtain borrowing firm financial data.[17] This matching procedure leaves us with 67,747 loan deals during the 1994-2009 period. Of these, 47,247 list their distribution method as "syndication."

In our multivariate analysis, we exclude firms with missing loan characteristics, such as loan amount, spread, maturity, security, loan type, loan purpose, and lender information, and those with missing firm financial data, such as total assets, cash-to-total assets ratio, book leverage, firm age, market-to-book ratio, sales-to-total assets ratio, tangible assets, and Altman's Z-score. Our base regression sample contains 15,546 syndicated loans. In robustness checks, we also use the combined sample of syndicated loans and sole-lender loans, totaling 17,268 observations.

3.3 CDS Data on Referenced Borrowing Firms

We determine whether CDS contracts referencing the borrowers' debt exist at the time of loan issuance by using two major datasets on the sources of CDS transactions: CreditTrade and GFI Group. The CreditTrade data cover the period from June 1997 to March 2006; the GFI data cover the period from January 2002 to April 2009. The overlapping feature of the data allows us to perform a crosscheck to ensure data accuracy. We further validate the data by using Markit quotes. Similarly to Subrahmanyam, Tang, and Wang (2014), we use the first CDS transaction record for the issuer appearing in the data as the CDS introduction date. We identify 921 U.S. firms with debt referenced in CDS contracts from June 1997 to April 2009, accounting for 8.1% of the total number of unique borrowers in the same period.

[17] We appreciate the Dealscan-Compustat link file provided by Chava and Roberts (2008).

We include all borrowing firms, whether they are large or small, whereas Saretto and Tookes (2013) restrict their sample to S&P 500 firms. Among the 47,247 Dealscan syndicated loans, 9,341 are made to 867 CDS firms that have CDS referencing their debt at any time during the sample period ("CDS firm"), and 6,641 of them are made to firms with CDS trading at the time of loan origination ("CDS trading").

3.4 Overview of the Sample

Our base sample primarily consists of large banks that are required to file quarterly reports with the Federal Financial Institutions Examination Council. This is expected as the lead arrangers of syndicated loans are frequently large banks. The average book asset of our sample banks is 331.6 billion. The mean total risk-weighted capital ratio, tier 1 risk-weighted capital ratio, and tier 1 leverage ratio are 13.2%, 10.2% and 8.2%, respectively, all of which are higher than the regulatory minimum. In addition to specifying the minimum risk-weighted capital ratios, the US banking regulators also set minimum tier 1 capital leverage.[18] Among all types of loans including commercial and industrial loans (C&I loans), home mortgages, farm loans and consumer loans, C&I loans account for the largest percentage of 19.8% on average. Other bank characteristics are comparable to those reported in Loutskina (2011).

Panel B of Table I presents the year-by-year summary of the bank sample. The first instance of a bank reporting CDS positions occurred in 1997. Banks enter and exit the CDS market over time. The maximum number of CDS-using banks at any given time in our sample is 20. The average amount of bank total assets grew steadily during the sample period. The total amount of

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[18] The Federal Reserve Board, the Federal Deposit Insurance Corporation (FDIC), and the Office of the Comptroller of the Currency (OCC) proposed that the tier 1 capital leverage ratio be tightened: "bank holding companies with more than $700 billion in consolidated total assets or $10 trillion in assets would be required to maintain a tier 1 capital leverage buffer of at least 2 percent above the minimum supplementary leverage ratio requirement of 3 percent, for a total of 5 percent."

new loans grew from $491.51 billion in 1994 to $4.56 trillion in 2007 and then declined to $2.66 trillion in 2008 and to $2.12 trillion in 2009.

Panel C of Table I summarizes the syndicated loans in our sample by year. Approximately 20% (or 9,341) of the total number of loans are from 867 CDS firms. The largest number of syndicated loans issued is 3,828 in 2005, whereas 2007 witnessed the largest average loan size in our sample ($598.79 million). Although CDS firms account for less than 10% of our entire sample of borrowers, they account for 43% of the syndicated loan volume in dollar terms. The average loan size for CDS firms ($868 million) is more than twice as large as the average loan size for non-CDS firms. The average loan spread for CDS firms is 109.62 basis points, which is 78.07 basis points lower than the average spread for non-CDS firms.

IV. Empirical Results

4.1 Banks' CDS Usage and Regulatory Capital Ratios

The effects of banks' CDS trading on their capital ratios are worth investigating because capital relief is a major purpose of using CDS by banks. If banks exclusively use CDS for hedging, then their credit exposures would be reduced. As a consequence, the risk weights of their loan portfolios are reduced and their regulatory capital ratios become higher. However, if banks extend more risky loans, larger risk weights can result owing to their riskier banking books, and their capital ratios will subsequently decline.[19] The net impact of CDS on risk-weighted assets and capital ratios depends on the relative strength of these separate effects, and thus it is an empirical issue to sort out.

[19] Alternatively, if banks are more involved in dealer activities by using CDS, then more trading assets will appear on the banks' balance sheets, which can be riskier and result in larger RWAs.

4.1.1 Baseline Results

Table I shows that all banks in our sample maintain capital ratios that are higher than the minimum requirements.[20] Risk-weighted assets are used as the denominator to calculate the regulatory capital ratios. Our baseline specification for bank capital ratio is as follows：

$$\begin{aligned}\text{Bank Regulatory Capital Ratio}_{it} &= \alpha + \beta\text{CDS - Usage}_{it} + \gamma_1\text{Bank Characteristics}_{it-1} \\ &+ \gamma_2\text{Year Fixed Effects}_t + \gamma_3\text{Bank Fixed Effects}_i + \varepsilon_{it}\end{aligned} \tag{1}$$

We use two regulatory capital ratio measures: (1) *Total Risk-Weighted Capital Ratio*, which is total capital (Tier 1+Tier 2+Tier 3) divided by total RWA, and (2) *Tier 1 Risk-Weighted Capital Ratio*, which is Tier 1 capital divided by total RWA.

The key independent variable is the indicator *CDS-Usage*, which takes one if the bank is taking a non-zero CDS position in the given quarter and zero otherwise (see the variable definitions for details).[21] To control for other unobservable differences that may systematically drive capital ratios between banks that trade CDS and banks that do not, we control for bank fixed effects to ensure that the CDS-Usage dummy only captures time-series variation within banks.

Bank Characteristics comprise other variables that are identified by the literature (e.g., Ellul and Yerramilli, 2013) to affect a bank's regulatory capital ratio, including the bank's total assets, sales growth rate, deposits-to-asset ratio, loan-to-asset ratio, and market share in bank deposits. These variables are lagged one quarter when entering the regressions. To capture the potentially nonlinear relationship between bank capital and bank size, we allow total assets squared to enter

[20] Basel II requires an 8% minimum total capital ratio and a 4% minimum Tier 1 capital ratio. Basel III increases the minimum Tier 1 capital ratio to 6% (the minimum common equity capital ratio is 4.5%). The level of equity capital measures the extent to which a bank is prepared to internalize the cost of bank failure rather than to rely extensively on deposit-based financing (Allen, Carletti, and Marquez, 2011).

21 We use the dummy representing CDS-using banks rather than a continuous variable representing the quantity of CDS positions held by banks in the baseline regression because CDS positions are highly skewed across banks. The top two CDS-using banks, Bank of America and J.P. Morgan Chase & Co, hold CDS positions far exceeding those of other banks. We focus on the qualitative measure to capture the first-order effects.

the regressions. To allow for the possibility that banks with different funding strategies or sources of revenue may hold different levels of capital, we also control for the deposits-to-liabilities ratio and the noninterest income-to-total operating income ratio. These variables describe banks' operating strategies and act as controls for bank types. In all the specifications, we control for year fixed effects to isolate time trends in the capital ratio.

The estimation results of the baseline regressions presented in Panel A of Table II show that banks' capital ratios decline slightly after they begin using CDS. However, the coefficients of the CDS-Usage dummy are not statistically significant. While this finding is consistent with the observation in Minton, Stulz, and Willianson (2009), it is contrary to the expectation that the usage of CDS would help improve banks' capital ratios. In addition, we find that the roles of the control variables conform to the results documented in the literature.[22]

To check the robustness of our baseline findings, we conduct same analysis using two alternative samples: (1) all Compustat banks and (2) the baseline sample excluding the largest banks with deposits exceeding 10% of the total deposits aggregated across all banks in the same quarter, following Houston, Lin, Lin, and Ma (2010). The results presented in Internet Appendix Table IA1 are similar to those in Panel A of Table II, i.e., no clear difference in capital ratios between banks that trade CDS and those that do not.

4.1.2 Selection of Banks' CDS Usage: The Instrumental Variable Approach

[22] For example, an increase in the capital ratio is associated with an increase in the deposits-to-assets ratio and a decrease in the loans-to-assets ratio. Banks use capital as complementary funding to deposits, consistent with the view that high-level bank capital provides signals of bank creditworthiness that are relevant to potential depositors (Demirgüc-Kunt and Huizinga, 2010). The finding that a higher loans-to-assets ratio is associated with a lower capital ratio may suggest that loans may have higher risk weight that other assets, thus a larger proportion of loans out of total assets is associated with a lower risk-weighted capital ratio.

The observed insignificant and negative relationship between banks' use of CDS and bank capital may be confounded by the selection of banks into CDS trading. There may be omitted variables correlated with both banks' decision to trade CDS and their choice of capital ratio. For instance, when suffering negative shocks to its loan portfolio (e.g., default by a group of borrowers in the portfolio), a bank's need for capital to cover the loss and use of credit derivatives to hedge can increase simultaneously. Or, a bank may move loans off its balance sheet through securitization or selling off risky loans to boost up its capital ratio. The observed capital ratio with such endogeneity would then be higher than that in the case in which only the causal effect of CDS occurs. In other words, this endogeneity may result in an underestimation of the negative association between CDS trading and the capital ratio. Another source of endogeneity could arise from reverse causality: banks with weaker capital positions are more likely to buy credit protection. We construct instrumental variables to identify the causal effect of CDS trading on bank capital ratios.

Our first instrument is the fraction of a bank's borrowers that have bond issuance in the past quarter. Firms that have issued public bonds are more likely to be CDS-referenced (Saretto and Tookes, 2013; Subrahmanyam, Tang and Wang, 2014). If banks use CDS that are linked to their borrowers' debt to hedge loan risk, then these banks are engaged in the CDS market by our definition, which refers to banks that take non-zero CDS positions in a given quarter. As shown by Column 1 of Table IA3, a higher fraction of borrowers that have bond issuance predicts a higher probability of CDS trading by the lender in the next quarter, indicating that this instrument satisfies the relevance condition. Meanwhile, this fraction should not affect the bank's regulatory capital ratio.

Our second instrument is the bank's weather-induced revenue-assets volatility before 1997, which is constructed following Pérez-González and Yun (2013). The idea is that if a bank's revenue is more dependent on local weather conditions, the bank is more likely to use weather derivatives to hedge the weather-induced revenue volatilities.[23] These banks are also expected to be more likely to take position in CDS contracts because banks that use derivatives to hedge tend to hedge more than one aspect of their business (Saretto and Tookes, 2013). Because weather derivative contracts were introduced in 1997, and our sample banks started trading in first CDS contracts also in 1997, we construct this instrumental variable based on the pre-1997 (1994 to 1996) information on weather and bank revenue. In the meantime, the pre-1997 weather-induced revenue-assets volatility is not likely to have direct impact on banks' capital position after 1997.[24]

The empirical results of the second-stage IV estimation with instrumented variables for bank CDS usage are presented in Panel B of Table II. The coefficient for the instrumented variable is significantly negatively related to bank capital ratios in all specifications, suggesting that the causal impact of CDS usage on capital ratio is negative and this effect is attenuated by banks' endogenous choice of engaging in the CDS market. This result further corroborates the message from the baseline regressions that CDS usage does *not* improve banks' capital ratios. Instead,

[23] There can be many ways why some banks' revenue is more sensitive to weather than other banks. For example, if a bank's loan portfolio comprises more energy or utility firms, whose revenue is more dependent on local whether changes, the bank's financial condition may also be more affected by weather changes.

[24] To construct this IV, we first obtained monthly average temperature information from the National Oceanic and Atmospheric Administration (NOAA). Then we mapped the location of the weather stations which collected the local temperature information with the latitude and longitude of a bank's headquarter location. We obtained the weather exposure by estimating the below specification using the 1994-1996 data on temperature and bank revenue: $\text{Revenue/Assets}_{it} = \alpha_i + \beta_i * DD_{it} + \gamma_i * \ln(\text{Assets}_{it}) + \varepsilon_t$, where Revenue/Assets is the bank's quarterly revenue-to-assets ratio, and the DD_{it} is |temperature – 65ºF|, a measure of local demand for cooling or heating energy. β_i is the "weather beta", which measures the sensitivity of revenue to variation in DD_{it}. We multiply the estimated $|\beta_i|$ with σ_i, the historical standard deviation of monthly DD_{it} over the period 1994 to 1996 to obtain the pre-1997 weather exposure measure.

capital ratios significantly decline after instrumentation of the indicator for banks' CDS usage. A bank may appear to be "safe" in terms of its capital ratio, as our baseline regressions show, because the Basel capital accord allows banks to use credit derivatives to hedge and to substitute the asset risk weight with the (lower) insurer risk weight for the calculation of RWA. However, capital ratios are actually reduced when the endogeneity of CDS trading is accounted for.

4.1.3 Determinants of Risk-Weighted Capital Ratios

Next we explore the determinants of risk-weighted capital ratios. We include one-quarter-lagged capital ratio as an explanatory variable since banks' capital ratios are likely to be sticky to adjustment and hence auto-correlated. Apart from the control variables for bank characteristics that we use in the baseline regressions in Table II, we also include bank liquidity, other derivatives positions held for trading and non-trading purposes, and variables that describe firm fundamentals used by Duchin and Sosyua (2014): bank age, the ratio of the value of foreclosed assets divided by net loans and leases (foreclosures), the ratio of loan charge-offs to total loans (loan charge-offs), and the ratio of deposit funding from purchased money to core deposits (funding mix). All explanatory variables are lagged one quarter when entering the specifications.

Regressions results in Table III show that capital ratios of CDS-using banks and non-CDS-using banks are dependent upon different aspects of bank activities. A higher deposits-to-total assets ratio and a lower funding mix lead to a larger capital ratio for CDS-using banks, while they have no significant effects on the next-quarter capital ratios for banks not using CDS. The differential impact of banks' funding sources on capital ratio can be related to banks' use of structured credit instruments such as CDS. Holding CDS may expose banks to increased embedded leverage and worsen their asset-liability mismatch, and banks' capital ratios may become more sensitive to funding risks. When a bank is able to attract ample deposits and thus become more liquid, a higher capital ratio will result in the next quarter. The presence of CDS would amplify such an effect.

