Credit Default Swaps and Bank Risk Taking*

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Abstract

Credit derivatives in the form of credit default swaps (CDS) are recognized by Basel II and Basel III as a tool for managing bank regulatory capital requirements. We find that banks become more aggressive in risk taking after they begin using credit derivatives. This increase in bank risk is linked to banks' CDS trading. Loans issued to CDS-referenced borrowers are larger and have higher yield spreads if the lead banks in the syndicate are active in CDS trading. During the 2007-2009 credit crisis, banks with large positions in credit derivatives at the onset of the crisis raised more capital, reduced lending more, and experienced larger stock price drops than CDS-inactive banks. Although they take more risks, CDS-active banks have better operating and financial performance during normal times.

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Abstract

Credit derivatives in the form of credit default swaps (CDS) are recognized by Basel II and Basel III as a tool for managing bank regulatory capital requirements. We find that banks become more aggressive in risk taking after they begin using credit derivatives. This increase in bank risk is linked to banks' CDS trading. Loans issued to CDS-referenced borrowers are larger and have higher yield spreads if the lead banks in the syndicate are active in CDS trading. During the 2007-2009 credit crisis, banks with large positions in credit derivatives at the onset of the crisis raised more capital, reduced lending more, and experienced larger stock price drops than CDS-inactive banks. Although they take more risks, CDS-active banks have better operating and financial performance during normal times.

I. Introduction

Credit default swaps (CDS) were originally created to help banks better manage their credit risk exposures. Former Federal Reserve Chairman Alan Greenspan (2004) proclaimed that CDS contributed to "the development of a far more flexible, efficient, and hence resilient financial system." If banks use CDS to hedge their credit exposures, their overall risk levels should be lower, assuming that their loan portfolios remain identical before and after CDS usage. Indeed, bank regulators encourage CDS to be used for such hedging purposes. For instance, the regulatory capital requirement under Basel II and its comprehensive revision, Basel III, is lower for loans that are hedged with CDS. Despite the surging importance of CDS, there is not yet a systematic examination of whether CDS have worked as intended to improve bank risk management and lower banks' risk levels. To fill this research gap, we conduct an empirical study of banks' risk-taking behavior—and particularly their lending practices—associated with CDS trading.

Theoretically, CDS can help improve risk sharing in the market and move bank lending toward an optimal level (Allen and Gale, 1994). However, the use of CDS can also have feedback effects on bank risk taking. For example, CDS can generate potentially adverse externalities such as contagion (Allen and Carletti, 2006) and the empty creditor problem (Bolton and Oehmke, 2011). Duffee and Zhou (2001) model the impact of the CDS market and then argue that "theory alone cannot determine whether a market for credit derivatives will help banks better manage their loan credit risks." Conversely, Duffie (2007) notes that "the available data do not yet provide a clear picture of whether the banking system as a whole is using these forms of CRT [credit risk transfer] to shed a major fraction of the total expected default losses of loans

originated by banks." Moreover, Stulz (2010) observes that "there is a dearth of serious empirical studies" on the implications of CDS.

Contrary to the risk-mitigating role of CDS, we find that banks become riskier after they begin using credit derivatives.[1] In a comprehensive sample of banks in the U.S., larger credit derivatives positions are associated with looser bank lending standards during the period from 1997 to 2009. Such risk-taking behavior is reflected by risk measures such as bank Z-scores and distance-to-default. Specifically, CDS-active banks hold less capital and provision more for expected loan losses than banks that do not use CDS. The CDS effect on bank risk taking is not only statistically significant but also economically large. All else equal, CDS-active banks hold an average of 13% less tier 1 capital than their counterparts that do not trade CDS.

If the risk-management practice of banks does not change over time, as Fahlenbrach, Prilmeier, and Stulz (2012) suggest, then CDS trading cannot easily increase bank risk. One might argue that our finding results from reverse causality: riskier banks are more likely to trade CDS because they must lower their loan portfolio risk levels. We use the post-2001 dummy and loan portfolio concentration as instrumental variables for bank CDS trading because CDS became more tradable after 2001 and banks also used CDS to diversify their portfolios. Our findings remain significant using instrumented bank CDS trading variables. To address the concern of omitted variables, we construct a different measure of a bank's CDS exposure. We find that banks are riskier when they lend more to borrowers whose debt is referenced by CDS trading. Such evidence suggests a connection between bank risk taking and the availability of borrower CDS. Thus, the higher level of bank risk may result from changes in the composition of the banking book, which is affected by banks' lending behavior.

[1] Credit default swaps (CDS) are the most fundamental form of credit derivatives. We use CDS and credit derivatives interchangeably hereafter.

Banks do not always use CDS to hedge their loan credit risk. On the contrary, Duffie (2007) and Minton, Stulz and Williamson (2009) find that the dramatic growth of the CDS market is driven by various non-banking activities such as trading and dealing. One recent headline-grabbing example is the 2012 J.P. Morgan "London Whale" case in which CDS trading led to multi-billion dollar losses for the bank.[2] If CDS trading activities increase risk levels, banks may reduce loan risk to partly offset the increased risk from trading CDS. Conversely, the availability of CDS for hedging and diversification may increase banks' perceived risk capacity; in such cases, banks may engage in riskier lending.

Our examination of individual loan-level data shows that banks make larger and riskier loans to firms whose debt is referenced by CDS contracts. CDS trading on a borrower on average increases its loan size by 15-19% and its loan spread by 8-15 basis points. We adopt identical instrumental variables to those used in Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2013) to account for the endogenous selection of firms with CDS contracts. Additionally, we use the propensity score matching approach to further attenuate the endogeneity concern. Our results remain robust in these analyses.

This loan-level finding corroborates our bank-level result and is consistent with the view that CDS facilitate credit supply at the firm level. However, during our sample period, banks were active in both CDS trading and securitization, which may generate similar consequences. The first notable distinction between these two activities is that the loan spread decreases after securitization but increases after CDS trading. Moreover, the use of credit derivatives is typically

[2] On April 5, 2012, *Bloomberg* reported that J.P. Morgan was incurring large trading losses in the CDS market through its Chief Investment Office (CIO) in London. In one instance, the CIO sold $7 billion worth of CDS protection on February 29, 2012 after $3 billion in the previous two days. J.P. Morgan's losses eventually exceeded $6.2 billion.

confined to investment-grade loans, whereas loan sales and securitization involve more speculative-grade issuers.[3]

We further demonstrate that, among banks that make loans to borrowers both with and without CDS, only those active in CDS trading differentiate CDS-referenced borrowers from other borrowers. This result suggests that the borrower CDS effect is linked to the lending bank's CDS activities, beyond CDS firm characteristics. Consistent with Subrahmanyam, Tang, and Wang (2013), we find that loan quality deteriorates after the onset of CDS trading. Therefore, it is justifiable to charge CDS-referenced borrowers higher spreads. As a potential benefit to the borrowers, we find that loan rates are less sensitive to negative shocks to banks' existing loan portfolios when the borrower is referenced by CDS. We interpret this as further evidence that banks are more aggressive in lending (or weaker in risk control) after CDS become available to the borrower.

The credit crisis of 2007-2009 provides a unique setting in which to better understand the consequences of banks' CDS usage. The bankruptcy of Lehman Brothers and bailout of AIG exposed the perils of counterparty risk in CDS transactions and brought CDS trading to a halt. Banks relying on CDS were forced to adjust their capital positions and lending practices when they could not use CDS as they had previously. Indeed, we find that banks active in the CDS market at the onset of the crisis raised more capital during the crisis than banks not trading CDS. Moreover, those CDS-active banks tightened their lending practices more dramatically—cutting loan amounts and raising loan spreads—than CDS-inactive banks. Moreover, those CDS-active banks suffered larger drops in stock price.

[3] See Duffee and Zhou (2001), Drucker and Puri (2009), Minton, Stulz, and Williamson (2009), Shivdasani and Wang (2011), Nadauld and Weisbach (2012) Benmelech, Dlugosz, and Ivashina (2012), Parlour and Winton (2013), Subrahmanyam, Tang, and Wang (2013), and Wang and Xia (2013) for details.

A natural question arises: why do banks use CDS to take more risk in the first place? We find that, during the pre-crisis period, banks' financial and operating performance measures were better if they were active in the credit derivatives market. Therefore, profit motives might lead banks to take more risk with CDS. However, although banks make more profits during the normal period, they suffer larger losses during the crisis period. Thus, CDS trading makes banking performance even more procyclical.

Although CDS trading is a phenomenon for banks that is comparable to securitization, the implications of CDS trading are substantially less studied than those of securitization. Several studies on the effects of securitization demonstrate that banks reduce screening and monitoring and do not transfer risk out sufficiently when they securitize their loans (see, e.g., Acharya, Schnabl, and Suarez, 2013; Wang and Xia, 2013). Some of the effects of CDS trading might parallel those of securitization because both might be used to manage bank credit risk exposures. However, there are some key differences between these effects. First, securitization expands banks' funding sources, which leads to lower borrowing costs. CDS, however, do not expand banks' funding sources, and loan spreads are higher on firms with CDS trading. Second, securitization is found to reduce banks' economic capital while maintaining a stable regulatory capital ratio (Acharya, Schnabl and Suarez, 2013), but CDS allow banks to lower their regulatory capital ratios.