Meanwhile, capital ratios become less tightly related to the asset side after banks start using CDS, as suggested by the insignificant coefficients of loans-to-assets ratio for CDS-using banks. In the absence of CDS, credit expansion substantially reduces capital ratios, as shown by the negative and significant coefficients in columns (2) and (4). These results corroborate our conjecture that banks exploit the use of CDS for capital relief. The recognition of CDS for capital relief in current capital regulations create room for banks to increase risky lending while maintaining the same capital ratios. The weaker link between loans-to-assets ratio and risk-weighted capital ratios may indicate why regulators may have failed to detect the worsening of capital positions induced by banks' use of CDS.

4.1.4 The Effects of CDS on Tier 1 Leverage Ratio

In addition to the risk-based capital ratios, the G-20 and the Financial Stability Board have proposed another non-risk-based capital measure, leverage ratio, as a supplementary prudential tool to complement minimum capital adequacy requirements. The United States adopts the simplest leverage ratio, expressed as the ratio of tier 1 capital to the adjusted amount of total average assets (quarterly average total assets less intangible assets that include goodwill, investments deducted from tier 1 capital, and deferred taxes).[25] If banks' use of CDS affects both risk weights and quantity of assets that are used to calculate capital ratios, then not only the risk-

[25] The other two types of leverage are economic leverage, which is based on market-dependent future cash flows; and embedded leverage, which depends on whether a bank holds securities or exposures that are themselves leveraged.

weighted capital ratios are affected by CDS using as we have shown, but the non-risk-based leverage can also be different for CDS-using banks and non-CDS-using banks.

However, the baseline regression in column (1) of Table IV shows that banks' use of CDS appears to have no impact on their leverage. The coefficients of CDS-Usage become significantly negative when the endogenous selection of CDS usage is accounted for by instrumentation. A one standard deviation increase in the likelihood of a bank using CDS leads to a 9.53% percent decline in its leverage ratio, suggesting a causal relation between banks' use of CDS and a worse capital position.

These results suggest that the selection of banks into CDS trading can mitigate the worsening effect of banks' use of CDS on leverage ratio. Because off-balance-sheet activities such as securitization cannot affect the balance-sheet leverage ratio, banks that aim to circumvent regulatory capital requirements may fund their long-term assets through off-balance-sheet vehicles. A great amount of CDS is used to facilitate securitization.[26] Therefore, banks with greater demand of removing assets to off-balance-sheet tend to use more CDS, which leads to improvement in their leverage ratios. If the use of CDS induces banks to expand their assets through more risky lending which would result in a lower leverage ratio, such an effect may be masked by the inflated leverage ratio due to banks' endogenous CDS trading.

These observations reveal the limitations of using balance-sheet leverage ratio as a regulatory target, as it may not capture the real risk exposures taken by banks, and may induce banks to take on more risks in an implicit way without being detected.

4.2 Effects of CDS Usage on Lending Practice: Bank- and Loan-Level Evidence

[26] The Financial Crisis Inquiry Report (2011, Page 132).

The lower risk-weighted capital ratio for CDS-using banks after instrumentation suggests CDS may induce banks to expand their risky assets. One way is to increase their loan issuance. We examine this by plotting borrowers' CDS market activities and the aggregate amount of syndicated loans issued to them over the period from 1997 to 2009 in Panel A of Figure 2. Both loan issuance and the number of CDS trades increase rapidly from early 2000 until mid-2007, when the credit crisis erupted. The Pearson correlation coefficient of quarterly volume of syndicated loan issuance and number of CDS trades in borrowers' names is 0.59, significant at the 5% level. In addition, trading in the CDS contracts that reference a borrower's debt is more active in months leading up to loan origination, as indicated by Panel B of Figure 2. The number of CDS trades peaks in the month of loan origination and declines over the next six months. These observations suggest that banks may open CDS contracts referencing a borrower's debt when they initiate a new loan to this firm, consistent with our conjecture that banks use CDS for purposes related to loan issuance. A plausible explanation for this observation is that CDS trading facilitates bank lending. Alternatively, lenders may begin to trade CDS in anticipation of increasing loan issuance in the coming months. Of course, changes in macro-economic conditions may cause CDS and lending to grow simultaneously. These issues of reverse causality and spurious correlation are addressed after we present the baseline results.

4.2.1 Bank-Level Evidence: Commercial and Industrial Loans (C&I Loans)

Bank loan portfolios comprise various types of loans, including C&I loans, real estate loans like home mortgages, consumer loans, and farm loans, etc. The average share of C&I loans in total loans outstanding in our sample is 19.8%, the largest among all loan types. In contrast to mortgage loans and consumer loans which are often sold and securitized by originating banks as a way of credit risk transferring, C&I loans are more likely to be hedged with credit derivatives. Most liquid names in the CDS market are large, investment-grade U.S. firms and foreign multinational companies, because these firms tend to be more transparent and be more efficient (Minton, Stulz and Williamson, 2009; Loutskina and Strahan, 2009; Wang and Xia, 2014). Moreover, securing lending relationships with corporate borrowers who have repeated financing needs is of considerably value to banks. Therefore, it is more prevalent for banks to transfer risks related to C&I loans using CDS which allow them to maintain lending relationships with the borrowing firm. Thus, we expect that C&I loans are more likely to be affected by banks' use of CDS, relative to other types of loans.

Table V shows a positive relationship between banks' share of C&I loans in their total loan portfolios and their CDS usage. The ratio of C&I loans to total loans is 0.015 higher (or 7.6% higher relative to the mean) for CDS-using banks than for non-CDS-using banks. We control for bank fixed effects, year fixed effects and other time-varying bank characteristics, hence we are effectively observing the within-bank changes in C&I loan shares around the time when a bank starts to use CDS. By focusing on C&I loans, our findings also help distinguish the effects of CDS from possible effects from securitization, which happens more often to mortgage and consumer loans.

4.2.2 Loan-Level Evidence: Individual Loan Issuance Amount

Now we turn our attention to individual loans extended to CDS-referenced corporations. We use a difference-in-differences estimator to examine the CDS effect on the initial loan issuance amount. The first difference is between firms whose debt is referenced by CDS contracts ("CDS firm") versus firms whose debt is never referenced by CDS contracts. The second difference is for CDS firms after CDS trading begins ("*CDS Trading*") versus before the trading begins. Specifically, we estimate the following panel regressions:

$$\begin{aligned} \text{Loan Amount}_{it} = {} & \alpha + \beta_1 \text{CDS Trading}_{it} + \beta_2 \text{CDS Firm}_{jt} + \gamma_1 \text{Loan Characterstics}_{it} \\ & + \gamma_2 \text{Borrower Characteristics}_{jt-1} + \gamma_3 \text{Year Fixed Effects}_t \\ & + \gamma_4 \text{Industry Fixed Effects}_j + \gamma_5 \text{Loan Purpose Fixed Effects}_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

where subscript i denotes the loan, subscript j denotes the borrowing firm, and subscript t denotes the quarter of loan issuance. The dependent variable—loan amount—is observed at loan initiation. We scale the loan amount by the amount of the firm's assets in the quarter prior to loan origination. The key independent variable of interest is *CDS Trading*, which equals one if the issuer has been named in a CDS contract before the time of the loan's origination and zero otherwise. We use *CDS Firm*, a dummy that equals one if the borrowing firm has been named in CDS contracts at *any* point during the sample period, to account for potential unobservable differences between CDS firms and non-CDS firms.

Following prior studies such as Sufi (2007) and Cerqueiro, Degryse, and Ongena (2011), we include other typical determinants of loan amounts. The first set of control variables, loan characteristics, includes loan spread, maturity and syndicate size (the number of syndicate lenders), and indicators for loan security and type (term loan versus revolving loans). The control variables of firm characteristics are measured at the end of the quarter prior to loan initiation, including the logarithm of total assets, market-to-book ratio, sales-to-total assets ratio, cash-to-total assets ratio, leverage, tangibility, S&P long-term issuer rating, and Altman's Z-score. In all specifications, we include fixed effects for the loan issuance year, the borrower 2-digit SIC industry and loan purposes.[27] Finally, all standard errors are clustered at the firm level to account for correlations among loan issuance to the same firm.

Table VI presents the estimation results for loan amount based on the sample of syndicated loans.[28] The coefficient estimates of *CDS Trading* are positive and statistically significant. Following Ashcraft and Santos (2009) and Saretto and Tookes (2013), we exclude *CDS Firm* in Column 2 because *CDS Trading* and *CDS Firm* are correlated. The coefficient estimates from Column 1 in Panel A indicate that the presence of CDS trading increases the average loan amount scaled by firm size by 14.5% (or by 36.5% relative to the mean).

Our baseline results are robust to the treatment of endogeneous CDS trading. Following Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2014), we instrument CDS trading with *past* lender foreign exchange hedging activities and borrower's participation in the bond market. Table IA6 of the Internet Appendix shows that the probabilities of CDS trading on the reference firms are positively associated with the firm's *past* lender foreign exchange derivatives position and the existence of public bonds of the firm. The 2SLS estimation with instrumental variables (Table IA6 of the Internet Appendix) and propensity score matching results (Table IA7 of the Internet Appendix) show that CDS trading has causal effects on loan size. More details of the instrumental variable and estimation results are provided in the Internet Appendix.

To explore whether the effect of CDS on loan size is related to changes in banks' lending strategies, we examine loans from CDS-using and non-CDS-using banks separately. One data

[27] We are interested in within-firm changes in the scaled loan issuance amount. Because our sample firm issue fewer than two loans on average, adding firm fixed effects would leave us little degree of freedom. As an alternative, we control for 2-digit SIC borrower industry, by assuming that firms in the same industry have similar ratios of loan issuance amount to firm size in the same year.

[28] We conduct the same analysis with the full sample of syndicated loans and sole-lender loans. The results, reported in Table IA4 of the Internet Appendix, are qualitatively similar.

limitation for our study is that we observe banks' total credit derivatives positions only, not their CDS positions on individual firms. One implicit assumption that we make is that banks that take credit derivatives position trade CDS that reference their borrowers' debt.[29] We expect the effects of CDS trading to be stronger for CDS-using banks. Borrower CDS should not influence a bank's lending decisions if the bank does not trade CDS at all.[30] This test can help differentiate banks' CDS-related lending strategies from their general lending strategies.

Because CDS-using banks usually make more loans than non-CDS-using banks, we choose banks of similar size to provide a sensible comparison. Specifically, we match each CDS-using bank with a non-CDS-using bank that is most comparable in the amount of total assets. Then, we extract the loans originating from each paired bank in the same quarter. To ensure the robustness of our findings, we also conduct the analysis on the entire sample of banks and on all loans without the matching requirement. Table IA8 of the Internet Appendix reports results similar to the matched sample results. Panel B of Table VI shows that the incremental CDS effects on loan amount are exclusively due to CDS-using banks: Model 1 shows that the point estimate is significant for *CDS Trading* but not for *CDS Firm*, which suggests that the effect is due to the actual availability of CDS on a borrower at the time of initiation rather than certain firm characteristics that make them CDS referenced. Model 3 shows that the size of loans issued by non-CDS-using banks is not affected by the presence of CDS in their borrowers' names. Therefore, although CDS-using banks treat CDS borrowers differently from non-CDS borrowers, their counterparts not engaged in the CDS market do not make this distinction.

[29] This should be a sensible assumption, because we find the number of CDS trades referencing the borrower's debt, rather than the lender's aggregated CDS position, peaks in the month of loan initiation.

[30] There are possible spillover effects. For example, a CDS-inactive bank changes its own lending practice because competing banks begin trading CDS and the competing banks lend to a CDS firm. We do not rule out this possibility in this paper; however, we focus on the direct effects of CDS trading on the bank's lending strategies.

Overall, this finding suggests that the increase of loan amount to the underlying firm is indeed due to its lender trading CDS rather than some characteristics of the firm being changed after CDS introduction. If its lender does not use CDS, the loan size will not be different between CDS firms and non-CDS firms. This further illustrates that the lending channel is the key to explain our finding of lower capital ratios for CDS-using banks, because the increase in loan size is related to the lender's CDS trading in *that* particular borrower's debt, rather than the bank's total credit derivatives position in general. The results provide additional evidence that CDS induce banks to alter their lending practices.

4.2.4 The Effects of CDS Trading on Loan Quality

So far we document that CDS-using banks issue larger loans to firms named in CDS contracts and carry lower risk-weighted and non-risk-based capital ratios. But are these loans riskier? Figure 3 shows a negative correlation between loan quality, as measured by Altman's Z-score, and the lender's derivatives position over time (the Pearson correlation is -0.74, significant at the 1% level). This negative correlation also holds in the multivariate regressions reported in Table IA9 of the Internet Appendix, revealing that the credit quality of CDS-referenced borrowers, measured by the S&P long-term issuer rating, is lower at loan issuance and deteriorates thereafter.[31] These results are consistent with the finding that CDS-referenced borrowers become riskier after banks begin trading in their contracts documented by Subrahmanyam, Tang, and Wang (2014).

[31] In an untabulated plot, we examine the lending standard measure from the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices (http://www.federalreserve.gov/boarddocs/snloansurvey/). In this survey, the tightness of lending standard is measured by the net percentage of respondents who report that they believe the current lending standard is tight. We find the lending standards are lower when banks takes larger CDS positions.

To further understand banks' lending practices, we examine *Loan Loss Provision*, the allowance a bank sets aside for its expected loan loss. This measure is a bank's own estimate of loan portfolio risk. A higher loan loss provision suggests that banks are aware of the additional risks they are taking on through lending. Table VIII shows that the loan loss provision for CDS-using banks is higher--25% higher relative to the mean--than that for non-CDS-using banks, as shown in Column 1. The loss provision ratio is also higher in Column 2 for borrowers referenced with CDS than those not linked to CDS. Column 3 further shows that the higher loan loss provision is associated with a larger proportion of loans issued to CDS-referenced firms. Although banks are not required to report the breakdown of their use of CDS, which makes it hard to uncover direct evidence on the consequence of using CDS for banks, our finding on potential loan losses provides concrete evidence on the adverse effect of CDS on their banking book.

4.2.5 Banks' CDS Usage and Quality of Bank Capital

In this subsection, we analyze the effect of bank CDS trading on capital quality, measured by the ratio of Tier 1 capital to total capital which consists of Tier 1, Tier 2 and Tier 3 capital. Table IX presents the regression results using the same specification as in the previous analysis of capital ratio. The coefficients of the CDS-Using dummy in the baseline regressions are negative and significant, indicating that the composition of bank capital tilts toward lower quality capital when a bank is engaged in the CDS market. The ratio of Tier 1 capital to total capital is 0.032 lower (or 4.26% lower relative to the mean of the ratio) for CDS-using banks than for banks that do not trade CDS. This difference is statistically significant at the 1% level after we control for bank fixed effects. The decline in capital quality remains robust in the instrumental variable estimations that use the fitted value of the CDS-Usage variable estimated from the instruments, as shown by Panel B.