Our study contributes to the burgeoning literature examining the implications of CDS trading, such as the studies of Saretto and Tookes (2013) on leverage and Subrahmanyam, Tang, and Wang (2013) on bankruptcy risk. The findings in this study suggest that active engagement in the CDS market allows banks to assume more risk, which is contrary to the intended effect of managing banks' credit risk exposure. Our study therefore provides a new perspective on bank

risk taking because the prior literature has focused mainly on the effects of bank governance and executive compensation. We show that CDS-active banks tend to have better financial and operating performance measures in tranquil times, but they suffer more during the financial crisis. Our analysis bolsters the view in Beltratti and Stulz (2012) that factors that are rewarded in normal times may have adverse realizations during the crisis.

The rest of the paper proceeds as follows: Section II provides the background of our study in relation to the relevant literature. Section III describes our datasets and sample selection. Section IV presents the empirical results on bank-level risk taking. Section V provides loan-level results. Section VI discusses the impact of the 2007-2009 credit crisis and bank performance associated with CDS trading. Section VII concludes.

II. Background

Credit default swap contracts were created in 1994 and are widely credited to J.P. Morgan, who invented the instruments for the purpose of selling off Exxon Mobil credit risk to the European Bank of Reconstruction and Development. At first, CDS were primarily used to hedge credit risk in connection with banks' lending activities. Other players, such as asset managers and hedge funds, began participating in the CDS market more actively in approximately 2002, fueling the growth of a market that was facilitated by the standardization of CDS contracts by the International Swaps and Derivatives Association (ISDA). From $300 billion in 1998, the notional amount of outstanding CDS contracts had grown rapidly to peak at $62.2 trillion by the end of 2007 and stabilized after the financial crisis at the level of $25.1 trillion at the end of 2012, with a handful of big banks, including J.P. Morgan, being the dominant players in the global CDS market.

One driver of the fast growth of the CDS market was the recognition of CDS in the regulatory capital requirements for bank risk-weighted assets that were formally incorporated into Basel II by the Basel Committee for Banking Supervision (BCBS). Basel II treats CDS and other credit derivatives that are similar to guarantees as instruments of credit risk mitigation.[4] AIG's 2007 Form 10-K disclosed that 72% of CDS sold by AIG Financial Products during the year were used by banks for capital relief, which suggests that banks indeed used CDS for regulatory capital purposes. With regulatory capital reduction from CDS, banks may extend more credit to riskier firms with potential hedging opportunities.

CDS often appeared in headlines during the 2007-2009 credit crisis and became more widely known by the general public because many banks had bought CDS protection from AIG, which had to be bailed out by the U.S. government. Minton, Stulz, and Williamson (2009) document that banks largely use CDS for non-hedging purposes. Stulz (2010) discusses the role of CDS in the credit crisis and suggests that CDS enabled excessive risk taking by financial institutions. A prominent example is that J.P. Morgan, arguably the best performing bank during the credit crisis and the most vocal opponent of tighter regulations—such as Dodd-Frank and Basel III—suffered a large CDS trading loss in 2012. J.P. Morgan's loss in CDS trading brought substantial attention to bank risk taking through dealer activities. Banks' balance sheets may become more volatile if they trade CDS on their own accounts and act as dealers to facilitate client trading.

Of particular importance in understanding the net effect of CDS on bank risk taking is bank regulatory capital. In fact, capital adequacy is the first measure of bank risk in the CAMELS ratings used by bank examiners. Basel II aims to equate regulatory capital to economic capital

[4] 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 the 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. It also allows maturity mismatch and partial hedging (for credit event definitions and coverage). If CDS protection is counted as a hedge, the CDS seller's credit risk is used to determine the underlying obligation risk weight.

(Basel III adds liquidity into the regulatory framework and enhances the role of leverage). CDS affect the denominator of regulatory capital ratio in two ways. First, CDS can lower the risk weights on assets. Second, CDS positions on trading books add to assets. The net effect depends on the relative amount of banking book risk reduction and trading book risk increase. Banks may appear safer, with higher regulatory capital ratios, if they use CDS to hedge credit risk and reduce risk-weighted assets. However, banks may hedge only partially, or they may not hedge immediately after making loans. Moreover, if the availability of CDS as a hedging tool encourages banks to take more risk and increase risky lending, bank capital ratios will be lower. Although risky banks naturally have greater needs to hedge with CDS, a negative relationship between CDS use and capital ratios would suggest that banks do not use CDS to raise their capital ratios. If banks hold less capital during normal times because of CDS, they may be more vulnerable to crises.

Regulators have become more concerned with banks' risk-taking activities related to CDS after the credit crisis. Consequently, the U.S. enacted the Dodd-Frank Act in 2010, which, among its main objectives, aims to improve the oversight of both bank risk taking and the CDS market function. For example, bank trading activities in CDS are curbed according to the Volcker Rule in the Dodd-Frank Act. The role of CDS for bank capital regulation in Basel III continues with some modification. For instance, banks are now subject to greater capital charges for derivatives trading, including CDS (so-called "incremental risk charge"). Moreover, credit value adjustment for counterparty risk, a new component of Basel III, is mainly managed via CDS protections.

Prior studies paint a mixed picture on how risk-management practices and non-banking activities affect bank risk taking. Although Santomero and Trester (1998) argue that "the existence of a market for bank loans does not in and of itself imply that banks will become more

or less risky," Cebenoyan and Strahan (2004) demonstrate that loan sales increase bank risk. Moreover, bank risk is positively associated with noninterest income[5] (Demirguc-Kunt and Huizinga, 2010) and use of interest rate derivatives (Begenau, Piazzesi, and Schneider, 2013). Conversely, Ellul and Yerramilli (2013) illustrate that better risk controls lead to lower bank risk.

Banks may exploit their information advantage in the CDS market, e.g., buying protection before negative news becomes public (Acharya and Johnson, 2007). However, CDS-protection sellers may sell too much CDS relative to their risk absorbing capacity (Biais, Heider, and Hoerova, 2012).[6] Moreover, interbank CDS trading may create contagion (Allen and Carletti, 2006). CDS can transform relationship lending into transactional lending while maintaining the advantage of being a relationship lender. In doing so, banks make more commissions due to increased loan volume, but such practices induce greater risk taking (Acharya and Naqvi, 2012). Banks create riskier borrowers when they reduce monitoring after buying CDS (Parlour and Winton, 2013). Yorulmazer (2013) suggests that regulatory arbitrage motivates banks to grant more risky loans when CDS are available. Additionally, credit quality of borrowers with CDS may deteriorate because of "empty creditors" and creditor coordination failure (Bolton and Oehmke, 2011; Subrahmanyam, Tang, and Wang, 2013). Alternatively, the supply of bank loans may decline as banks can choose to sell CDS instead of making loans in acquiring credit exposures (Che and Sethi, 2012). Therefore, it is ultimately an empirical issue whether CDS encourage or "crowd out" banks' risky lending and how banks' risk profiles are affected as a consequence. This is the issue we focus on in this paper.

[5] One form of noninterest income can come from securitization. Several studies have analyzed how securitization affects bank risk-taking. Banks relax screening and reduce monitoring when they can securitize loans (Keys, Mukherjee, Seru and Vig, 2010; Wang and Xia, 2013). Acharya, Schnbl and Suarez (2013) demonstrate "securitization without risk transfer." Jiang, Nelson, and Vytlacil (2013) show that loans remaining on a bank's balance sheet ex post incurred higher delinquency rates than loans sold into securitization products.

[6] Fung, Wen, and Zhang (2012) demonstrate that insurance companies that use CDS for income generation purposes, such as AIG, are riskier.

III. Data and Sample Description

We employ three main datasets on U.S. banks, syndicated loans, and borrowers. The first concerns bank data and includes bank credit derivatives positions, total assets, capital ratios, risk measures, and stock prices for publicly listed banks. The second contains information on individual syndicated corporate loans with loan contract terms at origination such as loan size, interest rate, and lender identities. The third provides the CDS market information of U.S. publicly listed corporate borrowers.

A. 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").[7] Banks with more than $150 million in assets are required to file FR Y-9Cs (the threshold increased to $500 million in 2006). Our focus is 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 a RSSD ID in the bank dataset to the name of a lead lender in Dealscan to identify the list of lending banks that are active in CDS trading. We ensure that the match is done 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 there was also a substantial change in the CDS market. FR Y-9C filers include 7,646 banks, and 121 banks act as syndicate leads in Dealscan. Our base sample includes 84 banks with complete financial information, 37 of which traded CDS at some time during the sample period.

CDS position data for foreign banks are not available from FR Y-9C filings. We collect additional bank CDS position data from the Office of the Comptroller of the Currency (OCC)

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

Quarterly Report on Bank Derivatives to include large foreign banks. OCC reports list the top 25 banks, including the U.S. subsidiaries of foreign banks, with the largest credit derivative positions every quarter starting from 1998. Both the FR Y-9C filings and the OCC Reports provide aggregate CDS positions and positions held by banks as beneficiaries ("bought") or as guarantors ("sold"). We cross-check CDS position data covered by both datasets.

B. Corporate Loan Data

Corporate lending is most relevant for CDS. We obtain syndicated loan data from Dealscan. We sum the loan amount and take a simple average of all-in-drawn spread and maturity to aggregate different tranches (also called facilities) from the same loan deals and conduct our analysis at the deal level. In our multivariate analysis, we exclude firms with missing accounting data, such as total assets. 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 with 17,268 observations.

C. ***CDS Data on Referenced Borrowing Firms***

We determine whether CDS contracts referencing the borrowers' debt exist at the time of loan issuance from two major sources of CDS transactions datasets: 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 cross-check to ensure data accuracy. We further validate the data with Markit quotes. The first CDS transaction record in the data for the issuer is used as the CDS introduction date, similar to Subrahmanyam, Tang, and Wang (2013). We identify 921 U.S. firms whose debt is referenced by CDS contracts from June 1997 to April 2009.