The 1996 Amendment of Basel capital accord allows Tier 3 capital to be used for the market risk in the trading book. Many of the CDS positions are for trading purposes. The results in Table IX suggest that bank capital regulations during our sample period may have induced banks to shift from controlling risk to controlling capital ratios through RWA.[32] While the capital ratios remain unchanged, the growth in RWA is supported more by Tier 2 and Tier 3 capital than by core capital (Tier 1). Because there is no obvious trend in capital ratios, regulators may overlook the actual risk accumulated by banks. If banks pursue a strategy that controls or limits a specific capital target and if banks can do so independently of the impact of the strategy on other capital quality measures, then such a strategy would not effectively improve capital level, but instead lead to lower capital quality. Indeed, we find that capital quality is significantly worse for banks that trade CDS. One goal of Basel III is to "raise both the quality and quantity of the regulatory capital base."[33] Indeed, regulators closed the loopholes in previous capital regulations by (1) improving bank capital definitions, specifically, abolishing Tier 3 capital, and by (2) including the leverage ratio (i.e., Tier 1 capital to total assets, rather than RWA, must be greater than 3%) into the capital accord.

Overall, our bank-level evidence indicates that banks' capital level and quality deteriorate after banks begin trading CDS. While neither the total capital ratio nor Tier 1 capital is significantly lower for CDS-using banks in the baseline regressions, the coefficients become significant after instrumentation. Moreover, the share of Tier 1 capital in total capital, which we

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[32] Sheila Bair, former chairman of the U.S. Federal Depository Insurance Corporation, has expressed her concern in the calculation of RWA: "The risk weightings are highly variable in Europe and have led to continuing declines in capital levels…There's pretty strong evidence that the RWA calculation isn't working as it's supposed to." (http://www.risk.net/risk-magazine/news/2081139/europe-lax-rwa-calculations-bair)

[33] See page 2 of "Basel III: A global regulatory framework for more resilient banks and banking systems".

use to measure capital quality, is substantially lower after CDS trading. One factor driving the decline in the capital ratios is the increased risky asset base of banks after they begin trading CDS, as we showed earlier.

4.3 The Effects of CDS during the 2007-2009 Credit Crisis

After presenting the evidence of CDS effects on bank capital and lending over the entire sample period, we examine whether banks react differently to the credit crisis depending on their CDS positions in the pre-crisis period. Banks' CDS positions peaked at the beginning of 2008 and subsequently declined precipitously. Banks held substantially fewer CDS positions during the crisis. During this period, several banks failed. One prominent example was Wachovia, which was an active CDS user. Shocks to the CDS market during the crisis, particularly after the bankruptcy of Lehman Brothers and the bailout of AIG, should both change banks' understandings of the function of CDS and limit their further use of CDS.

4.3.1 Bank Capital

If banks retain lower buffer levels of regulatory capital ratios because of CDS, they may need to raise additional capital during crisis periods because CDS become less available, making it more difficult for banks to use CDS for capital relief.[34] According to data from the ISDA 2009 mid-year market survey, the total notional amount of outstanding CDS fell to $31.2 trillion at the end of June 2009, representing a substantial decline from the peak of $62.2 trillion at the end of 2007. CDS protection also became more expensive during the crisis.[35] Simultaneously,

[34] Federal officials announced on May 7, 2009, that 10 of the largest banks in the U.S. would need to raise a total of $74.6 billion in capital (http://money.cnn.com/2009/05/07/news/companies/stress+test_Announcement). On June 3, 2009, FDIC Chairman Bair stated that "Banks have been able to raise capital without having to sell bad assets through the Legacy Loans Program" (http://www.fdic.gov/news/news/press/2009/pr09084.html).

[35] For example, investment-grade corporate credit spreads, as measured by the CDX.IG index, increased from 50 basis points in early 2007 to more than 250 basis points at the end of 2008. Even AAA-rated synthetic credit

regulators became more concerned with bank soundness and strengthened bank capital regulations.[36] Although most banks had to raise capital owing to the heightened downside risk during the crisis, CDS-using banks had to increase capital to a greater extent to support their risk exposure and to fulfill regulatory requirements, as these banks used CDS to circumvent regulatory requirements while building up riskier loan portfolios in the pre-crisis period, and could no longer exploit such opportunities when the crisis hit.

Panel A of Table X reports the estimation results of a regression of banks' regulatory capital ratios during the crisis on their pre-crisis CDS status. Following Ivashina and Scharfstein (2010), we separate the crisis into two phases: July 2007 to August 2008 as Phase 1 ("Crisis 07-08") and September 2008 to June 2009 as Phase 2 ("Crisis 08-09"), with the collapse of Bear Stearns and the bankruptcy of Lehman Brothers as the watershed events for Phase 1 and Phase 2, respectively. Table X shows that banks that were using CDS before bring back more capital to their balance sheet than non-CDS-using banks during the second phase of the crisis (i.e., post-Lehman) relative to the first phase of the crisis and the pre-crisis period. The results are consistent when we use both the total capital ratio and the Tier 1 capital ratio. The results are also robust when we recast the pre-crisis window from 2005Q3 to 2007Q2. Following Fahlenbrach and Stulz (2011) and Beltratti and Stulz (2012), we use the entire sample for columns 1 and 2 but use only the 2005-2007 data as the pre-crisis period for columns 3 and 4. Relative to the pre-crisis period of 2005Q3 to 2007Q2, the average total risk-weighted capital ratio for CDS-using banks slightly increased by 0.006 during the first phase of the crisis. However, the total capital ratio significantly increased by 0.016 during the second phase of the crisis. The findings for the Tier 1 capital ratio are similar. Our findings indicate that when the

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products, which were considered nearly risk free prior to the crisis, saw their spreads widen dramatically during the crisis.

[36] The news release is available at: http://www.federalreserve.gov/newsevents/press/bcreg/20081112a.htm

CDS market became less liquid, banks that took CDS positions prior to the crisis improved their capital positions to a greater extent than banks that were not trading CDS.

4.3.2 Bank Lending

Raising capital may not be sufficient to maintain a bank's stability during a crisis. Banks may have to reduce their risky assets as well. Panel B of Table X reports the results of regressing the amount of new loan issuance on CDS-Usage, the indicator for CDS-using banks, during the crisis. The dependent variables are the amount of total loan issuance in column 1 and the amount of revolver issuance in column 2, both scaled by the amount of total assets in the previous quarter. The regression sample includes 937 observations because we restrict the sample to the period from 2005 to 2009. The coefficients of the interaction term of CDS-Usage and the crisis dummy are negative and statistically significant. For instance, in column 2 of Panel B, the average revolver issuance by CDS-using banks is 1.1% lower during the first phase of the crisis and 1.6% lower during the second phase of the crisis relative to that during the pre-crisis period. Overall, CDS-using banks reduced lending to a greater extent than non-CDS-using banks during the crisis.[37]

These results suggest that the availability of CDS may exacerbate the procyclicality of credit supply. The borrowers of CDS-using banks suffered more than borrowers of non-CDS-using banks because their lenders reduced lending to a greater extent. Although CDS-using banks increased their capital levels, the new capital levels might not have been sufficient to accommodate their risk levels because they have extended more risky loans prior to the crisis, which were supported by a relatively well-functioning CDS market. The role of CDS in risk

[37] The crisis dummies have negative coefficients, suggesting that all banks (including both CDS-using and non-CDS-using banks) reduced lending during the crisis. Ivashina and Scharfstein (2010) document that new loans to large borrowers during the peak period of the financial crisis (fourth quarter of 2008) fell by 79% relative to the peak of the credit boom and by 47% relative to the prior quarter.

transfer and capital reduction became limited when the crisis struck; thus, banks became more conservative by raising capital and reducing loan issuance. Hence, the impact of the crisis on lenders is also felt by their borrowers.

4.3.3 Stock Market Reaction to Banks' CDS Usage

We use the stock market reaction to examine whether the ex post remediation was sufficient to compensate for banks' risk-taking activities prior to the crisis. We follow Beltratti and Stulz (2012) to regress bank stock returns on their pre-crisis CDS positions. Table XI presents the regression results. The first column shows that banks that were active in CDS trading during the second quarter of 2008 underperformed their counterparts that were not active in CDS trading by 24.5% in terms of buy-and-hold returns in 2008Q3-Q4, after we control for other factors that may affect stock returns. The second column shows that banks that were active in the CDS market before the onset of the crisis in 2007Q2 experienced significantly larger stock price declines during the entire crisis period from 2007Q3 to 2009Q2. The second phase of the crisis, hallmarked by the bankruptcy of Lehman Brothers, contributes to most of the underperformance of these banks.

If CDS-using banks were ex post punished by their exposure to the CDS market, which was brought to a halt during the crisis, were there any benefits from using CDS for banks? In other words, are banks ever rewarded for trading CDS during normal periods by earning more profits and higher stock returns? Column 3 of Table XI reports the estimated relationship between banks' buy-and-hold returns from mid-2006 to mid-2007 and banks' CDS activity in the second quarter of 2006. Banks that took CDS positions in 2006Q2 outperform non-CDS-using banks by 10% in the subsequent year. Shareholders may thus believe that using CDS increases a bank's value and react positively to such information. The outperformance in the stock market provides a rationale for banks' use of CDS, consistent with our previous findings that bank use CDS to facilitate lending.

This finding indicates that participating in the CDS market may create value for bank shareholders in tranquil times but exposes them to risks during crisis periods. The CDS market suddenly became illiquid when the crisis erupted, leaving banks that relied on them for lending in the pre-crisis period unable to find protection at economically sensible prices for the risky loans that they had already extended. Our findings are consistent with the view expressed in Beltratti and Stulz (2012) that bank decisions that may create more value during normal periods can be associated with negative realizations during crisis periods. Moreover, as firms become riskier after the introduction of CDS (Bolton and Oehmke, 2011; Subrahmanyam, Tang and Wang, 2014), CDS-referenced firms are more likely to default on the loans that they obtained during a credit boom, which might have worsened the performance of their lenders during the crisis.

V. Conclusion

CDS are recognized in bank capital regulations, including both Basel II and Basel III, as tools that banks may deploy for capital relief and risk management. Regulatory capital requirements are lower when banks use CDS to hedge against credit exposure. In contrast to regulators' desire to improve bank capital adequacy with CDS, we find that regulatory capital ratios are *not* higher for CDS-using banks than for non-CDS-using banks. Moreover, we find that capital quality is lower for CDS-using banks than non-CDS-using banks. These findings are more pronounced when we account for the endogenous selection of banks into using CDS.

Banks increase risky lending when they use CDS or when CDS are available on borrowers, as loan size is larger when a borrower's debt is referenced in CDS. Moreover, the effect of CDS on loan size is only significant if the lender is an active CDS user.

CDS-using banks raised more capital and contracted their lending to a greater extent during the credit crisis than non-CDS-using banks. Further, CDS-using banks experienced worse stock performance than non-CDS-using banks during the crisis. However, CDS-using banks had better pre-crisis financial and operating performance than their non-CDS-using counterparts; thus, banks may be rewarded with higher returns by using CDS to take on more risk during tranquil periods. We conclude that the capital relief brought about by CDS induces banks to tilt toward lower quality capital and in turn facilitates credit expansion through the increased bank loan supply, particularly from CDS-using banks to CDS-referenced borrowers. Future studies could explore the overall welfare effect of CDS trading on banks, borrowers, and financial markets.

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Appendix: Variable Definitions

Variable Name	Description
Bank-Level Variables	
CDS-Using Bank (CDS Usage)	A dummy equal to one if the bank takes a non-zero CDS long or short position in the quarterly observation, and zero otherwise. The CDS data for U.S. banks are extracted from FR Y-9C report, in which CDS long position is reported by variable BHCKC969 (the bank as the beneficiary) and CDS short position is reported by variable BHCKC968 (the bank as the guarantor). The CDS data for foreign banks are extracted from OCC report, in which CDS long position is reported as "CDS bought" and CDS short position is reported as "CDS sold"
Non-CDS-Using Bank	Banks that take zero CDS position in a given quarter
The Ratio of Borrowers with Bond Issuance	The ratio of the number of borrowers with bond issuance out of the total number of borrowers in a bank's loan portfolio in a given quarter
Pre-1997 Weather Exposure	Bank historical (1994 to 1996) revenue sensitivity to weather fluctuations, introduced by Perez-Gonzalez and Yun (2013). It is calculated by multiplying the estimated weather beta β_i and σ_i , the historical standard deviation of the weather variable DD_{it} . The β_i is obtained by estimating the below specification: $\text{Revenue/Assets}_{it} = \alpha_i + \beta_i * DD_{it} + \gamma_i * \ln(\text{Assets}_{it}) + \varepsilon_t$, where Revenue/Assets is the quarterly revenue-to-assets ratio, and the DD_{it} is |temperature – 65oF|, a measure of demand for cooling or heating energy.
Tier 1 Risk-Weighted Capital Ratio	The ratio of Tier 1 capital relative to risk-weighted total assets
Tier 1/Total Capital Ratio	The ratio of Tier1 capital relative to total capital
Tier 1 Leverage Ratio	The ratio of tier 1 capital relative to the average adjusted assets, which is calculated as total assets less intangible assets.
C&I Loans/Total Loans	The ratio of commercial and industrial loans (C&I loans) relative to total loan amount outstanding in a bank-quarter
Deposits/Total Assets	The ratio of the sum of domestic deposits and foreign deposits relative to the bank's total assets in the same quarter
Deposits/Total Liabilities	The ratio of the sum of deposits and foreign deposits relative to the bank's total liabilities
Loan Loss Provision	The ratio of expense prepared for potential loan loss relative to total pre-tax income
Loan to CDS Firm Ratio	The issuance amount of syndicated loans to firms that have CDS market referencing its debt at loan initiation relative to total syndicated loan issuance amount from the same bank in the same year
Total Loans /Total Assets	A bank's total outstanding loan amount relative to the bank's total assets
Market Share	The percentage of a bank's total deposits relative to the total deposits of all bank holding companies in the same quarter
Market Value	Stock price multiplied by the number of shares outstanding
Net Interest Margin	The difference between the interest income and the amount of interest paid out to their lenders, relative to the amount of their interest-earning assets, measured on quarterly basis
Net Interest Margin Volatility	The standard deviation of quarterly net interest margin in the past four quarters prior to the bank-quarter
Non-Interest Income /Total Operating Income	The ratio of non-interest income relative to the bank's total operating income
ROA	The ratio of quarterly net income before extraordinary items to total assets
ROA Volatility	The standard deviation of quarterly ROA in the past four quarters prior to the bank-quarter
Total Risk-Weighted Capital Ratio	The ratio of total capital over risk-weighted total assets
Sales Growth	The logarithm of the ratio of sales (revenue) at quarter *t* relative to sales at quarter *t-1*
Beta	Beta calculated from the CAPM model using monthly stock return