We merge CDS trading data with Dealscan loan records using borrower identifiers in Compustat.[8] 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 those 15,546 syndicated loans in our regression sample, 9,341 are made to 867 CDS firms that have CDS referencing their debt at any time during the sample period, and 6,641 are made to firms with CDS trading at the time of loan origination.

D. Overview of the Sample

Our base sample consists of mainly large banks that are required to file quarterly reports with the Federal Financial Institutions Examination Council. Lead arrangers for syndicated loans are frequently large banks. Panel A of Table I shows that the average book value of assets among our sample banks is $260.983 billion. Because CDS-active banks are large, focusing on large banks makes our treatment and control groups more comparable and alleviates concerns of bank characteristics driving our findings. Other bank characteristics are comparable to those reported in Loutskina (2011). The average notional amount of total credit derivatives positions at the quarter-end for banks in our sample is $65.085 billion. The CDS bought, sold, and net positions are on average $32.977, $32.108, and $0.869 billion, respectively.

Panel B of Table I presents the yearly 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-active 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 new loans grew from $491.51 billion in 1994 to $4.56 trillion in 2007, then dropped to $2.66 trillion in 2008 and $2.12 trillion in 2009. Whereas CDS-active banks decreased lending substantially

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

during the crisis in 2008 and 2009, CDS-inactive banks issued more loans in 2008 and 2009 than in 2007.

Panel C of Table I summarizes syndicated loans in our sample by years. 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 saw the highest average loan size of $598.79 million in our sample. 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 amount to 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. Table A1 of Internet Appendix presents summary statistics for all loans and borrowing firm characteristics.

IV. Bank-Level Evidence

A. Bank Risk Profile and CDS Trading

We begin by examining how bank-level risk taking is affected by banks' CDS trading activities. We focus on banks that can be identified as lead arrangers of syndicated loans in Dealscan.[9] We construct a bank-quarter panel data set to estimate the following model:

$$\begin{aligned} Bank\ Risk\ Measure_{it} = \alpha + \beta CDS\ Active\ Bank_{it} + \gamma_1 Bank\ Characteristics_{it-1} \\ + \gamma_2 Fixed\ Year\ Effect_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

We use both accounting-based and market-based measures of bank risk taking.[10] The first measure is *Z-score*, which is defined as (ROA+CAR)/σ(ROA), where ROA is return-on-assets,

[9] We did the same analysis for all Compustat banks, too. The results reported in Tabe A2 of Internet Appendix are qualitatively similar to our base sample results. We also exclude the "too-big-to-fail" banks that hold deposits that exceed 10% of the total deposits of all sample banks in the same quarter. The results in Table A3 of Internet Appendix remain robust for this restricted sample.

CAR is capital asset ratio, and σ(ROA) is the volatility of ROA. Z-score measures the distance from insolvency and is the most commonly used bank risk measure (see Laeven and Levine, 2009 and Houston, Lin, Lin, and Ma, 2010). A higher Z-score indicates a lower probability of bank insolvency. Our second bank risk measure is *Distance-to-default*, which is calculated using the Bharath and Shumway (2008) method and is applicable only for publicly listed banks.

Given the particular importance of capital for banks and regulatory requirements, we also examine *Risk-weighted Total Capital Ratio*, which is total capital divided by total risk-weighted assets. Finally, we examine *Loan Loss Provision*, which is the allowance set aside for a bank's expected loan loss. This measure is a bank's own estimate of loan portfolio risk because it is prepared to absorb such loss with its own capital. Higher loan loss provision suggests that banks are aware of the additional risks they are taking on.

The key independent variable is the indicator *CDS Active Bank*, which takes on the value of one if the bank is actively trading CDS in the quarter and zero otherwise.[11] The regressions include a set of variables that may determine a bank's risk. These control variables are extracted at the end of the year prior to the bank-quarter observation and include the bank's total assets, total assets squared, sales growth rate, deposits-to-asset ratio, loan-to-asset ratio, market share in bank deposits, and fixed year effects.

Table II presents the estimation results regressing bank risk-taking measures on bank use of CDS. Column 1 indicates that CDS-active banks have lower Z-scores. The negative coefficient estimate for *CDS Active Bank* suggests that, *ceteris paribus*, CDS-active banks are less

[10] As a robustness check, we use a broader set of variables to measure bank risk, including net interest margin volatility, ROA volatility, and stock return volatility. We find consistent results with those measures.

[11] We use the dummy representing CDS-active 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-active banks, Bank of America and J.P. Morgan Chase & Co, hold CDS positions far exceeding other banks. We focus on the qualitative measure to capture the first-order effects.

financially sound than CDS-inactive banks. The effect of CDS trading is also economically significant: CDS-active banks have Z-scores that are on average 17.2% lower than those of CDS-inactive banks. Column 2 shows that among public banks, distance-to-default is significantly shorter for those that are trading CDS.

Bank capital ratios are top regulatory concerns. 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% (common equity minimum is 4.5%). Bank capital may also work as an important channel through which banks can take more risk. The level of equity capital measures the extent to which a bank is prepared to internalize the cost of bank failure, rather than rely extensively on deposit-based financing (Allen, Carletti, and Marquez, 2011). Column 3 shows that the effect of CDS trading on banks' total risk-weighted capital ratio is significant. CDS-active banks' total capital ratio is 0.5 percentage point lower than that of CDS-inactive banks. Column 4 shows that the average tier 1 capital ratio of CDS-active banks is 1.3 percentage points (13% of the mean) lower than that of CDS-inactive banks. The finding of lower capital ratios for CDS-active banks has important implications for the analysis of bank risk taking. If banks use CDS purely for hedging, then risk-weighted assets should be lower and capital ratios should be higher. The lower capital ratio suggests that banks either carry less capital or expand their assets, and the expansion may substantially exceed the amount reduced by the hedging role of CDS. The expansion in assets could result from increased lending, such as lending to risky borrowers.

CDS-active banks also set aside more loan loss provision, as indicated in the last column of Table II. Loan loss provision for CDS-active banks is 7.6 basis points higher than that for CDS-inactive banks. Higher loan loss provision indicates that the bank anticipates that the loss rate of

their loan portfolios will be higher; thus, the result implies that banks are knowingly assuming more risk.

Overall, our findings suggest that banks become riskier—as bank risk is typically measured—after they begin trading CDS, with other bank characteristics being controlled for in the regressions. These results are contrary to the risk management role of CDS, which would have improved banks' balance sheets had they used CDS properly for risk transfer and diversification.

B. Instrumental Variables for CDS Active Bank

The previous section establishes a strong positive association between banks' CDS trading and risk taking. We now examine whether such a relation is causal. One potential concern is that banks' risk culture is persistent and driven by innate firm characteristics, as suggested by Fahlenbrach, Prilmeier, and Stulz (2012), whereas CDS trading is a choice made by a bank. The complication to our identification is twofold. First, omitted variables may drive both banks' CDS trading and their risk-taking behavior. Second, riskier banks are in a greater need of using CDS to hedge and to increase capital ratios; therefore, the causality may run from bank risk to CDS trading. We conduct instrumental variable (IV) analyses to make causal inferences.

Our first instrument, the post-year 2001 indicator, is motivated by the recognition of CDS in capital regulation. After extensive efforts by J.P. Morgan and the ISDA, among others, the proposal of the new Capital Accord by the Basel Committee on Banking Supervision was published by the Bank for International Settlements (BIS) in January 2001.[12] The framework of the Basel II Capital Accord introduces new approaches to the treatment of credit derivatives and places great emphasis on banks' own assessments of credit risk.[13] In the meantime, U.S.

[12] The news release can be found at: http://www.bis.org/press/p010116.htm; and related documents can be found at: http://www.bis.org/bcbs/bcbscp2.htm.

[13] "The Committee has been examining the capital treatment of credit risk mitigation techniques, including credit derivatives…The new proposals provide capital reductions for various forms of transactions (including credit

regulators began formally considering to change capital rules and allowing banks to use CDS to manage capital requirements. In 2001, J.P. Morgan also launched the JECI and Hydi indices, which are the origin of synthetic credit indices. Moreover, Markit Group began distributing CDS price information in 2001, which also facilitated bank's CDS trading.[14] Although the passage and implementation of Basel II occurred after 2001, the treatment of credit derivatives as credit mitigation in setting capital requirements for banks is clarified for the first time in its 2001 Capital Accord proposal.[15] We therefore expect more extensive use of CDS by banks after 2001,[16] and, indeed, the CDS market grew exponentially in the post-2001 era. The post-2001 indicator has significant explanatory power for banks' CDS trading activities, as shown by Table A4 of Internet Appendix.

We believe that the instrumental variable also satisfies the exclusion condition. The post-2001 indicator itself is unlikely to have a direct impact on bank risk taking. If anything, banks would be expected to adopt a more prudential lending practice after the WorldCom accounting scandal, the bankruptcy of Enron in 2001, and the bursting of the Internet bubble. Apart from increasing bank risk via CDS, it is unlikely for the post-2001 dummy to increase bank risk directly.

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derivatives) that reduce risk." — from "Overview of The New Basel Capital Accord" published in January 2001 (http://www.bis.org/publ/bcbsca02.pdf).

[14] Markit Group is partly owned by banks, including J.P. Morgan, Goldman Sachs, and UBS. See, "Plumbers in Suits: A Private Company Controlled by Banks Connects Much of the Financial System", *The Economist*, July 16, 2013, and "Risk-taker Lance Uggla Challenges Bloomberg", *Financial Times*, October 11, 2013.

[15] Before 2001, the Basel Committee began the consideration of the impact of credit mitigation instruments seriously in their June 1999 issue of A New Capital Adequacy Framework: "…In particular, bank guarantees in the form of credit derivatives have gained widespread usage. These developments have had important effects on the credit risk profile of many banks." (http://www.bis.org/publ/bcbs50.pdf) To develop its approach to the treatment of credit risk mitigation techniques, the Basel Committee solicited industry views in 2000 and found that "many banks expect the use of credit derivatives to grow significantly in the future…greater and more flexible regulatory recognition of the credit risk mitigating effect of credit derivatives would provide for a strong impetus for the expansion of this market." ("Industry Views on Credit Risk Mitigation", http://www.bis.org/publ/bcbs67.pdf).

[16] We note that the Gramm-Leach-Bliley Financial Modernization Act, which allows banks to conduct non-banking activities and effectively repeals the Glass-Steagall Act, was enacted in 1999. We expect that regulation change will be incorporated mostly within the subsequent two years.

Therefore, we believe that the post-2001 indicator is a valid IV for bank CDS trading because it satisfies both the relevance and exclusion conditions.

Our second instrument is selected based on the theoretical and empirical work in the credit derivatives and banking literature. One major rationale for banks to use credit derivatives is to improve diversification and manage concentration in their credit portfolios (Morrison, 2005). Additionally, banks that concentrate on lending to a smaller group of firms or sectors may have accumulated more information about a borrower. Such informational advantage and lending expertise may encourage a bank to initiate a CDS contract on a borrower. Indeed, CDS insider trading linked to banks is documented by Acharya and Johnson (2007). Meanwhile, the prior literature does not find a clear relationship between loan concentration and bank risk (see, e.g., Berger, Bouwman, Kick and Schaeck, 2012). We therefore use bank-level loan portfolio concentration as an instrument for banks' CDS trading. To measure loan concentration, we calculate the ratio of each loan relative to total loan amount from the same bank in the same quarter and sum the squared ratios by bank-quarter. The measure is higher for more concentrated loan portfolios. Banks with more concentrated loan portfolios are more likely to trade CDS, as shown in Table A4 of Internet Appendix.

The empirical results with instrumented bank CDS trading are presented in Table III. The coefficient estimates for the instrumented CDS Active Bank are significantly related to all risk measures when the instrumental variable is *Post Year 2001* in Panel A. All coefficient estimates except for loan loss provision are significant when the instrumental variable is loan portfolio concentration in Panel B. The results from the IV estimation support the implication that banks' CDS trading induces more risk taking.

C. Lending to CDS-referenced Firms on Bank Risk Taking

Our focus is on banks' lending behavior in the presence of CDS trading. A bank's lending practice is more likely impacted by CDS when the bank takes direct CDS positions in a borrower's name. If a bank's credit derivatives positions include CDS contracts referencing its borrowers' debt, then we expect to find a positive relationship between the bank's credit derivatives positions and the following: (1) its borrower base that is CDS referenced; and (2) market activities in its borrower-referenced CDS. Table A5 of Internet Appendix confirms the existence of these two positive relations, which thus suggests that the observed positive relationship between banks' trading in CDS and their total risk-level is beyond coincidental.

Risks may arise both from banks' dealer activities in the credit derivatives market and, of greater interest to us, their lending practice to CDS firms. We first investigate the co-movement of banks' CDS activities and syndicated loan issuance. Panel A of Figure 1 plots the time-series of our sample borrowers' CDS market activities and the amount of syndicated loans issued to them. It appears that there is a positive correlation between syndicated loan issuance volume and the quantity of CDS trading. Both loan issuance and CDS trading grew rapidly from early 2000 until mid-2007 when the credit crisis erupted. The Pearson correlation coefficient of the quarterly volume of syndicated loan issuance and the number of CDS trades in the borrowers' name is 0.59, which is significant at the 5% level. In addition, CDS trading became more active in the months leading up to loan initiation as shown by Panel B of Figure 1. The number of CDS trades peaks in the month of loan initiation and clips off over the next six months. This observation implies a link between banks' CDS trading activities and their loan initiation. One plausible explanation for this observation is that CDS trading facilitates bank lending. In this case, it is

expected that the increased level of bank risk stems from the increased credit supply induced by CDS trading.

To examine this proposition, we regress bank-level risk measures on the loan volume to CDS-referenced firms in the prior year. To mitigate the concern that loan volume to CDS firms captures only the bank size effect, we scale this loan volume by the aggregate loan issuance to both CDS and non-CDS firms by the same bank in the same year; essentially, we measure the relative loan size to CDS firms out of the bank's total loan portfolio. Table IV reports the estimation results. Banks that lend more to CDS-referenced borrowers have lower Z-scores. Lending to CDS firms increases a bank's default risk, which is indicated by the negative coefficient on distance-to-default. Moreover, a higher ratio of loans to CDS firms is associated with a lower tier 1 capital ratio. A one-standard-deviation increase in a bank's loan-to-CDS firm ratio is associated with a 1.5% decrease in its tier 1 capital ratio. More lending to CDS firms results in a higher level of loan loss provision, and the economic magnitude is substantial: a one-standard-deviation increase in the loan-to-CDS firm ratio leads to a 7.4% increase in the percentage of loan loss provision relative to pre-tax income.

Banks' loan portfolios are composed of various types of loans including home mortgages, consumer loans, and commercial and industrial (C&I) loans, among which C&I loans account for the largest portion in terms of their aggregate amount relative to the total amount of loans.[17] We expect that C&I loans are those most likely to be affected by banks' use of CDS-referencing corporate names. Table 6 of Internet Appendix shows a positive relationship between banks' share of C&I loans in their total loan portfolios and their CDS trading. The findings on C&I loans help distinguish CDS effects from securitization. Securitization expands bank funding that can be used to finance all types of loans and most likely increases mortgage lending because

[17] C&I loans account for approximately 31% of the total loans in the data compiled by Loutskina (2011).

mortgage and consumer loans are more often securitized than corporate loans, whereas CDS are associated with a larger fraction of C&I loans.

Overall, our bank-level evidence indicates that CDS encourage more risk taking by CDS-active banks by extending loans to CDS firms. To further corroborate the bank-level evidence, we examine how CDS affect bank lending practice at the loan level in the next section.

V. Loan-Level Results

To underpin the link between CDS trading and bank risk taking, we first investigate how syndicated loan issuance is affected by the introduction of CDS on a borrower's debt. We then study how banks incorporate the availability of CDS on a borrower's debt into their lending practice based on their participation in the CDS market.

A. CDS Trading, Loan Amount and Loan Spread

Our baseline empirical strategy is a difference-in-differences approach. To examine the CDS effect relative to borrowers without CDS trading, we estimate panel regressions that are variants of the following form:

$$Loan\ Amount_{it} = \alpha_1 + \beta_1 CDSTrading_{jt} + \beta_2 CDSTraded_{jt} + \gamma_1 X_{1it} + \gamma_2 X_{2jt-1} + \mu_t + \mu_k + \varepsilon_{it} \quad (2)$$

$$Loan\ Spread_{it} = \alpha_2 + \beta_3 CDSTrading_{jt} + \beta_4 CDSTraded_{jt} + \gamma_1 X_{1it} + \gamma_2 X_{2jt-1} + \mu_t + \mu_k + \varepsilon_{it} \quad (3)$$

where subscript i denotes the loan, subscript j denotes the borrowing firm, subscript t denotes the loan issuance quarter and subscript k denotes the borrower 2-digit SIC industry. The dependent variables, loan amount and spread, are observed at loan initiation. We scale the loan amount by firm assets in the quarter prior to loan origination. The key independent variable of interest is *CDS Trading*, which equals one if the issuer's debt is referenced by CDS at loan initiation and zero otherwise. CDS traders in the market could be the lender or other investors.

We also consider *CDS Traded*, a dummy equal to one if the borrowing firm has active CDS trading at *any* point in time during the sample period and zero otherwise. *CDS Traded* accounts for potential unobservable differences between CDS and non-CDS firms. The existence of referenced CDS contracts indicates an opportunity for the lender to trade in its borrower's CDS contracts.

We follow prior studies such as Sufi (2007) and Lin, Ma, Malatesta and Xuan (2012) to include other typical determinants of loan amounts and spreads. The first set of control variables, X_{1it}, includes loan characteristics, such as maturity and indicators for loan security, multiple tranches, existence of loan rating, and loan purpose. The other set of control variables, X_{2jt-1}, includes firm characteristics that are measured at the end of the quarter prior to loan initiation, such as the logarithm of total assets, market-to-book ratio, sales-to-total assets ratio, cash-to-total assets ratio, leverage, tangibility, and Altman's Z-score. In all specifications, we include the loan-issuance-year and industry fixed effects. Finally, all standard errors are clustered at the firm level to address the concern that error terms are correlated across loans from the same firm.

Table V presents the estimation results for loan amount (Panel A) and loan spreads (Panel B) using the sample of syndicated loans.[18] The coefficient estimates of *CDS Trading* in both amount and spread regressions are positive and statistically significant. We follow Ashcraft and Santos (2009) and Saretto and Tookes (2013) to exclude *CDS Traded* in column 2 because *CDS Trading* and *CDS Traded* are correlated. The coefficient estimates from column 1 in Panel A indicate that the presence of CDS trading increases the average loan amount relative to firm size by 14.5%. Column 1 of Panel B shows that the average loan spread for a CDS firm is 15.5 basis points

[18] We conduct the same analysis with the aggregate sample of syndicated loans and sole lender loans. The results, found in Table A7 of Internet Appendix, are qualitatively similar.

higher than that of similar firms without CDS. The results in Table V imply that, *ceteris paribus*, CDS firms on average obtain larger loans with higher spreads than non-CDS firms.