Firm-Level Variables	
CDS Trading	A dummy indicating that the firm has an active CDS market referencing its debt in the quarter of loan initiation
CDS Firm	A dummy indicating that the firm ever had an active CDS market referencing its debt during the sample period
Cash/Total Assets	The ratio of the sum of cash, cash equivalents and short-term investment relative to total assets
Firm Age	The number of years as of the date when the firm first appeared in Compustat
FX Derivatives	The amount of foreign exchange derivatives used for hedging purpose relative to the amount of loans of the lead banks that the firm has borrowed from in the past five years
Has Other Derivative Positions	A dummy indicating that the bank takes position in derivatives linked to equity, interest rate, foreign exchange or commodity for hedging or trading purposes
Leverage	(Short-term Debt+0.5*Long-term Debt)/Total Assets
Number of CDS Trades	The number of trades in CDS contracts referencing a borrower's debt in a given quarter
Rated	A dummy indicating whether the issuer of a loan is has a S&P long-term issuer rating at the time of loan initiation
Sales/Total Assets	The ratio of total sales relative to total assets
Tangibility	The ratio of tangible assets to total assets
Z-score	Z-score developed by Altman (1968) calculated from the formula Z=1.2*Working Capital/Total Assets+1.4*Retained Earnings/Total Assets+3.3*EBIT/Total Assets+0.6*Market Value of Equity/Book Value of Total Liabilities+0.999*Sales/Total Assets
Loan-Level Variables	
Loan Amount/Total Assets	The ratio of loan issuance amount (aggregated amount across facilities/tranches) at loan (package) level relative to the borrower's total assets at the end of the quarter prior to loan initiation
Loan Spread	The loan (package) level all-in-drawn spread averaged across facilities/tranches.
Maturity	Maturity in years averaged across tranches at loan (package) level
Multiple Lead Arrangers	A dummy indicating whether there are multiple lead lenders in a loan syndicate
Number of Lenders	The number of lenders, including the lead arranger and participating banks, in a loan syndicate
Performance Pricing	A dummy indicating whether the loan has performance pricing clause
Secured	A dummy indicating whether the loan is secured by collateral
CP Backup	A dummy indicating that the purpose of loan is for commercial paper backup
Debt Refinancing	A dummy indicating that the purpose of loan is to refinance debt
Takeover	A dummy indicating whether the purpose of a loan is for corporate takeover
Term Loan	A dummy equal to one if at least half of the tranches included in the loan are term tranches
Working Capital	A dummy indicating whether a loan is issued for the purpose of financing working capital

Figure 1. Changes in on- and off- Balance Sheet Items after Bank Starts Using CDS

This figure illustrates changes in the composition of a bank's balance sheet before and after it started trading CDS. The yellow blocks to the left of the balance sheets are off-balance sheet items. For on balance sheet items, the height of each block represents the percentage of the amount of each component relative to the total book value of assets on the balance sheet. The width of the blocks represents the size of the balance sheet.

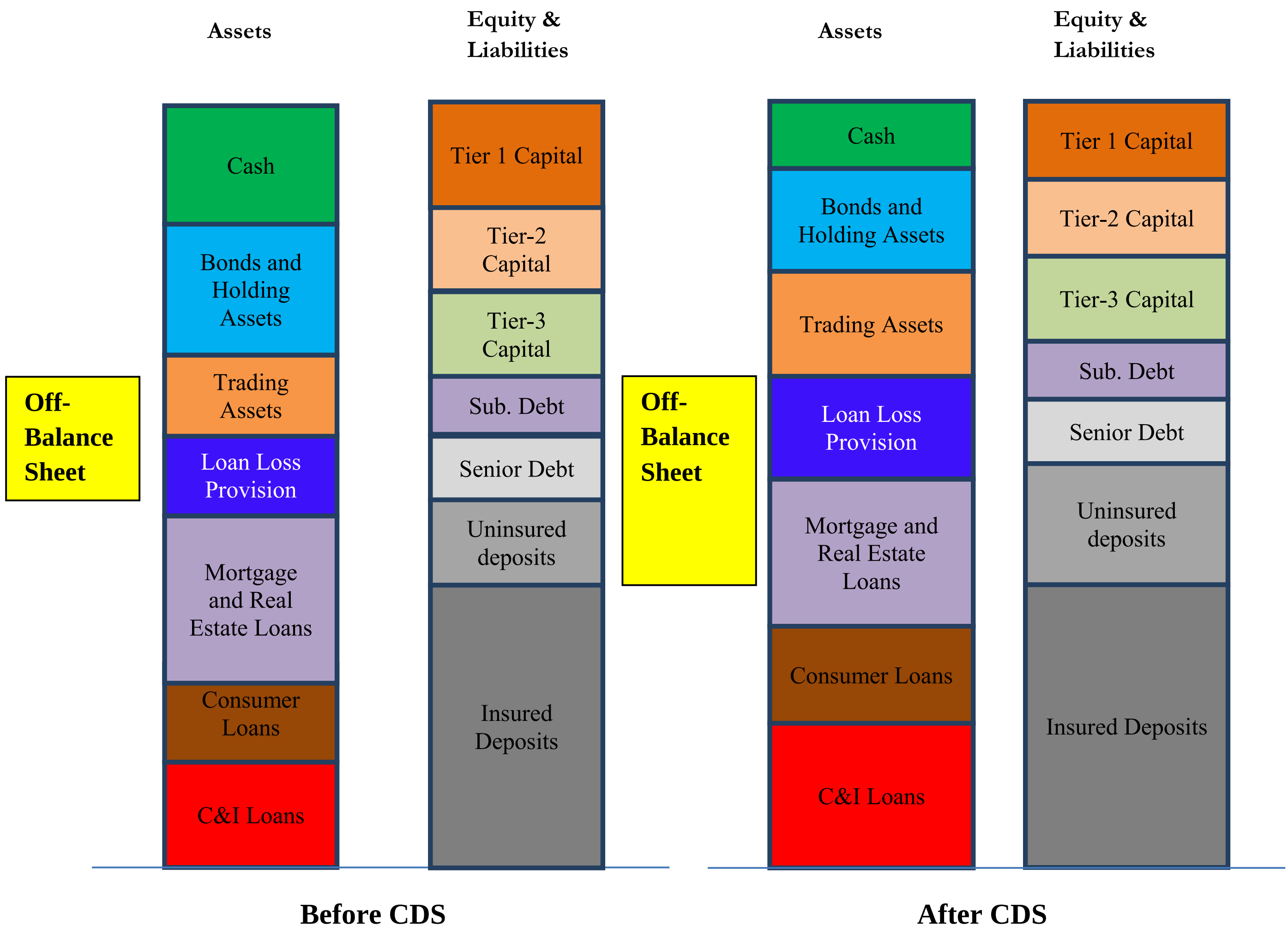
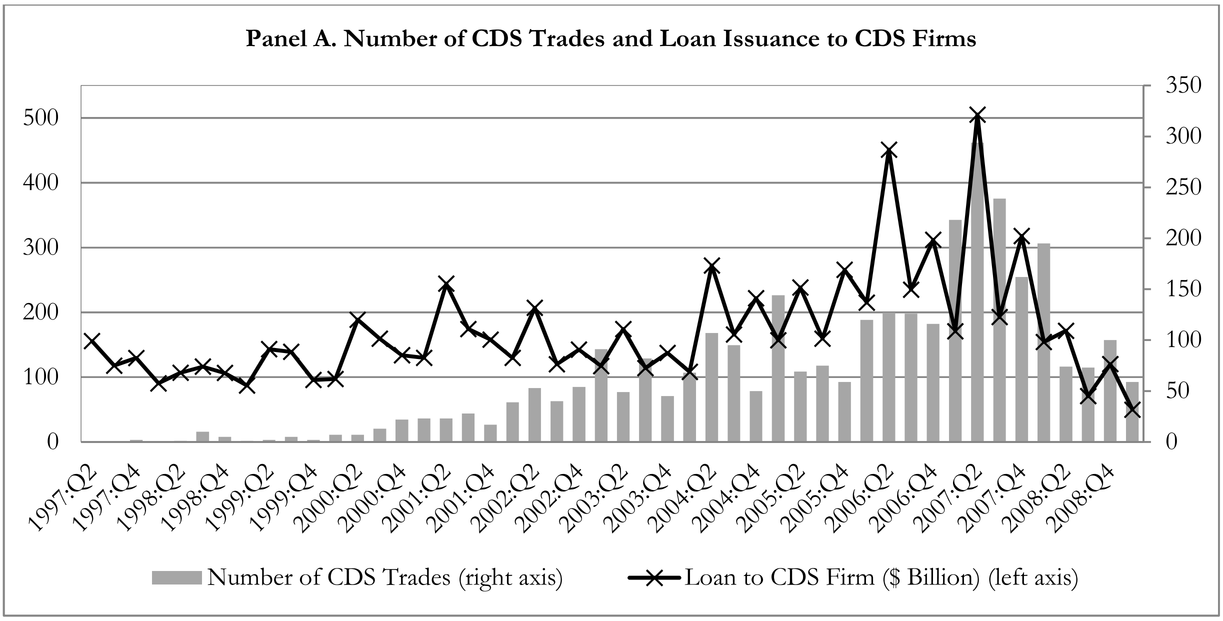


Figure 2. Number of CDS Trades and Syndicated Loan Amount to CDS Firms

This figure plots the relation between CDS trading and loan issuance. Panel A plots syndicated loan issuance amount to CDS firms and the number of CDS trades referencing the borrowers' debt by quarter over the period 1997Q2-2009Q1. The line with stars represents the aggregate amount of syndicated loans to CDS firms (left y-axis). The bars represent the total number of CDS trades referencing the borrowers' debt (right y-axis). CDS firms refer to firms that have active CDS market referencing its debt in the quarter of loan initiation. Panel B plots the quantity of CDS trading referencing the borrower's debt in month [-6, +6] around loan initiation, averaged across loans to CDS firms. Bars represent the average number of outstanding CDS contracts (left axis); the line with stars represents the average number of CDS trades (right axis). Number of CDS trades data are extracted from CreditTrade and GFI database. CreditTrade data cover the period from June 1997 to March 2006. GFI data cover the period from January 2002 to April 2009. Syndicated loan amount data are extracted from Dealscan.



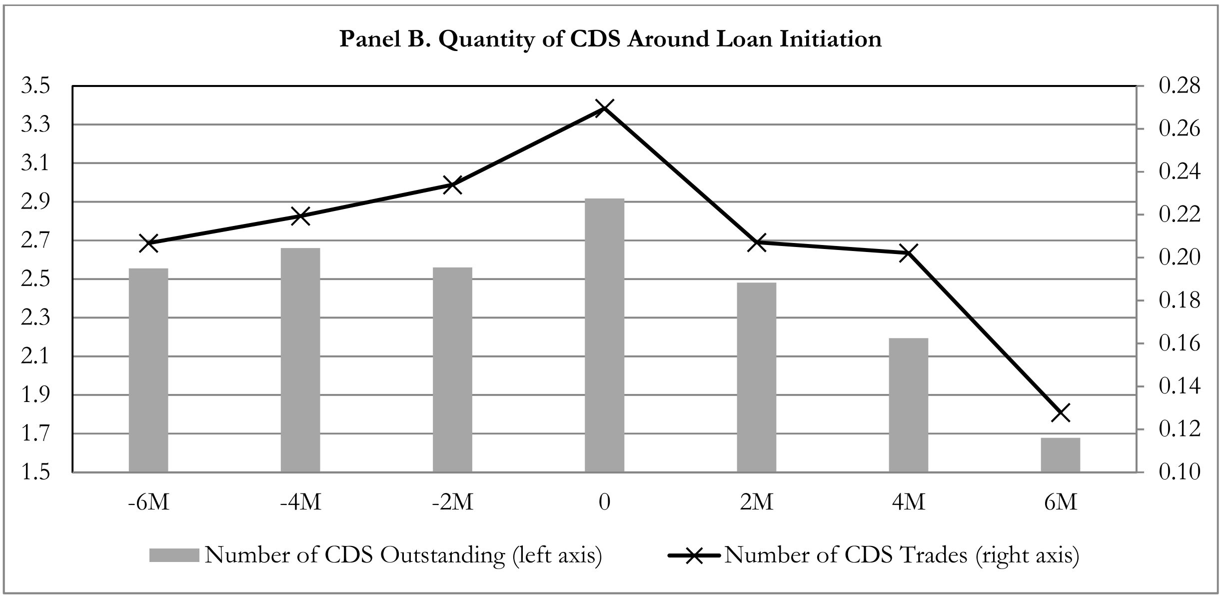


Figure 3. Bank CDS Position and Loan Quality

This figure plots borrowers' average Altman's Z-score at loan initiation and their lead lenders' average CDS total outstanding position by quarter over the period 1998Q3 to 2010Q1. We plot CDS position of lead lenders active in CDS trading in the quarter of loan initiation. The black line with stars represents their borrowers' average Altman's Z-score at loan initiation (left y-axis). The grey line with diamonds represents the banks' average CDS position (right y-axis). Banks' CDS position information is extracted from Federal Reserve Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) and the Office of the Comptroller of the Currency (OCC) Quarterly Report on Bank Derivatives Activities.

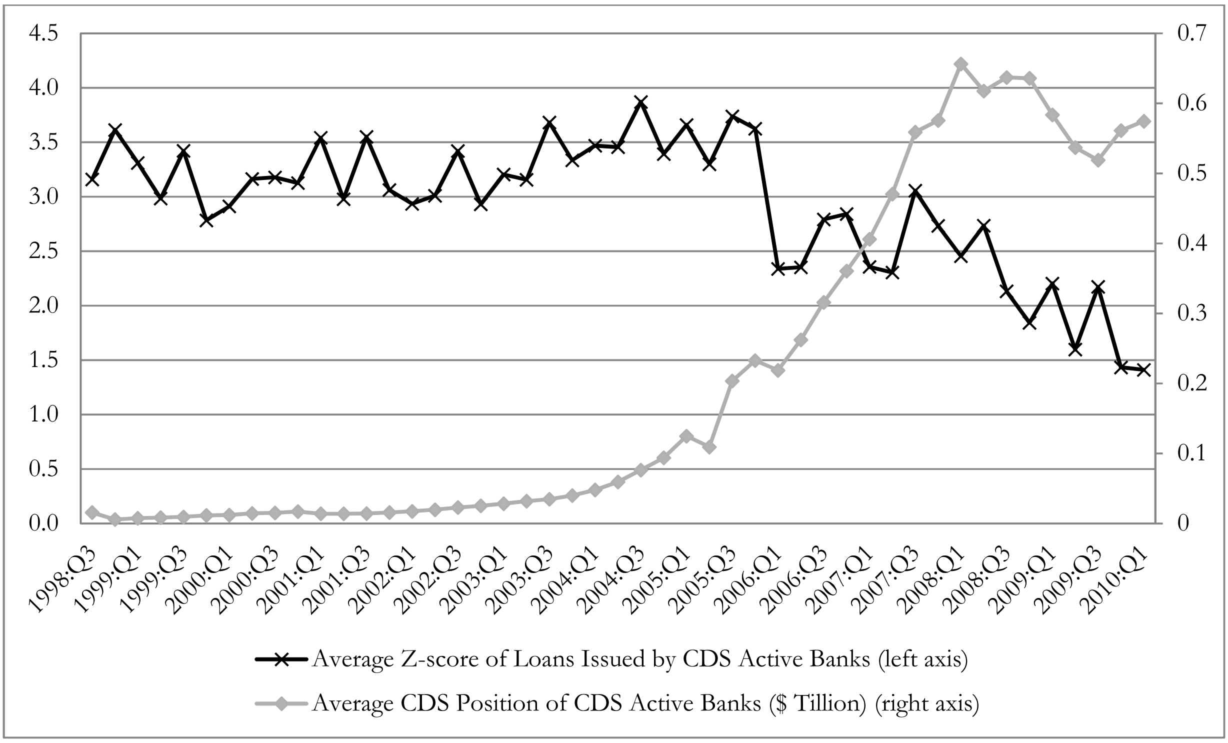


Table I

Summary Statistics of Lead Bank and Syndicated Loan

This table presents the descriptive statistics and yearly distribution for the key variables used in our analysis. Panel A presents summary statistics of lead banks in our sample. Panels B and C describe year distribution of our sample banks and syndicated loan issuance over the period 1994-2009. In Panel A, total risk-weighted capital ratio refers to the ratio of total capital relative to the risk-weighted assets. Tier 1 risk-weighted capital ratio is the ratio of tier 1 capital relative to risk-weighted assets. Tier 1 leverage ratio is the ratio of tier 1 capital relative to the adjusted assets, which is total assets less intangible assets. ROA is annualized by multiplying 4. Beta is the annual beta by estimating CAPM using monthly return. Other variables are extracted at the end of the quarter. In Panel B, column 2 reports the number of CDS active banks that are involved as syndicate lead arrangers by year. CDS active bank refers to banks that are active in CDS trading in the quarter of loan initiation. Column 3 reports the average total assets of all sample banks. Column 4 reports aggregate issuance amount of syndicated loans from our sample banks. In Panel C, column 2 presents the number of unique borrowers of our sample syndicated loans. Columns 3 to 6 report loan characteristics. Loan amount refers to the aggregated amount of all facilities (tranches) for each loan deal (package). Spread and maturity refer to the loan-level all-in-drawn spread and maturity averaged across facilities (tranches). Number of lenders refers to the number of banks (both lead and syndicate members) participating in a loan syndicate. We restrict the bank sample to banks that can be identified as syndicate lead arrangers in Dealscan. Bank CDS position data are from Federal Reserve Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) and the Office of the Comptroller of the Currency (OCC) Quarterly Report on Bank Derivatives Activities. Other bank-level variables are constructed using data from Compustat Bank. Syndicated loans are loans from Dealscan with distribution method as "Syndication". See Appendix for detailed variable definitions.

Panel A. Summary Statistics of Sample Banks

Variable	Mean	StdDev	Min	Max
Bank Capital Adequacy Measure				
Total Risk-Weighted Capital Ratio	0.132	0.024	0.109	0.211
Tier 1 Risk-Weighted Capital Ratio	0.102	0.024	0.073	0.162
Tier 1 Leverage Ratio	0.082	0.026	0.050	0.315
Tier 1/Total Capital Ratio	0.752	0.107	0.096	1.000
Bank Lending Practice				
C&I Loans/Total Loans	0.198	0.112	0.000	0.618
Loan Loss Provision	0.004	0.004	0.000	0.012
Bank Other Characteristics				
ROA	0.010	0.005	0.001	0.016
Net Interest Margin	0.033	0.008	0.027	0.050
Total Assets ($ Billion)	331.573	558.091	0.060	3879.172
Sales Growth	0.103	0.155	-0.124	0.351
Beta	1.002	0.817	-2.283	4.688
Market-to-Book	1.656	0.984	0.000	6.581
Deposits/Total Assets	0.586	0.163	0.337	0.852
Total Loans/Total Assets	0.609	0.123	0.385	0.763
C&I Loans/Total Assets	0.121	0.079	0.036	0.223
Market Share	0.017	0.020	0.000	0.121
Bank CDS Position				
CDS Total Position ($ Billion)	65.085	566.022	0.000	10189.101

Table I — *Continued*

Panel B. Distribution of Sample Banks				
Year	Number of Banks	Number of CDS-Using Banks	Total Assets ($ Billion)	Syndicated Loan Issuance Amount ($ Billion)
(1)	(2)	(3)	(4)	(5)
1994	55	.	56.15	491.51
1995	54	.	65.49	574.87
1996	52	.	76.09	627.76
1997	51	13	85.76	888.98
1998	53	17	118.26	666.49
1999	56	20	140.26	652.69
2000	56	19	160.62	1181.01
2001	62	19	185.87	1624.49
2002	66	18	208.91	1715.64
2003	65	20	235.72	2434.51
2004	64	19	279.30	3780.16
2005	62	20	339.52	4627.54
2006	61	18	397.04	4015.65
2007	59	18	510.02	4560.33
2008	57	16	602.79	2661.70
2009	53	15	631.33	2118.35
Total	84	43	331.573	32621.68

Panel C. Distribution of Sample Loans						
Year	Number of Syndicated Loans	Number of Unique Firms	Loan Amount ($ Million)	Spread (Basis Points)	Maturity (Years)	Number of Lenders
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1994	1723	1429	326.14	139.07	5.5	7.6
1995	2082	1633	337.77	137.14	5.9	7.2
1996	2700	2049	311.70	143.69	5.9	7.3
1997	3243	2424	342.76	133.76	6.0	7.2
1998	2726	2176	338.01	145.95	5.9	6.8
1999	2868	2287	362.00	167.06	5.7	8.0
2000	3212	2499	386.62	172.77	4.8	7.6
2001	3231	2531	382.41	176.33	4.2	7.9
2002	3164	2527	340.29	195.59	4.3	8.0
2003	3266	2651	342.82	206.17	4.6	8.5
2004	3710	2958	420.55	182.16	5.3	8.6
2005	3828	2992	499.35	151.82	5.8	8.6
2006	3740	2939	492.37	148.74	6.0	7.3
2007	3487	2776	598.79	151.64	6.4	7.3
2008	2631	2103	400.99	187.99	4.9	6.2
2009	1662	1389	370.97	325.45	4.2	6.3
Total	47273	11397	400.32	169.62	5.4	7.6

Table II

Effects of Bank CDS-Usage on Bank Risk-Weighted Regulatory Capital Ratio

This table reports the estimation results of panel regressions that examine how a bank's CDS trading affects its regulatory capital ratios. The dependent variables in columns 1 and 2 are total risk-weighted capital ratio and tier 1 capital ratio, respectively. The risk-weighted total capital ratio is the ratio of total capital relative to the risk-weighted assets (RWA). The Tier 1 capital ratio is the ratio of Tier 1 capital relative to the risk-weighted assets. The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with Compustat bank identifier from 1994 to 2009. The independent variable of interest is CDS-usage, an indicator taking one if the bank takes non-zero CDS position in the bank-quarter, and zero otherwise. CDS position data for U.S. banks are extracted from the Federal Reserve Consolidated Financial Statements for Holding Companies ("FR Y-9C"), and those for non-U.S. banks are extracted from Office of the Comptroller of the Currency (OCC) quarterly report on bank derivatives activities. Sales growth is the percentage increase in the bank's total revenue relative to the prior quarter. Market share refers to the share of deposits of the bank in the total deposits of all bank holding companies in our sample in the same quarter. All control variables are extracted one quarter prior to the bank-quarter. We control for year and bank fixed effects in both regressions.

Panel B reports the second-stage regression results of bank regulatory capital ratios on the fitted value of CDS active bank indicator using instrumental variable approach. The fitted value is estimated from OLS regressions on two instruments: (1) the ratio of ***borrowers*** that have bond issuance out of all borrowers of the bank in the bank-quarter; (2) the weather exposure (weather-induced revenue-assets volatility before 1997) introduced by Perez-Gonzalez and Yun (2013). The instruments are lagged one quarter in the first-stage OLS regression. Results of the first-stage OLS regressions are reported in Internet Appendix Table IA4. Control variables in the second stage regression are the same as those in Panel A. We do not report the coefficients of the control variables to conserve space. All variables are winsorized at 1% level. We control for year and bank fixed effects in all specifications. Standard errors clustered by bank are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Panel A. Baseline Regressions of Bank Regulatory Capital Ratio		
	Total Risk-Weighted Capital Ratio	Tier 1 Risk-Weighted Capital Ratio
Variable	(1)	(2)
CDS-Usage	-0.001	-0.005
	(0.003)	(0.003)
Total Assets	-0.018	-0.035
	(0.038)	(0.040)
Total Assets Squared	0.003**	0.003*
	(0.002)	(0.002)
Sales Growth	0.002	0.005
	(0.009)	(0.009)
Deposits/Total Assets	0.058*	0.077**
	(0.034)	(0.033)
Total Loans/Total Assets	-0.182**	-0.194***
	(0.072)	(0.075)
Market Share Squared	-0.066	-0.138*
	(0.075)	(0.075)
Deposits/Total Liabilities	0.001	0.001
	(0.001)	(0.001)
Non-Interest Income	-0.004	-0.002
/Total Operating Income	(0.025)	(0.010)
Intercept	0.237***	0.211***
	(0.057)	(0.057)
Year Fixed Effects	Yes	Yes
Bank Fixed Effects	Yes	Yes
R-squared (%)	47.47	57.95
Observations	4280	4280

Panel B. Effects of Instrumented CDS-Usage				
	Tier 1 Risk-Weighted Capital Ratio		Tier 1 Risk-Weighted Capital Ratio	
Variable	(1)	(2)	(3)	(4)
CDS-Usage (IV1)	-0.022***		-0.030***	
	(0.006)		(0.008)	
CDS-Usage (IV2)		-0.029*		-0.012*
		(0.016)		(0.006)
Intercept	0.174***	0.133***	0.155***	0.140***
	(0.009)	(0.010)	(0.020)	(0.020)
Bank Characteristics Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
R-squared (%)	76.01	75.59	83.44	64.58
Observations	4280	1766	4280	1766

Table III
Determinants of Bank Risk-Weighted Regulatory Capital Ratios

This table reports the estimation results of panel regressions that examine determinants of capital ratios for CDS-using banks and non-CDS-using banks. The dependent variables in columns 1 and 2 are total risk-weighted capital ratio and tier 1 capital ratio, respectively. The risk-weighted total capital ratio is the ratio of total capital relative to the risk-weighted assets (RWA). The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with Compustat bank identifier from 1994 to 2009. Sales growth is the percentage increase in the bank's total revenue relative to the prior quarter. Market share refers to the share of deposits of the bank in the total deposits of all bank holding companies in our sample in the same quarter. Age is bank age in years since a bank was established. Foreclosures is a backward-looking measure of loan quality and exposure to the crisis, measured as the value of foreclosed assets divided by net loans and leases. Loan charge-offs is the ratio of net loan charge-offs to total loans. Funding mix is the ratio of deposit funding from purchased money to core deposits. All explanatory variables are lagged one quarter when entering the regressions. All variables are winsorized at 1% level. We control for year and bank fixed effects in all specifications. Standard errors clustered by bank are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

	Total Risk-Weighted Ratio		Tier 1 Risk-Weighted Capital Ratio	
	CDS-Using Bank	Non-CDS-Using Bank	CDS-Using Bank	Non-CDS-Using Bank
Variable	(1)	(2)	(3)	(4)
Capital Ratio in the Past Quarter	0.728***	0.852***		
	(0.053)	(0.039)		
Tier 1 Ratio in the Past Quarter			0.686***	0.852***
			(0.051)	(0.039)
Total Assets	0.004	0.035	0.001	-0.001
	(0.005)	(0.037)	(0.004)	(0.045)
Total Assets Squared	0.001	-0.013	0.000	-0.008
	(0.001)	(0.010)	(0.001)	(0.013)
Sales Growth	0.000	-0.004	0.000	-0.005
	(0.001)	(0.004)	(0.001)	(0.004)
Deposits/Total Assets	0.019***	0.005	0.015***	0.005
	(0.004)	(0.011)	(0.005)	(0.012)
Deposits/Total Liabilities	0.004	0.003	0.005***	0.003
	(0.002)	(0.003)	(0.002)	(0.003)
Funding Mix	-0.001**	-0.015	-0.001***	-0.008
	(0.000)	(0.011)	(0.000)	(0.011)
Liquidity	0.029	-0.001**	0.016	0.000
	(0.026)	(0.000)	(0.020)	(0.000)
Loans/Total Assets	-0.002	-0.018***	-0.004	-0.015***
	(0.005)	(0.007)	(0.006)	(0.006)
Net Interest Margin	-0.195**	-0.019	-0.180***	-0.171*
	(0.077)	(0.097)	(0.064)	(0.097)
Net Interest Margin Volatility	0.001	0.005	0.000	0.007
	(0.002)	(0.007)	(0.002)	(0.007)
ROE	-0.010	0.004	-0.017**	0.002
	(0.010)	(0.025)	(0.008)	(0.024)
Z-score	0.001**	0.000	0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Loan Charge-Offs	0.039	0.407*	-0.012	0.142
	(0.059)	(0.233)	(0.055)	(0.271)
Non-Interest Income/Total Operating Income	-0.001	-0.009***	0.002	-0.010***
	(0.003)	(0.004)	(0.003)	(0.002)
Foreclosures	-0.079	-0.137	0.003	0.091

	(0.157)	(0.291)	(0.121)	(0.429)
Market Share Squared	-0.037	-0.066	-0.063	0.009
	(0.056)	(0.160)	(0.048)	(0.147)
Has Other Derivatives For Non-Trading Purposes	0.000	0.001	0.000	0.001
	(0.001)	(0.004)	(0.001)	(0.004)
Has Other Derivatives For Trading Purposes	0.000	-0.003*	-0.001	-0.002
	(0.001)	(0.002)	(0.001)	(0.002)
Intercept	-0.050	0.031***	-0.017	0.031***
	(0.034)	(0.009)	(0.030)	(0.012)
Year Fixed Effects	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
R-squared (%)	91.57	88.77	94.02	89.71
Observations	883	3397	883	3397