The amount and spread of loans can be determined jointly, and we estimate the two equations simultaneously by two-stage least squares. Note that the potential simultaneity of amount and pricing occurs at the firm level, i.e., the spread charged by the lender may be affected by the loan amount to which it commits, although the pricing is not likely to be driven by the firm's industry peer's loan amount. Therefore, we include industry average loan amount in the loan amount regression and industry average spread in the spread regression, respectively. Those industry variables are used as identifications. The estimation results in Appendix Table A8 show that the CDS effect remains robust when estimated from the simultaneous equations.

B. Selection of Borrowing Firm CDS Trading

A potential concern with the difference-in-difference approach (*CDS Trading* versus *CDS Traded*) 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.

B.1 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 included in the first-stage probit regression. Lenders' foreign exchange derivatives data are available from the FR Y-9C reports filed by bank holding companies, which track lending banks' derivatives usage and the composition of their loan portfolios. The idea is that banks that hedge the foreign exchange exposure of their loan portfolios are likely to be active risk managers in

general. Having been previously used by Saretto and Tookes (2013) and Subrahmanyam, Tang, and Wang (2013), this instrument captures the hedging demand of firms' creditors and is expected to be related to 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 better information transparency of a firm and may reduce the lemons problem in risk transfer, which facilitates banks' use of CDS (Minton, Stulz and Williamson, 2009). Therefore, the existence of public bonds is positively correlated with the possibility of having CDS in the future.

We believe that these two instruments satisfy the exclusion condition. The lender foreign exchange derivatives position is a macro hedge and characterizes the lender's global risk management strategy, which is unlikely to be driven by individual lending decisions. More importantly, the firms in our sample are U.S.-based, which makes a bank's decision to hedge foreign exchange risk exogenous to domestic lending. Therefore, this variable is unlikely to directly affect loan contract terms. Conversely, the presence of public bonds is unlikely to directly affect the firm's syndicated loan contract terms at initiation.

For the first-stage analysis, we estimate the probit model for firms' CDS trading:

$$Prob(CDS\,Trading_{it}) = \alpha + \beta x_{it-1} + \gamma Lender\,Foreign\,Exchange\,Derivatives_{it-1} \text{ or } Presence\,of\,Bond\,Market_{it-1} + u_{it} \quad (4)$$

where x_{it-1} refers to other firm-level determinants of CDS trading. The estimation results (provided in Table A9 of Internet Appendix) show that a larger lender foreign exchange derivatives position and pre-existence of public bonds predict a higher probability of available

CDS referencing the borrower's debt. The partial correlation between the IVs and CDS Trading is both economically and statistically significant.

We use a two-stage least-square estimation to account for the selection of CDS trading. We report the second-stage estimation results with the instrumented CDS trading probability in Table VI. The results 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.

B.2 Propensity Score Matching

Our alternative approach to address the potential endogeneity issue is propensity score matching. We measure the marginal impact of CDS by forming a group of treatment firms and control firms that have an equal propensity of having CDS before their loan is issued. We use the model in Table A9 of Internet Appendix to estimate the CDS trading propensity score for each firm. We select from non-CDS firms within the same 2-digit SIC industry the one with the propensity score closest to that of the treatment firm, which has CDS trading at the time of loan initiation, and find matching firms for 432 CDS firms. We identify syndicated loans to the matching firms issued in the same year as the treatment firm to form the control group. The average distance in the propensities between the treatment and matching firms is reduced significantly from 0.063 before matching to 0.007 after matching. Matched sample diagnostics are reported in Table A10 of Internet Appendix. The regression results estimated with the matched sample are reported in Table VII. We observe a statistically significant increase in loan amount and spread for treatment firms relative to control firms.

C. Bank Lending Practice: CDS-active Banks versus CDS-inactive Banks

To explore whether the effect of CDS on loan contract terms is related to changes in banks' lending strategies, we separately examine loans from CDS-active and CDS-inactive banks. One limitation in our study is that we only observe banks' total credit derivatives positions but not their individual CDS positions. One implicit assumption we have is that banks' credit derivatives positions consist of individual CDS contracts, including those referencing their borrowers. A unique situation exists when a CDS-inactive bank lends to a CDS firm. In such a case, borrower CDS should not influence lending decisions, except for some spillover effects. To capture the first-order effect of CDS, we investigate how banks' CDS trading affects their own lending practices. The findings may also help differentiate banks' CDS-related lending from general lending strategies.

CDS-active banks are on average larger and make more loans than CDS-inactive banks. We choose banks of similar size for a sensible comparison. Specifically, we match a CDS bank with a non-CDS bank in terms of total assets. Then, we extract loans originated from each paired banks in the same quarter. To ensure the robustness of our finding, we have also conducted the analysis using the entire sample of banks and all loans without the matching requirement. Table A11 of Internet Appendix shows results similar to the matched sample results in Table VIII.

We note that the incremental effects on loan amount are only from CDS-active banks: Model 1 in Table VIII shows that lending volume from banks that are inactive in CDS trading is not affected by the presence of CDS on their borrowers' debt. Model 2 shows that the point estimate is significant for *CDS Trading* but not for *CDS Traded*, which suggests that the effect is from the actual availability of CDS on a borrower at the time of initiation rather than from unobservable differences between firms with or without CDS. The results for loan spreads are also significant

only for CDS-active banks. Therefore, although CDS-active banks treat CDS borrowers differently from non-CDS borrowers, CDS-inactive banks do not make such distinction.

The results from the sub-samples of CDS-active banks and CDS-inactive banks help us identify the channel of the CDS effect, which reflects the incremental impact of CDS on the underlying firm's credit risk and provides additional evidence that the effect is from changes in the bank's lending behavior induced by CDS.

Why do CDS-active banks differentiate CDS-referenced borrowers from non-CDS borrowers? One possibility is that banks pass on their costs associated with CDS trading to borrowers. CDS-active lenders may reduce their screening and monitoring efforts and simply protect themselves with higher loan rates (Parlour and Winton, 2013). To see if that could be the case, we examine the lending standard measure from the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices. Indeed, lending standards are lower when banks trade CDS more actively, as shown by Figure 2.[19] Another possibility is that CDS-referenced borrowers become riskier after trading in their contracts begins, as documented by Subrahmanyam, Tang, and Wang (2013). Figure 3 shows a negative correlation between loan quality in terms of Altman's Z-score and lender derivatives position (the Pearson correlation is -0.74, which is significant at the 1% level). This negative correlation also holds in multivariate regressions reported in Table A12 of Internet Appendix, which shows that the credit quality of CDS-referenced borrowers deteriorates after loan issuance.

The evidence suggests that banks active in the CDS market lower their lending standards and cater to riskier borrowers. Anticipating this result, CDS banks charge higher loan spreads. CDS-inactive banks do not have such consideration. Although they may also implicitly take risk

[19] The tightness of lending standards is measured by the net percent of bank officer respondents that report that the lending standard for C&I loans is tight.

associated with CDS-referenced borrowers, such risk taking seems to be rather limited because we do not find changes in the borrower base along the dimension of CDS availability for CDS-inactive banks. Generally, CDS-referenced borrowers receive larger loans from CDS-active banks, albeit at higher costs, and they also thus tend to be subsequently riskier.

D. Negative Banking Shocks

Negative shocks to banks are frequently transmitted to borrowers in traditional banking (Gopalan, Nanda and Yerramilli, 2011; Ivashina and Scharfstein, 2010; Santos, 2011). Murfin (2012) shows that banks tighten loan covenants after portfolio losses. Shocks move banks away from their desired positions and provide a good opportunity to observe their reaction and adjustment toward their preferred choices. If CDS mitigate credit risk and protect against adverse events, they are expected to play a larger role when banks are hit by shocks. We aim to uncover whether CDS make banks more or less sensitive to such shocks.

We follow Murfin (2012) to construct two types of negative shocks: one is the number of defaults in the same state in which the bank is located; the other is the number of defaults in the bank's loan portfolio. The default indicator equals one if there are corporate defaults in the same state in which the bank is located or in the same bank loan portfolio; the percentage of defaults refers to the ratio of defaulted firms out of all firms located in the same state or from the same loan portfolio. We use corporate bankruptcy data, which is constructed following Subrahmanyam, Tang, and Wang (2013),[20] one quarter prior to loan initiation. We add the shock variables to our baseline regressions. We do not find any differential effects from the negative shocks on loan amounts: banks react to the shocks in a similar manner for CDS firms and for

[20] The corporate bankruptcy data from 1990 to 2009 are constructed from three sources: the bankruptcy list reported by the Federal Depository Insurance Corporation (FDIC), the website of bankruptcydata.com, and the UCLA-LoPucky Bankruptcy Research Database (BRD). These different sources of data allow for cross-checking to increase accuracy and widen data coverage.

non-CDS firms. (Therefore, we do not report those results.) However, loan spreads to CDS-referenced borrowers are less sensitive to the shocks, as shown by the estimation results in Table IX. The coefficients on the interaction terms are all *negative*. A default event, whether in the same state or in the same lender portfolio, usually leads to an increase in spreads, as lenders tighten their lending standards and increase the cost of loans. However, this increase in spreads does not apply to CDS firms, probably because banks are able to hedge their exposure by buying CDS contracts on affected firms. This finding suggests that CDS make loan pricing less sensitive to negative shocks on the lender side.