Table IV

Effects of CDS on Bank Tier 1 Leverage Ratio

This table reports the estimation results of panel regressions that examine the effects of CDS on bank leverage ratio. The dependent variable is the ratio of tier 1 capital relative to total assets. The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with Compustat bank identifier from 1994 to 2009. Sales growth is the percentage increase in the bank's total revenue relative to the prior quarter. Market share refers to the share of deposits of the bank in the total deposits of all bank holding companies in our sample in the same quarter. Age is the bank age in years since a bank was established. Foreclosures is a backward-looking measure of loan quality and exposure to the crisis, measured as the value of foreclosed assets divided by net loans and leases. Loan charge-offs is the ratio of net loan charge-offs to total loans. Funding mix is the ratio of deposit funding from purchased money to core deposits. All variables are winsorized at 1% level. We control for year and bank fixed effects. Standard errors clustered by bank are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)
CDS-Usage	0.003		
	(0.005)		
IV (Ratio of Borrowers with Bond Issuance)		-0.077**	
		(0.034)	
IV (Pre-1997 Weather Induced Revenue Volatility)			-0.011***
			(0.002)
Total Assets	0.006	-0.009	-0.010
	(0.021)	(0.021)	(0.016)
Total Assets Squared	-0.003	-0.004***	-0.003**
	(0.002)	(0.002)	(0.001)
Sales Growth	0.005	0.000	-0.008**
	(0.004)	(0.004)	(0.004)
Deposits/Total Assets	-0.012	-0.003	0.022
	(0.017)	(0.017)	(0.020)
Loans/Total Assets	0.051**	0.045**	-0.039
	(0.025)	(0.023)	(0.026)
Non-Interest Income/Total Operating Income	0.013***	0.000	0.007
	(0.003)	(0.002)	(0.008)
Deposits/Total Liabilities	-0.007	-0.010*	-0.009
	(0.006)	(0.006)	(0.006)
Market Share Squared	-0.732*	0.008	0.352
	(0.414)	(0.431)	(0.358)
Intercept	0.073***	0.073***	0.107***
	(0.025)	(0.024)	(0.017)
Year Fixed Effects	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes
R-squared (%)	52.21	51.08	59.36
Observations	4280	4280	1766

Table V

Bank CDS-Usage and C&I Loan Issuance

This table reports the estimation results of panel regressions that examine how a bank's CDS trading affects its lending decision. The dependent variables are the outstanding amount of commercial and industrial loans scaled by the total loan amount outstanding. The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with Compustat bank identifier from 1994 to 2009. The independent variable of interest is CDS active bank, an indicator taking the value of one if the bank takes non-zero CDS position in the bank-quarter, and zero otherwise. All control variables are extracted at the end of the prior quarter. We control for year and bank fixed effects in all specifications. All variables are winsorized at 1% level. Standard errors clustered at bank-level are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	C&I Loans/Total Loans
CDS-Usage	0.015**
	(0.006)
Total Assets	0.008
	(0.050)
Total Assets Squared	-0.001
	(0.005)
Sales Growth	0.003
	(0.014)
Deposits/Total Assets	0.014
	(0.069)
Total Loans/Total Assets	0.161*
	(0.083)
Deposits/Liabilities	0.001
	(0.001)
Non-Interest Income	-0.001
/Total Operating Income	(0.001)
Market Share Squared	0.385*
	(0.224)
Intercept	0.020
	(0.075)
Year Fixed Effects	Yes
Bank Fixed Effects	Yes
R-squared (%)	78.81
Observations	4280

Table VI

Borrower CDS Market Availability and Loan Amount: Loan-Level Evidence

This table presents OLS regression results of loan amount on CDS trading in borrower's name, controlling for loan and borrower characteristics. The loan sample is composed of all syndicated loans issued during the period from 1994 to 2009 with the distribution method as "syndication" reported in Dealscan. In Panel A, the dependent variable is the amount of the loan issued in quarter t, scaled by the firm's total assets measured at the end of quarter t-1. In Panel B, we reports the regression results of the same loan amount measure for the sub-samples of CDS bank and non-CDS bank. CDS banks refer to banks that ever take non-zero CDS position in the sample period. Non-CDS banks refer to banks that never trade CDS during the sample period. The independent variable of interest is CDS trading, a dummy equal to one if the borrowing firm has quoted CDS contracts referencing its debt in the quarter of loan origination. CDS Firm is a dummy equal to one if the firm ever had a CDS market with reference to its debt at any point during the 1994-2009 sample period. Loan spread is the average spread across facilities that compose the loan at issuance. Maturity is the average maturity of tranches contained in a loan package. Secured is a dummy which takes one if at least one tranche in the loan is secured by collateral. Term loan is a dummy which takes one if at least half of the tranches in the loan are term tranches. Firm-level control variables are extracted at the end of the quarter prior to loan initiation. Rated is a dummy which takes one if the borrowing firm has an S&P long-term issuer rating at loan initiation. Prime rate is the prime lending rate in quarter t that banks charge each other for overnight loans. All variables are winsorized at 1% level. We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Panel A. Loan Amount/Total Assets: All Sample Loans		
Variable	(1)	(2)
CDS Market Characteristics		
CDS Trading	0.145***	0.185***
	(0.029)	(0.031)
CDS Firm	0.064**	
	(0.026)	
Loan Characteristics		
Loan Spread	0.001*	0.001*
	(0.000)	(0.000)
Maturity	0.249***	0.248***
	(0.063)	(0.063)
Secured	-0.136***	-0.137***
	(0.045)	(0.045)
Term Loan	-0.039	-0.040
	(0.036)	(0.036)
Log (1+Number of Lenders)	3.437***	3.439***
	(0.671)	(0.672)
Firm Characteristics		
Log (Total Assets)	-0.166***	-0.162***
	(0.022)	(0.021)
Cash/Total Assets	1.351***	1.350***
	(0.389)	(0.389)
Book Leverage	0.142	0.142
	(0.136)	(0.136)
Log (1+Firm Age)	-0.008	-0.006
	(0.019)	(0.019)
Market-to-Book	-1.522	-1.348
	(5.538)	(5.538)
Sales/Total Assets	0.093	0.093
	(0.057)	(0.057)
Tangibility	0.321***	0.323***
	(0.072)	(0.072)
Z-score	-0.017***	-0.017***
	(0.006)	(0.006)
Rated	0.010	0.018
	(0.019)	(0.019)
Prime Rate	-4.718	-4.658
	(4.149)	(4.141)
Intercept	0.472	0.442
	(0.323)	(0.322)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes
R-squared (%)	41.14	41.12
Observations	15546	15546

Panel B. Loan Amount/Total Assets: Sub-Sample of Banks				
	CDS-Using Bank		Non-CDS-Using Bank	
Variable	(1)	(2)	(3)	(4)
CDS Market Characteristics				
CDS Trading	0.149**	0.197***	-0.224	0.055
	(0.064)	(0.068)	(0.171)	(0.076)
CDS Firm	0.063		0.398*	
	(0.047)		(0.208)	
Loan Characteristics				
Loan Spread	0.001	0.001	-0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Maturity	0.138***	0.139***	0.440***	0.432***
	(0.033)	(0.033)	(0.130)	(0.128)
Secured	-0.077***	-0.076***	-0.425*	-0.409*
	(0.026)	(0.026)	(0.243)	(0.240)
Term Loan	-0.031	-0.026	-0.033	-0.027
	(0.034)	(0.026)	(0.032)	(0.022)
Log (1+Number of Lenders)	2.855***	2.854***	5.545**	5.548**
	(0.686)	(0.686)	(2.305)	(2.303)
Borrower Characteristics				
Log (Total Assets)	-0.145***	-0.147***	-0.235***	-0.250***
	(0.020)	(0.021)	(0.052)	(0.056)
Payables/Assets	0.581	0.580	2.289	2.270
	(0.710)	(0.710)	(1.400)	(1.396)
Receivables/Assets	0.830**	0.831**	-0.457	-0.469
	(0.397)	(0.397)	(0.858)	(0.860)
Market-to-Book	-6.754	-6.847	18.666	18.931
	(7.189)	(7.193)	(25.021)	(24.983)
ROA	-0.674	-0.674	-1.802	-1.755
	(0.478)	(0.478)	(1.493)	(1.489)
Rated	0.011	0.006	-0.050	-0.073
	(0.017)	(0.017)	(0.081)	(0.083)
Cash/Total Assets	1.259**	1.262**	1.608*	1.586*
	(0.512)	(0.512)	(0.869)	(0.857)
Leverage	0.259	0.260	-0.474	-0.483
	(0.173)	(0.173)	(0.701)	(0.700)
Log (1+Firm Age)	-0.019*	-0.020*	-0.012	-0.021
	(0.010)	(0.010)	(0.045)	(0.043)
Sales/Assets	-0.072	-0.073	-0.567	-0.562
	(0.105)	(0.105)	(0.364)	(0.363)
Tangibility	0.260***	0.259***	-0.383	-0.420
	(0.095)	(0.096)	(0.462)	(0.463)
Z-score	-0.006	-0.006	-0.047	-0.050
	(0.007)	(0.007)	(0.033)	(0.033)
Prime Rate	-1.943	-1.979	-6.360	-6.742
	(2.218)	(2.221)	(6.830)	(6.875)
Intercept	0.709	0.724	0.761	0.891*
	(0.448)	(0.450)	(0.547)	(0.509)
Year Fixed Effects	Yes	Yes	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes	Yes	Yes
R-squared (%)	34.18	34.19	41.14	41.34
Observations	3830	3830	734	734

Table VII

Are Banks Still Sensitive to Loan Default When Borrowers are CDS-Referenced?

This table reports estimation results of regressions that examine how loan rates are affected by default in the bank's loan portfolio in the presence of CDS. The independent variable of interest is the interaction of CDS trading and lender portfolio default. Default in lender portfolio is a dummy equal to one if any firm in the lender's portfolio filed for bankruptcy. Percent of default in lender portfolio is the percentage of borrowers filing for bankruptcy out of all borrowers of the lender. All default measures are lagged one quarter when entering regressions. All specifications control for CDS firm fixed effects. Other control variables in the OLS regression are the same as we used in baseline regression. We do not report the coefficients of control variables to conserve space. All variables are winsorized at 1% level. We control for fixed loan initiation year, borrower industry and loan purpose in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)
CDS Trading*Default in Lender Portfolio	-10.494**	
	(4.714)	
Default in Lender Portfolio	12.096***	
	(3.110)	
CDS Trading*Fraction of Default in Lender Portfolio		-11.345***
		(2.865)
Fraction of Default in Lender Portfolio		8.309***
		(1.896)
CDS Trading	18.014***	16.414***
	(4.892)	(4.426)
CDS Firm	-5.330	-5.205
	(4.405)	(4.397)
Intercept	366.934***	366.766***
	(27.558)	(27.733)
Loan Characteristics Controls	Yes	Yes
Borrower Characteristics Controls	Yes	Yes
Year Fixed Effects	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes
Loan Purpose Controls	Yes	Yes
R-squared (%)	55.62	55.73
Observations	7057	7057

Table VIII

Bank CDS-Usage and Loan Loss Provision

This table reports the estimation results of panel regressions that examine how a bank's CDS trading affects its loan loss provision. The dependent variable is the ratio of loan loss provision, which is calculated as the allowance set aside for loan losses scaled by the pre-tax income. The independent variables of interest are: (1) CDS-Usage, an indicator taking the value of one if the bank takes non-zero CDS position in the bank-quarter, and zero otherwise; (2) Has CDS-Referenced Borrower, a dummy takes one if one or more borrowers in the lender's loan portfolio are referenced with CDS in the bank-quarter; (3) Loans to CDS Firm Ratio, the ratio of amount of loans issued to firms that have CDS market referencing its debt relative to total amount of loans from the same bank in the same quarter. The ratio is lagged one year when entering the regressions. The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with Compustat bank identifier from 1994 to 2009. All control variables are extracted at the end of the prior quarter. We control for year and bank fixed effects in all specifications. All variables are winsorized at 1% level. Standard errors clustered at bank-level are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)
CDS-Usage	0.001***		
	(0.000)		
Has CDS-Referenced Borrower		0.001**	
		(0.000)	
Loans to CDS Firm Ratio			0.002**
			(0.001)
Total Assets	0.002	0.001	0.001
	(0.002)	(0.004)	(0.004)
Total Assets Squared	0.001***	0.001	0.001
	(0.000)	(0.001)	(0.001)
Sales Growth	0.001	0.001	0.001
	(0.000)	(0.001)	(0.001)
Deposits/Total Assets	-0.002	-0.001	-0.001
	(0.001)	(0.002)	(0.002)
Total Loans/Total Assets	0.005***	0.005*	0.005*
	(0.001)	(0.003)	(0.003)
Deposits/Liabilities	0.004***	0.003*	0.004*
	(0.001)	(0.002)	(0.002)
Non-Interest Income	0.001	0.001	0.001
/Total Operating Income	(0.001)	(0.001)	(0.001)
Market Share Squared	5.304	-0.111***	-0.109***
	(3.495)	(0.032)	(0.033)
Intercept	0.001	0.003	0.003
	(0.001)	(0.003)	(0.003)
Year Fixed Effects	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes
R-squared (%)	51.29	51.66	51.64
Observations	4280	4280	4280

Table IX
Effects of Bank CDS-Usage on Bank Capital Quality

This table reports the estimation results of panel regressions that examine the effects of bank CDS trading on the bank's capital quality. Bank capital quality is measured by the share of a bank's Tier 1 capital in its total capital at the same quarter-ends. Column 1 reports the baseline regression results. Columns (2) to (4) report the second-stage regression results with the fitted value of bank CDS-usage estimated from the first-stage regressions on the instrumental variables. The instrumental variables are the same as we used in Table II: (1) the ratio of ***borrowers*** that have bond issuance out of all borrowers of the bank in the bank-quarter; (2) the weather exposure (weather-induced revenue-assets volatility before 1997) introduced by Perez-Gonzalez and Yun (2013). The instruments are lagged one quarter in the first-stage OLS regression. The sample is composed of quarterly observations of syndicate loan lead arrangers in Dealscan that can be matched with bank identifier in Compustat from 1994 to 2009. The independent variable of interest is CDS active bank, an indicator taking the value of one if the bank takes non-zero CDS position in the bank-quarter, and zero otherwise. All control variables are the same as those used in Table II and are extracted at the end of the prior quarter. The coefficients of control variables are omitted to conserve space. We control for year and bank fixed effects in all specifications. All variables are winsorized at 1% level. Standard errors clustered at bank-level are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)
CDS-Usage (Baseline)	-0.032***		
	(0.011)		
CDS-Usage (IV1)		-0.088**	
		(0.045)	
CDS-Usage (IV2)			-0.162***
			(0.046)
Total Assets	-0.151**	-0.106	-0.149***
	(0.069)	(0.067)	(0.036)
Total Assets Squared	0.008	-0.011**	-0.027***
	(0.005)	(0.005)	(0.007)
Sales Growth	0.022**	0.020**	-0.029**
	(0.010)	(0.010)	(0.012)
Deposits/Total Assets	0.202***	0.046	0.350***
	(0.055)	(0.064)	(0.057)
Total Loans/Total Assets	-0.217***	0.017	0.040***
	(0.060)	(0.014)	(0.015)
Market Share Squared	-0.652***	-0.071	-0.293***
	(0.232)	(0.080)	(0.051)
Deposits/Total Liabilities	0.001	0.005	-0.017
	(0.001)	(0.007)	(0.036)
Non-Interest Income	-0.021	-1.451	-0.321
/Total Operating Income	(0.020)	(0.988)	(0.461)
Intercept	0.875***	0.915***	0.844***
	(0.044)	(0.022)	(0.018)
Year Fixed Effects	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes
Sargan-Hansen J-test Statistics	N/A	N/A	N/A
R-squared '(%)	70.54	80.71	76.41
Observations	4280	4280	1766

Table X

Effects of CDS Trading during the 2007-2009 Credit Crisis

This table reports the regression results of bank capital and lending on bank CDS trading activities over the 2007-2009 credit crisis. Regression estimates for banks' capital ratio and new loan issuance volume are reported in Panel A and B, respectively. In Panel A, regressions are employed to both the whole sample period 1994 to 2009 and the restricted sample period 2005 to 2009. In Panel B, the sample is restricted to 2005 to 2009. We define credit crisis as the period July 2007 to June 2009. We split the crisis into two sub-periods: phase 1 from July 2007 to August 2008 and phase 2 from September 2008 to June 2009. The independent variables of interest are the interactions of bank CDS trading measures and crisis dummies. In Panel B, we aggregate new syndicated loan issuance from Dealscan by the lead bank-quarter. New loan issuance is composed of term loan and revolver. The dependent variables are total loan issuance amount and revolving loan issuance amount, both scaled by bank total assets at the end of the prior quarter. We employ the same control variables as in Table II but do not report them to conserve space. All variables are winsorized at 1% level. Standard errors clustered at bank-level are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Panel A. Bank Capital Ratios

	Full Sample		2005-2009 Sample	
Variable	Total Risk-Weighted Capital Ratio	Tier 1 Risk-Weighted Capital Ratio	Total Risk-Weighted Capital Ratio	Tier 1 Risk-Weighted Capital Ratio
	(1)	(2)	(3)	(4)
CDS-Usage*Crisis 07-08	0.007*	-0.003	0.006	-0.003
	(0.004)	(0.004)	(0.004)	(0.005)
CDS-Usage*Crisis 08-09	0.020***	0.012**	0.016***	0.009*
	(0.004)	(0.005)	(0.005)	(0.005)
CDS-Usage	-0.001	-0.002	-0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.001)
Crisis 07-08	-0.009**	-0.002	-0.007*	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Crisis 08-09	-0.008*	-0.004	-0.004	-0.000
	(0.005)	(0.005)	(0.005)	(0.005)
Intercept	0.187***	0.152***	0.160***	0.133***
	(0.007)	(0.004)	(0.005)	(0.005)
R-squared (%)	31.16	42.77	46.13	50.18
Observations	4280	4280	1150	1150

Panel B. Bank Loan Issuance Volume

Variable	Total Loan Issuance /Total Assets	Revolver Issuance /Total Assets
	(1)	(2)
CDS-Usage*Crisis 07-08	-0.008	-0.011**
	(0.007)	(0.005)
CDS-Usage*Crisis 08-09	-0.021***	-0.016***
	(0.006)	(0.005)
CDS-Usage	0.024***	0.019***
	(0.005)	(0.004)
Crisis 07-08	-0.009***	-0.005*
	(0.003)	(0.003)
Crisis 08-09	-0.013***	-0.010***
	(0.003)	(0.003)
Intercept	0.015***	0.006**
	(0.003)	(0.003)
R-squared (%)	31.26	8.12
Observations	937	937

Table XI

Stock Market Reaction to Bank CDS-Usage: Crisis vs. Normal Period

This table reports estimation results of regressions that examine how banks' buy-and-hold stock returns are affected by bank CDS trading in the previous quarter. We examine stock returns over the crisis period July 2007 to June 2009 and the pre-crisis period July 2006 to June 2007. The regression model we estimate is:

$$\text{Bank Buy - and - Hold Return}_{i[t,t+k]} = \alpha + \beta \text{Bank CDS Trading}_{it\text{-}1} + \gamma_1 \text{Current Return}_{i[t-4,t-1]} + \gamma_2 \text{Bank Characteristics}_{it-1} + \varepsilon_{it}$$

where k is the period over which the buy-and-hold returns are calculated. From columns 1 to 3, the independent variables of interest are banks' CDS trading activities in the second quarter of 2008, 2007 and 2006, respectively. Bank characteristics are lagged one quarter when entering the regressions. The sample includes 61 banks in Compustat which can be identified as lead arrangers in Dealscan with returns available in CRSP. We control for current stock returns, measured as the cumulative returns in the past four quarters, in all specifications. All variables are winsorized at 1% level. Standard errors are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	Buy-and-Hold Return 2008 Q3-2008 Q4	Buy-and-Hold Return 2007 Q3-2009 Q2	Buy-and-Hold Return 2006 Q3-2007 Q2
	(1)	(2)	(3)
CDS-Usage in 2008:Q2	-0.245**		
	(0.106)		
CDS-Usage in 2007:Q2		-0.292**	
		(0.136)	
CDS-Usage in 2006:Q2			0.100***
			(0.039)
Return in Current Year	1.493	0.774	-0.237*
	(0.920)	(0.659)	(0.127)
Total Assets	0.253	0.803**	-0.038
	(0.391)	(0.371)	(0.078)
Market-to-Book	1.048	2.824*	0.450*
	(0.915)	(1.676)	(0.262)
Leverage	-1.945***	-0.033	0.289
	(0.653)	(1.368)	(0.292)
Deposits/Total Assets	-0.520	0.832	0.079
	(0.597)	(0.753)	(0.124)
Total Loans/Total Assets	0.396	0.462	-0.483***
	(0.631)	(0.575)	(0.154)
Log (Market Value)	0.035	0.017	-0.015
	(0.050)	(0.029)	(0.009)
Tier 1 Capital Ratio	3.147	-3.413	-2.253***
	(3.009)	(3.775)	(0.557)
Intercept	-1.068	-0.741*	0.548***
	(0.729)	(0.398)	(0.165)
R-squared (%)	73.87	75.38	77.77
Observations	59	57	61

Internet Appendix for Additional Results

Table IA1. Effects of Bank CDS-Usage on Bank Capital Adequacy: Alternative Sample of Banks

This table reports the estimation results of panel regressions that examine how a bank's use of CDS affects its regulatory capital, using alternative samples of banks. In Panel A, the sample is all Compustat banks; in Panel B, the sample is the *base* sample excluding banks with deposits exceeding 10% of the total deposits aggregated across banks in the same quarter. The dependent variables are total capital to risk-weighted assets ratio and tier 1 capital to risk-weighted assets ratio. The independent variable of interest is CDS active bank, an indicator taking one if the bank is taking non-zero CDS position in the bank-quarter, and zero otherwise. We control for year and bank fixed effects in all specifications. Definitions of variables are listed in Appendix. All control variables are the same as we used in Table II and extracted one quarter prior to the bank-quarter. All variables are winsorized at 1% level. Standard errors clustered at bank-level are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively.

Panel A. All Compustat Banks		
	Total Risk-Weighted Capital Ratio	Tier 1 Risk-Weighted Capital Ratio
Variable	(1)	(2)
CDS-Usage	0.001	-0.001
	(0.006)	(0.006)
Intercept	0.246***	0.253***
	(0.044)	(0.047)
Bank Characteristics Controls	Yes	Yes
Year Fixed Effects	Yes	Yes
Bank Fixed Effects	Yes	Yes
R-squared (%)	52.39	60.93
Observations	38557	38557

Panel B. Dealscan Sample Excluding Big Banks		
	Total Risk-Weighted Capital Ratio	Tier 1 Risk-Weighted Capital Ratio
Variable	(1)	(2)
CDS-Usage	-0.003	-0.006*
	(0.003)	(0.004)
Intercept	0.244***	0.222***
	(0.063)	(0.063)
Bank Characteristics Controls	Yes	Yes
Year Fixed Effects	Yes	Yes
Bank Fixed Effects	Yes	Yes
R-squared (%)	46.63	56.58
Observations	4099	4099

Table IA2. Link between Lender CDS Position and Borrower CDS Market

This table reports estimation results of regressions that examine how lead lenders' CDS position is associated with the quantity of CDS trading referencing the borrower's debt. The dependent variable, lead lenders' CDS position, is the lead lender's total CDS position in the quarter of loan initiation. We use bank-quarter sample for columns 1 to 3, and the lender-loan match sample for columns 4 to 6. The independent variables of interest are: (1) the number of borrowers with CDS contracts referencing its debt in the bank-quarter; (2) the number of CDS trades referencing the borrower's debt in the quarter of loan initiation. Other explanatory variables which are composed of three sets: (1) bank characteristics including size, sales growth, deposits-to-total assets ratio, loans-to-total assets ratio, market share, among others; (2) the bank's other derivatives position linked to equity, commodity, interest rate and foreign exchange for trading and non-trading purposes; (3) bank capital, risk and profit measures. Control variables are lagged one quarter in the regressions. All variables are winsorized at 1% level. We control for fixed year effects in all specifications. Standard errors are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Number of CDS Referenced Borrowers	0.026***	0.016***	0.009**			
	(0.007)	(0.006)	(0.004)			
Number of CDS Trades Referencing Borrower Debt				0.091***	0.047***	0.025*
				(0.022)	(0.017)	(0.015)
Total Assets	0.251	0.881	-0.136	1.329***	1.096***	1.447***
	(0.228)	(0.575)	(0.430)	(0.034)	(0.027)	(0.058)
Total Assets Squared	-0.086	-0.147	0.866***	-0.403***	-0.327***	-0.284***
	(0.062)	(0.354)	(0.126)	(0.014)	(0.012)	(0.040)
Sales Growth	-0.029	0.100	0.165	0.221***	0.193***	0.194***
	(0.051)	(0.159)	(0.110)	(0.012)	(0.010)	(0.014)
Deposits/Total Assets	6.680	11.525	5.430	-0.065	-0.616***	-0.960***
	(13.551)	(18.523)	(13.667)	(0.059)	(0.083)	(0.100)
Loan/Total Assets	-1.899	-2.191	-0.686	0.100*	0.200***	0.731***
	(1.501)	(1.608)	(1.066)	(0.059)	(0.078)	(0.090)
Market Share	1.280	1.599	0.453	-47.297***	-23.630***	-40.003***
	(1.462)	(1.507)	(0.842)	(2.244)	(1.687)	(3.191)
Have Other Derivatives Position for Hedging		0.588***	0.188		0.381***	0.135***
		(0.231)	(0.180)		(0.010)	(0.009)
Have Other Derivatives Position for Trading		-0.387*	-0.170		0.263***	0.252***
		(0.200)	(0.156)		(0.010)	(0.015)
Tier 1 Ratio			1.948			-0.548
			(8.961)			(0.919)
Risk-weighted Capital Ratio			9.713			12.766***
			(15.227)			(0.978)
Net Interest Margin			-11.216***			-8.111***
			(3.379)			(0.481)
ROA			-0.187			-0.335
			(0.208)			(2.078)
ROE			1.461			-0.647***
			(2.023)			(0.209)
Z-score			-0.000			-0.000***
			(0.000)			(0.000)
Loss Provision			-0.067			0.626***
			(0.069)			(0.037)
volatility of ROA			-0.775			-0.594***
			(0.612)			(0.059)
Volatility of Net Interest Margin			7.383			25.083***
			(25.459)			(3.840)
Intercept	0.216	-0.048	-1.224	0.015	-0.184***	-1.741***
	(0.141)	(0.265)	(1.496)	(0.036)	(0.029)	(0.112)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	38.81	50.68	72.19	26.93	42.92	60.44
Observations	4280	4280	4280	38459	38459	38459

Table IA3. First-Stage Regression of the CDS-Usage on Instrumental Variables

This table reports estimation results of the first-stage OLS regression of banks' use of CDS on the instrumental variables. The dependent variable is an indicator equal to one if the bank is using CDS in the bank-quarter. The instrumental variables are: (1) the ratio of borrowers of the bank that have bond issuance; (2) the weather exposure (weather-induced revenue-assets volatility before 1997) introduced by Perez-Gonzalez and Yun (2013). Post-1997 is a dummy taking one if the quarterly observation is after 1997. The instruments are lagged one quarter in the first-stage OLS regression. Controls include variables that describe bank characteristics and trading in other derivatives linked to foreign exchange, interest rate, equity and commodity. Control variables are extracted at the end of the quarter prior to the bank-quarter. ROA volatility and net interest margin volatility are calculated with the quarterly ROA and net interest margin in the past four quarters. All variables are winsorized at 1% level. We control for year fixed effects in all specifications. Standard errors are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)
Ratio of Borrowers with Bond Market in the past quarter	0.344***	
	(0.033)	
Pre-1997 Weather Exposure*Post-1997		1.297**
		(0.517)
Post-1997		0.379***
		(0.022)
Intercept	0.020*	0.011
	(0.010)	(0.023)
Year Fixed Effects	Yes	No
Bank Fixed Effects	Yes	Yes
F-Value	47.84***	41.78***
R-squared (%)	44.09	45.81
Observations	4280	1766

Table IA4. Effects of Borrower CDS Availability on Loan Amount: Alternative Sample of Loans

This table presents estimation results of regressions that examine how loan issuance amount is affected by CDS trading in the borrower's name, using an alternative sample. The sample includes both syndicated loans and loans from sole lenders reported in Dealscan from 1994 to 2009. Loan and borrower characteristics are the same as we used in baseline regressions reported in Table V. Firm-level control variables are lagged one quarter in regressions. We do not report coefficients of control variables to conserve space. Columns 1 controls for CDS firm fixed effects (CDS Firm). We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. All variables are winsorized at 1% level. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)
CDS Trading	0.089***	0.107***
	(0.034)	(0.027)
CDS Firm	0.029	
	(0.030)	
Loan Spread	-0.001	-0.001
	(0.000)	(0.000)
Intercept	0.436***	0.434***
	(0.071)	(0.071)
Loan Characteristics Controls	Yes	Yes
Borrower Characteristics Controls	Yes	Yes
Year Fixed Effects	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes
R-squared (%)	9.22	9.21
Observations	17268	17268

Robustness of Loan-Level Evidence: Instrumental Variable (IV) Approach and Propensity Score Matching

A potential concern with the difference-in-differences approach (*CDS Trading* versus *CDS Firm*) is that the treatment effect may be confounded by the endogenous selection of a firm into CDS trading. To make causal inferences, we employ both an IV approach and a propensity score matching approach.

Instrumental Variables for Firms' CDS Trading

Our first instrument, *Lender Foreign Exchange Derivatives*, is the amount of foreign exchange derivatives used for hedging—not trading—purposes relative to the total loans of the syndicate banks that a firm has borrowed from over the past five years. The ratio is lagged by one quarter when it is included in the first-stage probit regression. Data on lenders' foreign exchange derivatives are available from the FR Y-9C reports filed by bank holding companies, which track the derivatives use of lending banks and the composition of their loan portfolios. The intuition is that banks that hedge the foreign exchange exposures of their loan portfolios are likely to be active risk managers in general. Moreover, this variable is more likely to capture the hedging demand from lending banks rather than that from other CDS market participants, such as hedge funds. Having been used by Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2014), this instrument captures the hedging demand of firms' creditors and can predict the existence of CDS for firms' debt.