The findings thus suggest potential benefits to CDS-referenced borrowers. The adverse effect from negative shocks to a bank's loan portfolio may be mitigated by the existence of CDS, which improves a bank's resilience to adverse events. Therefore, financing to CDS firms is more stable and less susceptive to negative banking shocks and bank performance. Nevertheless, this is another piece of evidence that banks employ more aggressive lending practices when they have access to the CDS market.

VI. The 2007-2009 Credit Crisis and A Rationale for Bank Risk Taking with CDS

In this section, we analyze the consequences of banks' activities involving CDS. We examine whether banks react differently to the credit crisis depending on their CDS positions in the pre-crisis period. Then, we evaluate banks' financial and operating performance associated with CDS positions both during and out of the crisis.

A. Bank Capitalization and Lending During the 2007-2009 Credit Crisis

Our main findings that banks active in CDS trading have higher risk profiles apply to the entire sample period. The interaction between bank risk taking and CDS was highlighted in the

credit crisis of 2007-2009. During this period, several banks failed. One prominent example is Wachovia, which was an active CDS user. If banks rely on CDS for their risk-taking behavior during normal periods, then the shocks to the CDS market during the crisis, particularly after the bankruptcy of Lehman Brothers and the bailout of AIG, should both change banks' understanding about the function of CDS and limit their further use of CDS. Figure A1 of Internet Appendix shows that banks' CDS positions peaked at the beginning of 2008 and subsequently dropped precipitously and significantly. Banks held substantially less CDS positions during the crisis. We thus expect banks that previously traded CDS to rein in their risk-taking activities during the credit crisis.

A.1. Bank Capital

If banks keep lower buffer levels of regulatory capital requirements because of CDS, they may need to raise more capital during crises, i.e., when CDS become less available.[21] According to ISDA 2009 mid-year market survey data, total outstanding CDS fell to $31.2 trillion at the end of June 2009, which represents a substantial drop from the peak of $62.2 trillion at the end of 2007. CDS protection during the crisis also became more expensive. For example, investment-grade corporate credit spreads, as measured by the CDX.IG index, rose from 50 bps in early 2007 to more than 250 bps at the end of 2008. Even AAA-rated synthetic credit products saw their spreads widen dramatically during the crisis. Simultaneously, regulators became more concerned with bank soundness and strengthened bank capital regulations.[22] Therefore, we expect CDS-active banks to increase their capital during the crisis.

[21] 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). FDIC Chairman Bair stated on June 3, 2009 "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).

[22] See news release at: http://www.federalreserve.gov/newsevents/press/bcreg/20081112a.htm

Panel A of Table X reports the estimation results regressing banks' capitalization rates during the crisis on their pre-crisis CDS statuses. We follow Ivashina and Scharfstein (2010) to 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 as the watershed event for each period, respectively. Table X shows that CDS banks increase capital ratios in the second phase of the crisis (i.e., post-Lehman) from the first phase of the crisis and the pre-crisis period. The results are consistent using both the tier 1 capital ratios and the total capital ratio. The results are also robust when we recast the pre-crisis window from 2005Q3 to 2007Q2. We use the entire sample for columns 1 and 2 but only the 2005-2007 data as the pre-crisis period for columns 3-4, following Fahlenbrach and Stulz (2011), and Beltratti and Stulz (2012). For instance, compared with the pre-crisis period of 2005Q3 to 2007Q2, the average total capital ratio for CDS-active banks rose by 0.006 during the first phase of the crisis, which is statistically insignificant. However, the total capital ratio increases significantly by 0.016 in the second phase of the crisis. The findings for the tier 1 capital ratio are similar. Our findings imply that banks that took CDS positions prior to the crisis raised more capital during the crisis than CDS-inactive banks.

A.2. Bank Lending

We also examine changes in bank lending during the crisis. Panel B of Table X reports the results of regressing new loan issuance on CDS-active banks during the crisis. In the odd columns, our dependent variable is the ratio of total loans to total assets. In the even columns, the dependent variable is the ratio of total revolvers to total assets. The regression sample includes 937 observations because we restrict the sample to the period between 2005 and 2009. We use three measures of CDS bank exposure. Regardless of how we define the newly issued loans or

the crisis period, the coefficients of the interaction term of CDS-active bank and the crisis are negative and statistically significant. For instance, in column 2 of Panel B, the average revolver issuance by CDS-active banks is 0.011 lower in the first phase of the crisis and 0.016 lower in the second phase of the crisis than that of the pre-crisis period. Moreover, CDS-active banks cut lending during the crisis more than CDS-inactive banks.[23]

Our findings show that CDS-active banks experienced larger drops in new loan issuance during the crisis than CDS-inactive banks. The results suggest that the availability of CDS may exacerbate the procyclicity of credit supply. The borrowers of CDS-active banks suffer more because their lenders had to raise more capital during the crisis. Although CDS-active banks increased their capital levels, this might not have been enough to accommodate their risk levels because they extended more risky loans during normal times, which are supported by a well-functioning CDS market. During the crisis, the role of CDS for capital reduction became limited; thus, banks may have to not only raise capital but also cut lending.

We replace the CDS-active bank dummy in columns 3 and 4 with banks' total CDS positions (bought + sold) and we replace columns 5 and 6 with banks' net CDS positions (bought - sold). The effect of CDS is amplified by CDS positions held by banks. During normal times, a larger CDS position is associated with more bank lending, particularly with larger revolvers, while it results in more drastic reductions during the crisis. For example, as indicated by column 3, a one-standard-deviation increase in the ratio of total CDS position to total assets is associated with a drop of 0.017 (2.79%) in the ratio of total loans to total assets in crisis phase 1 and 0.023 (3.77%) in crisis phase 2, which are both significant at the 1% level.

[23] The crisis dummies have negative coefficients, suggesting that all banks (including both CDS-active and inactive banks) reduce 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 credit boom and by 47% relative to the prior quarter.

Overall, CDS-active banks are impacted to a greater extent by the credit crisis than CDS-inactive banks, and the former seem to have become more conservative during the crisis. Moreover, the borrowers of CDS-active banks are potentially affected by the more severe reduction in credit supply.

B. Stock Market Reaction to Bank CDS Trading in Normal and Crisis Periods

Table X shows that CDS-active banks increased capitalization and cut lending during the credit crisis. However, is that ex post remediation enough to compensate for their risk-taking activity prior to the crisis? We use the stock market reaction to address this question.

We follow Beltratti and Stulz (2012) to regress bank stock returns on pre-crisis CDS positions. Table XI shows the regression results. The first column shows that banks that were active in CDS trading in the second quarter of 2008 underperformed their counterparts who were not active in CDS trading by 24.5% in their buy-and-hold returns from 2008Q3 to 2008Q4, after controlling for other factors that may affect stock returns. The second column shows that banks active in the CDS market before the onset of the crisis experienced significantly larger stock price drops during the entire crisis period that spanned from 2007Q3 to 2009Q2. The second phase of the crisis, hallmarked by the bankruptcy of Lehman Brothers, contributes to most of the underperformance.

If CDS-active banks are punished by their exposure to the CDS market, which was brought to a halt during the crisis, are there then any benefits from CDS trading by banks? In other words, are banks rewarded by trading CDS during normal times by earning more profits and higher stock returns? Column 3 of Table XI reports the estimated relationship of banks' buy-and-hold returns from mid-2006 to mid-2007 and banks' CDS activity in the second quarter of 2006. Banks active in CDS trading in the second quarter of 2006 outperform CDS-inactive banks by 10%

in the subsequent year. Shareholders may thus believe banks' CDS trading increases firm value and react positively. The outperformance in the stock market provides a rationale for banks' CDS trading, and this result is consistent with our previous finding that CDS-active banks are riskier in the full sample period and that those banks performed worse during the crisis.

This finding implies that exploiting the CDS market allows banks to create value for shareholders in tranquil times but also exposes them to risks during crises. Some CDS became illiquid suddenly when the crisis erupted, which left banks that relied on them for lending in the pre-crisis period unable to find protection for the risky loans they had extended. Moreover, CDS-referenced firms were more likely to default on the loans they obtained during the credit boom, which might have led to worse performance by their lenders.

C. CDS Trading and Bank Operating Performance

The stock return analysis suggests that bank shareholders embrace CDS trading during normal times. We further analyze whether CDS have any real effects on banks' operating performance. We focus on net interest margin and return-on-assets (ROA). We regress those operating performance measures on banks' CDS status. Table XII reports the regression results.

Column 1 of Table XII shows that CDS-active banks have higher net interest margins than CDS-inactive banks during our sample period. The ROA difference is insignificant, as shown by column 2. We examine the ratio of loans to CDS firms in columns 3-6, which is the percentage of the amount of loans to CDS firms out of total loans from the same bank prior to the bank-quarter. Columns 3 and 4 show that lending to CDS firms raises net interest margins and ROA for CDS-active banks. A one-standard-deviation increase in the ratio of loans to CDS firms leads to a 2.48% increase in net interest margin and 0.88% increase in ROA for CDS-active banks. The results suggest that once a bank has the facility to trade CDS, the more it uses the facility in

its loan supply, and the more profits it generates. For CDS-inactive banks, more lending to CDS firms reduces the net interest margin but has no effect on ROA. This finding implies a negative spillover effect of CDS on CDS-inactive banks. Overall, CDS increase both bank risk and return.