Our second instrument is the pre-existence of public bonds for the borrowing firm. In our sample, all CDS-referenced firms had public bonds prior to the introduction of their CDS. The presence of public bonds signals that a firm has better information transparency and that it may reduce the lemons problem in risk transfer, which facilitates the initiation of a CDS market on the firm's debt (Minton, Stulz and Williamson, 2009). Therefore, the pre-existence of public bonds is positively correlated with the possibility of the introduction of CDS on the firm's debt.

We believe that these two instruments satisfy the exclusion restriction. First, we use the foreign exchange derivatives position of *past* lenders, which may not be the current lender in our loan sample; second, the lender's foreign exchange derivatives position is a macro hedge and characterizes the lender's global risk management strategy, which is unlikely to affect the individual loan contract terms in its domestic lending (the borrowing firms in our sample are all U.S. based).

Similarly, apart from affecting the possibility of the introduction of CDS on the borrower's debt, the presence of public bonds is unlikely to independently affect the firm's syndicated loan size and spread at initiation. One may argue that firms' access to the bond market affects firm leverage (see Faulkender and Petersen, 2006, for example) and that such access thus may affect loan terms. However, the primary reason that the presence of a bond market is linked to firm leverage is that the availability of a public debt market can make firms less financially constrained because firms have more choices regarding the source of debt capital. Thus, the channel at work is the alternative source of financing provided by the public debt market rather than any changes induced by the presence of the public debt market on banks' lending strategies. Even if the presence of the bond market represents better information on borrowing firms, as a company with publicly traded debt always has a bond rating, such additional information provided by rating agencies may not provide a substantial amount of increased value to lending banks, which are usually considered to have a private information advantage and to be specialized in screening and monitoring. Thus, we do not expect a firm's access to the bond market to have a direct effect on its loan terms set by lending banks, other than via the CDS channel.

We use a two-stage least-squares estimation to account for the selection into CDS trading. For the first-stage analysis, we estimate the OLS regression model for firms' CDS trading:

$$\begin{aligned} \text{CDSTrading}_{it} = \alpha + \beta \text{FX Derivatives}_{it\text{-}1} (\text{or Presence of Bond Market}_{it-1}) \\ + \gamma_1 X_{it\text{-}1} + \gamma_2 \text{Year Fixed Effects}_t + \gamma_3 \text{Industry Fixed Effects}_j + u_{it} \end{aligned}$$

where $X_{it\text{-}1}$ refers to other firm-level determinants of CDS trading. The estimation results (provided in Table IA6 of the Internet Appendix) reveal that a larger past lender foreign exchange derivatives position and the pre-existence of public bonds are associated with greater probabilities of available CDS referencing the borrower's debt. The partial correlation between the IVs and CDS trading is both economically and statistically significant.

We report the second-stage estimation results using the instrumented CDS trading probability in Internet Appendix Table IA7. The results for the loan amount and spread are presented in panels A and B, respectively. Both panels consistently show positive and significant coefficient estimates for instrumented CDS trading. These results suggest that the impact of CDS trading on syndicated loan financing is robust to the potential endogeneity of CDS trading.

Propensity Score Matching

Endogeneity bias may arise if the observed loan terms depend on characteristics that affect whether a firm is linked to CDS rather than the effect of the introduction of CDS. We use propensity score matching to address potential endogeneity bias. We measure the marginal impact of CDS by forming groups of treatment and control firms that have an equal propensity of having CDS before their loan is issued. Using the same explanatory variables as in Table IA6 of the Internet Appendix, we estimate a probit model to obtain the CDS trading propensity score for each firm. We select from non-CDS firms within the same 2-digit SIC industry with the propensity score nearest to that of the treatment firm, which has CDS trading at the time of loan initiation, and obtain one-to-one matching firms for 432 CDS firms. We identify syndicated loans issued to the matching firms in the same year as the treatment firm to form the control group. The average distance in the propensity scores between the treatment and matching firms is significantly reduced from 0.063 before matching to 0.007 after matching. The matched sample diagnostics are reported in Table IA8 of the Internet Appendix. The regression results estimated with the matched sample are reported in Internet Appendix Table IA9. We observe a statistically significant increase in loan amount and spread for treatment firms relative to control firms.

Table IA5. Instrumental Variable of Borrower CDS Market Availability: First-Stage Regression

This table presents results of OLS regression of the availability of CDS trading referencing the borrower's debt on instrumental variables. The sample is composed of loans issued before CDS introduction and loans issued in the first quarter when CDS start trading for CDS firms, and all loans to non-CDS firms. In column 1, the instrument is FX derivatives for hedging, which is calculated as the amount of foreign exchange derivatives used for hedging purposes (not trading) relative to the amount of loans of the lead syndicate banks that the firm has borrowed money from in the past five years; in column 2, the instrument is the presence of bond trading, a dummy indicating whether the firm has a bond market by the time it issues the loan; in column 3, both instruments enter regression. Control variables are mainly from Ashcraft and Santos (2009), Saretto and Tookes (2013) and Subrahmanyam, Tang and Wang (2013). Instruments and control variables are lagged one quarter when entering the regressions. All variables are winsorized at 1% level. We control for year and industry fixed effects in all specifications. Standard errors are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)
FX Derivatives for Hedging	42.069***		31.574***
	(7.185)		(6.976)
Presence of Bond Trading		2.384***	2.371***
		(0.172)	(0.172)
Log (Total Assets)	1.107***		1.102***
	(0.026)	(0.024)	(0.026)
Leverage	0.221	1.521***	0.082
	(0.339)	(0.303)	(0.341)
Market-to-Book	1.557***	1.498***	1.523***
	(0.173)	(0.146)	(0.174)
Profitability	-2.124*	-2.272**	-2.171*
	(1.140)	(1.012)	(1.145)
Tangibility	-0.141	0.140	-0.111
	(0.148)	(0.139)	(0.149)
Z-score	-0.063***	-0.107***	-0.060***
	(0.021)	(0.019)	(0.021)
Excess Return	-0.291***	-0.239***	-0.291***
	(0.063)	(0.059)	(0.063)
Stock Return Volatility	-0.514	-1.710***	-0.501
	(0.548)	(0.510)	(0.550)
Intercept	-0.117***	-0.109***	-0.117***
	(0.003)	(0.003)	(0.003)
Year Fixed Effects	Yes	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes	Yes
F-statistic	302.28***	345.47***	342.78***
R-squared (%)	38.05	34.41	38.65
Observations	21640	21640	21640

Table IA6. Effects of Borrower CDS Market Availability on Loan Amount: Second-Stage Regression of the Instrumental Variable Approach

This table presents regression results of loan amount and loan spread on instrumented CDS trading. In the first stage we estimate an OLS model to obtain the fitted value of the independent variable, CDS trading, using two instrumental variables: (1) *past* lender foreign exchange derivatives position for hedging; (2) The presence of bond market for the borrowing firm before it issues the loan. The first instrument is the amount of foreign exchange derivatives used for hedging purposes (not trading) relative to the amount of loans of the lead syndicate banks that the firm has borrowed money from in the past five years. Past lender's foreign exchange derivatives position data are extracted from Call Report on bank activities. The presence of bond market is a dummy indicating whether the firm has a bond market prior to its issuance of loan. Bond issuance information is from Mergent Fixed Income Securities Database (FISD). In the second-stage regressions we regress loan amount relative to total assets on the fitted value of CDS trading from the first stage, with the same controls as we used in the baseline regression in Table V. We do not report the coefficients of the controls to conserve space. Columns 1 to 3 report estimation results of regressions of loan terms on the fitted value of CDS trading in borrowers' name obtained from first-stage OLS regressions 1 to 3, respectively. All variables are winsorized at 1% level. We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Variable	(1)	(2)	(3)
Instrument1 (FX Derivatives for Hedging)	0.781***		
	(0.110)		
Instrument2 (Presence of Bond Trading)		0.260***	
		(0.037)	
Instrument3 (FX Derivatives for Hedging and Presence of Bond Trading)			0.513***
			(0.071)
Loan Spread	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)
Intercept	1.346***	1.082***	1.215***
	(0.321)	(0.308)	(0.313)
Loan Characteristics Controls	Yes	Yes	Yes
Borrower Characteristics Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes	Yes
R-squared (%)	28.25	29.29	28.74
Observations	14416	14416	14416

Table IA7. Effects of Borrower CDS Market Availability on Loan Amount: Propensity Score Matching

Panel A presents matched sample diagnostics for CDS firms and non-CDS firms. We estimate a probit model of CDS trading on the explanatory variables, which are lagged by one quarter, to obtain scores that measure firms' propensity to have CDS market referenced its debt. For each CDS firm, we choose one non-CDS firm that is the closest match in the same 2-digit SIC industry, based on its propensity score. 432 CDS firms are paired with one matching firm each. The first column shows difference in propensity scores and other key variables that describe loan and borrower characteristics between CDS and non-CDS firms of the full sample before matching; the second column shows difference in the same variables between CDS firms and their one-to-one matched non-CDS firms. Panel B presents regression results of loan amount on CDS trading in borrower's name, with the matched sample based on the estimated propensity scores. The control variables in the OLS regression are the same as we used in baseline regressions in Table V. We do not report the coefficients of control variables to conserve space. All variables are winsorized at 1% level. We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * represent statistical significance by which a number is different from zero at 1%, 5% and 10% level, respectively. See Appendix for detailed variable definitions.

Panel A. Matched Sample Diagnostics: Propensity Score Matching		
	Before Matching	After Matching
Variable	Difference (CDS Firms – Non-CDS Firms)	Difference (CDS Firms – Matched Non-CDS Firms)
Propensity Score	0.063***	0.007
Loan Characteristics		
Loan Amount/Total Assets	0.034***	0.005
Loan Spread	-82.142***	-0.183
Maturity (Years)	-0.371***	-0.042***
Secured	-0.128***	0.010
Total Number of Lenders	4.940***	-0.049
Borrower Characteristics		
Log (Total Assets)	2.536***	0.492***
Leverage	0.016***	0.001
Profitability	0.008***	0.000
Market-to-Book	-0.185	0.135
Tangibility	-0.043	-0.039
Current Ratio	-0.537***	-0.005
Cash/Total Assets	-0.018***	0.001
Log (1+Fixed Charge Coverage)	-0.001***	0.000
Altman's Z-score	-0.544***	-0.145*

Panel B. Effects of CDS Availability of Borrowers: Matched Sample results		
Variable	(1)	(2)
CDS Trading	0.032*	0.044***
	(0.018)	(0.016)
CDS Firm	0.019	
	(0.022)	
Loan Spread	0.023	0.023
	(0.015)	(0.015)
Intercept	0.391***	0.396***
	(0.123)	(0.123)
Loan Characteristics Controls	Yes	Yes
Borrower Characteristics Controls	Yes	Yes
Year Fixed Effects	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes
R-squared (%)	40.09	40.07
Observations	6740	6740

Table IA8. Effects of Borrower CDS Availability on Bank Lending Practice: Full Sample Results

This table reports estimation results of regressions that examine how loan amount is affected by borrower CDS availability for the sample of CDS bank and non-CDS banks. CDS bank refers to lead banks that ever traded CDS in the sample period. Non-CDS bank refers to banks that never traded CDS during the sample period. The control variables in the OLS regression are the same as we used in baseline regression in Table V. We do not report the coefficients of control variables to conserve space. All variables are winsorized at 1% level. We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

	CDS-Using Bank		Non-CDS-Using bank	
Variable	(1)	(2)	(3)	(4)
CDS Trading	0.145***	0.124***	0.309*	0.159
	(0.026)	(0.028)	(0.177)	(0.176)
CDS Firm		0.034		0.232*
		(0.022)		(0.130)
Loan Spread	0.001	0.001	0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.724	0.709	0.891*	0.761
	(0.450)	(0.448)	(0.509)	(0.547)
Loan Characteristics Controls	Yes	Yes	Yes	Yes
Borrower Characteristics Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes	Yes	Yes
R-squared (%)	34.19	34.18	41.34	41.14
Observations	10624	10624	938	938

Table IA9. Effects of CDS Trading on Loan Quality

This table presents estimation results of regressions that examine how loan quality is affected by CDS trading in borrowers' name. Panel A examines results of loan quality at loan initiation. Panel B examines results of subsequent changes in loan quality after the loan is issued. The sample is composed of CDS firms that ever borrowed both before and after CDS introduction, and the whole non-CDS firm sample. Loan quality is measured by S&P long-term issuer rating. Letter ratings have been converted into a number scale (1=AAA, 2=AA+, 3=AA, …, 25=D). In panel A, the independent variable of interest is CDS trading, a dummy equal to one if the borrower is referenced by CDS at loan initiation. Column 2 controls for CDS firm fixed effects (CDS Firm). In Panel B, we calculate changes in issuer credit rating in one year, two years and three years after loan initiation, relative to the issuer's initial credit rating. In even columns of Panel B, another independent variable in interest is the interaction of CDS trading and CDS active bank. CDS active bank is a dummy equal to one if the lead arranger takes non-zero CDS position at loan initiation. We do not report all control variables to conserve space. All variables are winsorized at 1% level. We control for loan initiation year, borrower industry and loan purpose fixed effects in all specifications. Standard errors clustered by firm are reported in parentheses. ***, ** and * denote statistical significance level at 1%, 5% and 10%, respectively. See Appendix for detailed variable definitions.

Panel A. Loan Quality at Initiation

Variable	(1)	(2)
CDS Trading	0.305***	0.541***
	(0.104)	(0.096)
CDS Firm		-0.385***
		(0.119)
Log (Loan Amount)	0.060	0.061
	(0.039)	(0.039)
Loan Spread	0.011***	0.011***
	(0.000)	(0.000)
Intercept	14.103***	15.119***
	(0.548)	(0.548)
Loan and Borrower Characteristics	Yes	Yes
Year and Borrower Industry Fixed Effects	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes
R-squared (%)	68.86	68.98
Observations	8110	8110

Panel B. Changes in Loan Quality

	Δ in 1 Year		Δ in 2 Years		Δ in 3 Years	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
CDS Trading	0.167***	0.127**	0.336***	0.268***	0.467***	0.393***
	(0.056)	(0.058)	(0.090)	(0.091)	(0.120)	(0.126)
CDS Firm	-0.096*	-0.095*	-0.179**	-0.177**	-0.265***	-0.263***
	(0.050)	(0.050)	(0.083)	(0.083)	(0.104)	(0.103)
CDS Trading*		0.173**		0.303***		0.323**
CDS Active Bank		(0.080)		(0.109)		(0.133)
CDS Active Bank		-0.095*		-0.187**		-0.168*
		(0.055)		(0.086)		(0.095)
Initial Rating at	-0.221***	-0.222***	-0.282***	-0.282***	-0.333***	-0.333***
Loan Issuance	(0.024)	(0.024)	(0.028)	(0.028)	(0.029)	(0.029)
Intercept	3.386***	3.393***	4.698***	4.709***	5.439***	5.450***
	(0.428)	(0.428)	(0.547)	(0.547)	(0.641)	(0.642)
Loan and Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Loan Purpose Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan Initiation Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	15.39	15.45	16.01	16.11	16.62	16.71
Observations	7808	7808	7356	7356	6928	6928