VII. Conclusion

Credit default swaps are recognized by bank capital regulations, including Basel II and Basel III, as tools that banks may deploy to manage risk. We examine whether the use of CDS is associated with bank risk taking. We find that banks are more aggressive in risk taking when they use CDS; CDS-active banks exhibit higher risk by both accounting-based and market-based measures. Both total and tier 1 capital ratios are lower for CDS-active banks than for CDS-inactive banks. We further corroborate our bank-level results with loan-level evidence. Loan size is larger and loan spread higher when a borrower's debt is referenced by CDS. However, the CDS effects on loan size and spread are significant only if the lender is an active CDS user. Moreover, when lending to CDS-referenced borrowers, loan pricing is less dependent on a lender's portfolio performance.

CDS-active banks raised more capital and contracted their lending more during the credit crisis. Their stock performance was worse than CDS-inactive banks during the crisis. However, CDS-active banks enjoy better pre-crisis financial and operating performance. Therefore, our findings suggest that banks use CDS not only to take more risk but also to obtain higher returns. At the same time, CDS-referenced borrowers receive larger loans but at higher costs. We conclude that CDS facilitate credit expansion by means of bank loan supply. Our study, however, cannot address the overall welfare impact of CDS trading and whether it is good or bad for banking. Those are important questions for future research.

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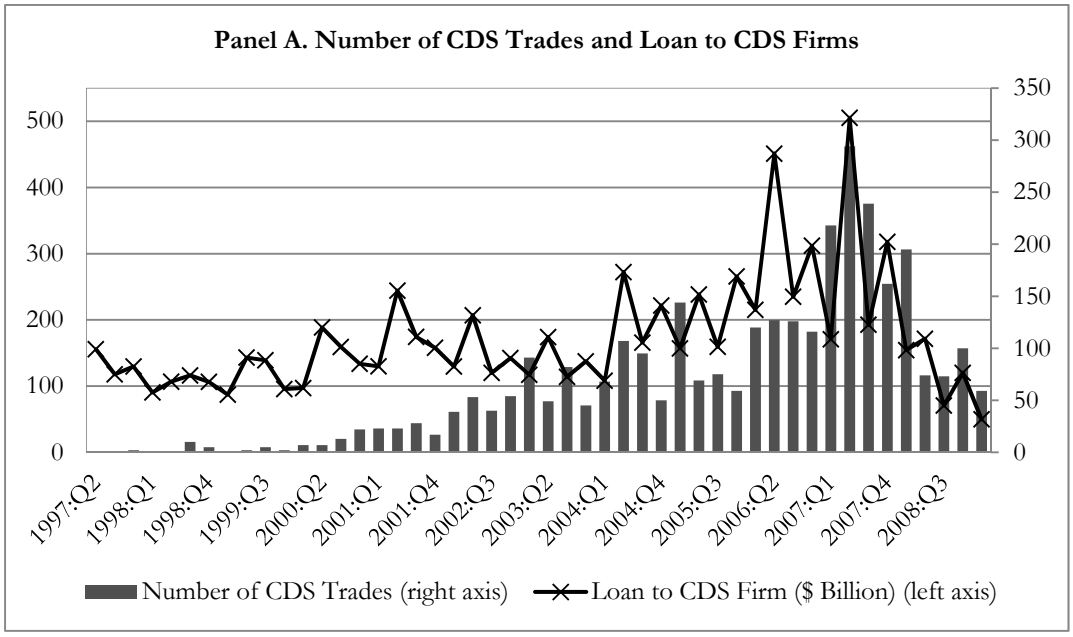
Appendix: Variable Definitions

Variable Name	Description
Bank-Level Variables	
Bank Z-score	$(ROA+CAR)/\sigma(ROA)$, where ROA is return-on-assets measured on quarterly basis; CAR is bank capital ratio measured at the end of the same quarter; $\sigma(ROA)$ is the annual standard deviation of ROA
Beta	Beta calculated from the CAPM model using monthly stock return
C&I Loans/Assets	Outstanding commercial and industrial loans relative to the bank's total assets
CAR	The capital-to-assets ratio for banks
CDS Active Bank	A dummy indicating that the bank is active in CDS trading in the bank-quarter or in the quarter of loan initiation
CDS Net Position	A bank's CDS long position (the bank as the beneficiary) – CDS short position (the bank as the guarantor)
CDS Total Position	A bank's CDS long position (the bank as the beneficiary) + CDS short position (the bank as the guarantor)
Deposits/Assets	The ratio of the sum of domestic deposits and foreign deposits relative the bank's total assets
Distance-to-Default	Following Bharath and Shumway (2008), a naive distance-to-default is calculated from the below formula: $DD_{Naive} = \frac{\ln[(E+F)/F] + (r_{t-1} - 0.5 * Naive\sigma_v^2)T}{Naive\sigma_v\sqrt{T}}$, where E is equity value equal to shares outstanding multiplied by stock price, F is the book value of debt, r_{t-1} is the stock return over $t-1$, σ_v is asset volatility, T is the forecasting horizon, $Naive\,\sigma_V = \frac{E}{E + NaiveD}\sigma_E + \frac{NaiveD}{E + NaiveD}\sigma_D$, $\sigma_D = 0.05 + 0.25 * \sigma_E$ and $NaiveD = F$.
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 CDS firms relative to total syndicated loan issuance amount from the same bank in the year prior to the bank-quarter
Loan/Assets	A bank's total outstanding loan amount relative to the bank's total assets
Market Share	The percentage of a bank's total deposit relative to the total deposit 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
ROA	The ratio of quarterly net income before extraordinary items to total assets
Risk-Weighted Capital Ratio	The ratio of total capital over risk-adjusted total assets
Tier 1 Capital Ratio	The ratio of tier-1 capital relative to risk-weighted assets
Sales Growth	The logarithm of the ratio of sales (revenue) at quarter *t* relative to sales at quarter *t-1*
Firm-Level Variables	
Cash/Assets	The ratio of the sum of cash, cash equivalents and short-term investment relative to total assets
CDS Traded	A dummy indicating that the firm ever had a CDS market referencing its debt during the sample period
CDS Trading	A dummy indicating that the firm has an active CDS market referencing its debt in the quarter of loan initiation

Firm Age	The number of years as of the first date when the firm 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 for Hedging/Trading	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/Assets	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	
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
Loan Amount/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-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
Takeover	A dummy indicating whether the purpose of a loan is for corporate takeover
Term Loan	A dummy equal to one if the loan is composed of term tranches
Working Capital	A dummy indicating whether a loan is issued for the purpose of financing working capital

Figure 1. 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.



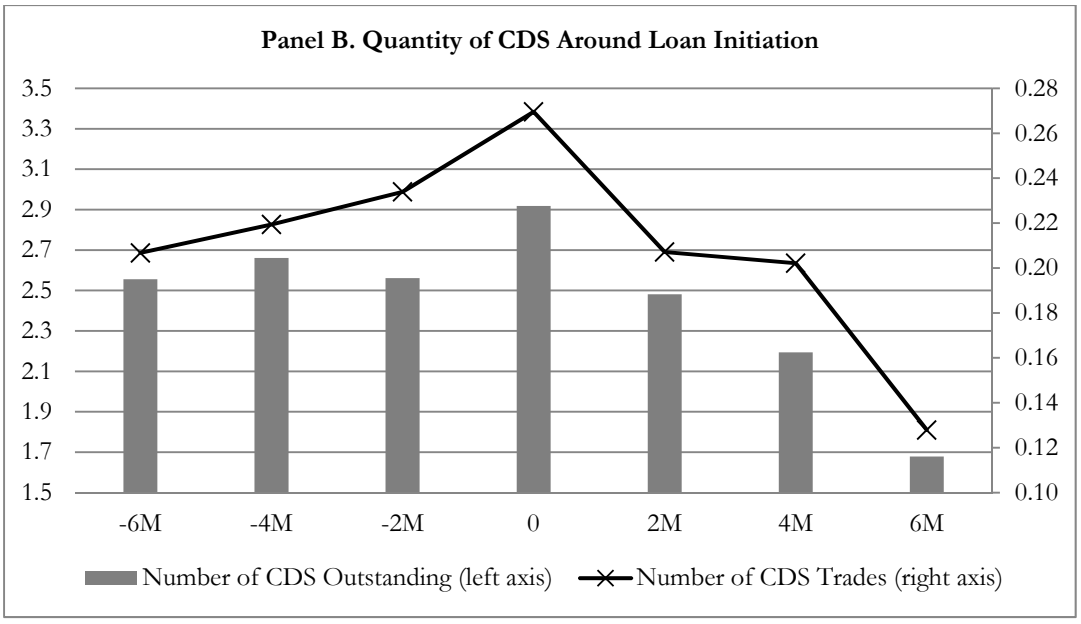


Figure 2. Number of CDS Trades and Bank Lending Standard

This figure plots the number of CDS trades and bank lending standard by quarter from 1997Q4 to 2009Q1. Lending standard information is extracted from Senior Loan Officer Opinion Survey on Bank Lending Practices reported by Federal Reserve Board (http://www.federalreserve.gov/boarddocs/snloansurvey/). The tightness of lending standard is measured by the net percent of respondents that report the lending standard for C&I loans is tight. This number is within [-100, 100]. CDS trades data are from CreditTrade and GFI database, available from June 1997. We start the plot from the fourth quarter of 1997 since the number of CDS trades is zero for the second and third quarter of 1997.

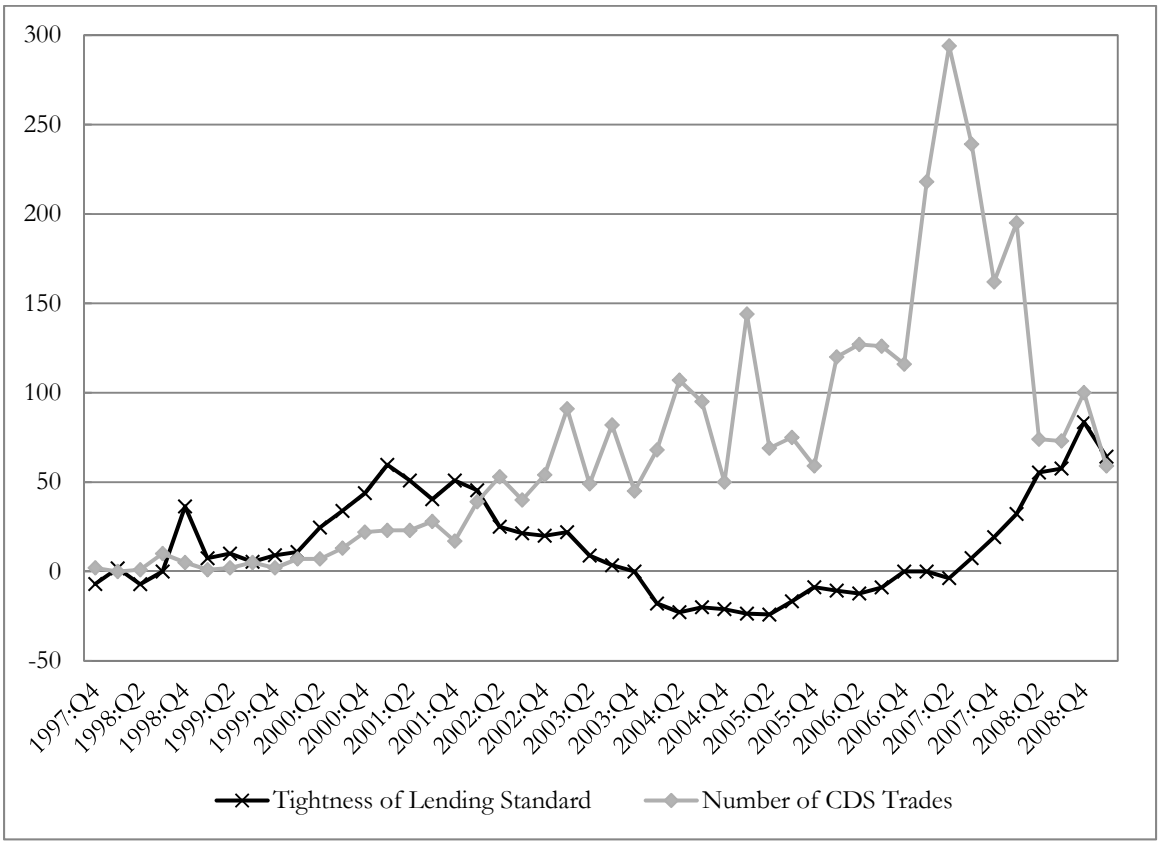


Figure 3. Bank CDS Position and Loan Quality

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.

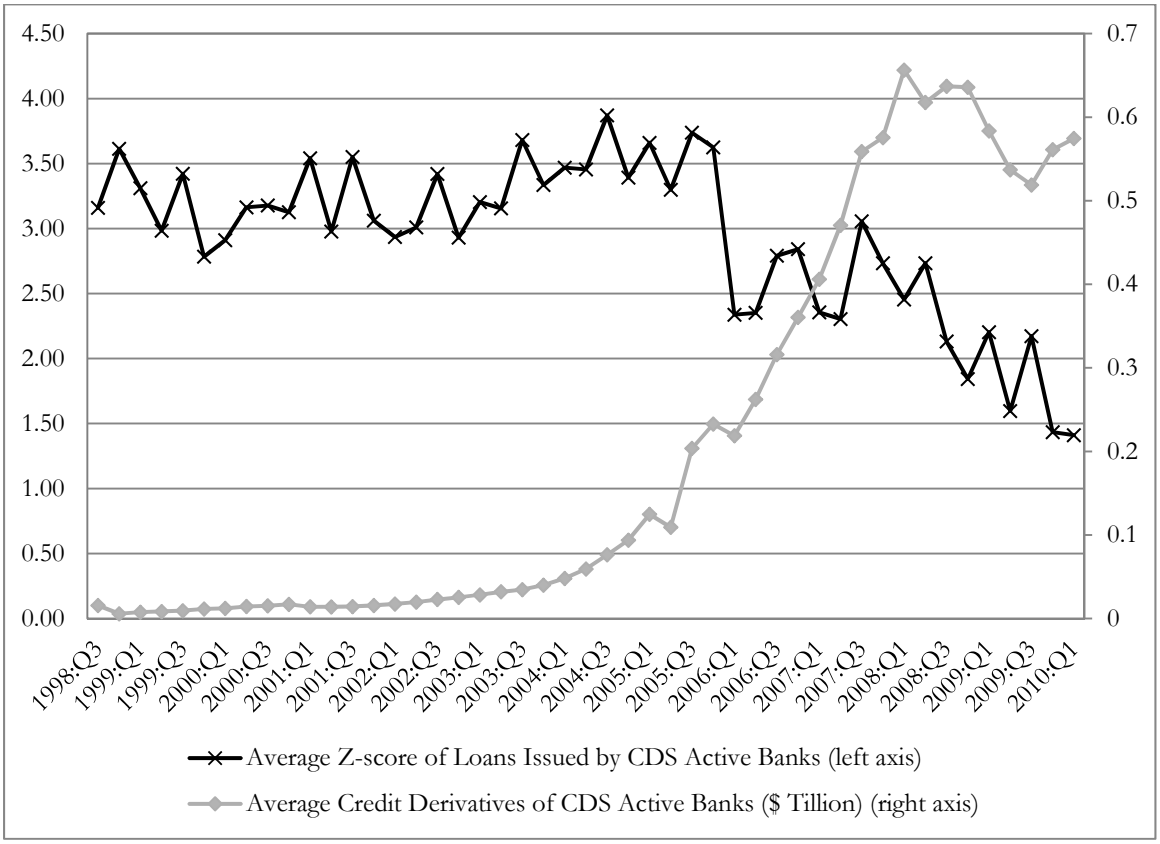


Table I

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 from from 1994 to 2009. We restrict the bank sample to banks that can be identified as syndicate lead arrangers in Dealscan. Bank-level variables are constructed using data from Compustat Bank. 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. Syndicated loans are loans from Dealscan with distribution method as "Syndication". In Panel A, ROA is annualized by multiplying 4. 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. Columns 4 to 6 report 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. See Appendix for detailed variable definitions.

Panel A. Summary Statistics of Sample Bank

Variable	Mean	StdDev	Min	Max
Bank Risk Measure				
Z-score	71.250	74.996	4.663	376.247
Distance-to-Default	7.160	2.746	-0.032	18.089
Risk Weighted Capital Asset Ratio	0.132	0.024	0.109	0.211
Tier 1 Capital Ratio	0.099	0.024	0.073	0.162
Loan Loss Provision	0.004	0.004	0.000	0.012
Bank Characteristics				
Total Assets ($ Billion)	260.983	558.091	0.060	3879.172
ROA	0.010	0.005	0.001	0.016
Net Interest Margin	0.036	0.008	0.027	0.050
Beta	0.986	0.817	-2.283	4.688
Market-to-Book	1.656	0.984	0.000	6.581
Sales Growth	0.089	0.155	-0.124	0.351
Loan/Assets	0.609	0.123	0.385	0.763
Deposits/Assets	0.586	0.163	0.337	0.852
C&I Loan/Assets	0.135	0.064	0.036	0.223
Bank CDS Position				
CDS Total Position ($ Billion)	65.085	566.022	0.000	10189.101
CDS Bought ($ Billion)	32.977	285.623	0.000	5187.211
CDS Sold ($ Billion)	32.108	279.899	0.000	5001.890
CDS Net Position	0.869	11.943	0.000	418.013

Table I — *Continued*

Panel B. Distribution of Sample Bank

Year	Number of Banks	Number of CDS Active Banks	Average Total Assets ($ Billion)	Total Loans ($ Billion)	Total Loans from CDS Active Banks ($ Billion)	Total Loans from CDS Inactive Banks ($ Billion)
1994	55	.	56.15	491.51	.	491.51
1995	54	.	65.49	574.87	.	574.87
1996	52	.	76.09	627.76	.	627.76
1997	51	13	85.76	888.98	539.55	349.43
1998	53	17	118.26	666.49	439.67	226.82
1999	56	20	140.26	652.69	555.39	97.31
2000	56	19	160.62	1181.01	1067.80	113.22
2001	62	19	185.87	1624.49	1495.32	129.17
2002	66	18	208.91	1715.64	1596.16	119.48
2003	65	20	235.72	2434.51	2281.52	153.00
2004	64	19	279.30	3780.16	3522.32	257.84
2005	62	20	339.52	4627.54	4429.79	197.74
2006	61	18	397.04	4015.65	3756.22	259.43
2007	59	18	510.02	4560.33	4427.54	132.79
2008	57	16	602.79	2661.70	2342.72	318.98
2009	53	15	631.33	2118.35	1812.54	305.81
Total	84	34	260.983	32621.68	28266.54	4355.16

Panel C. Distribution of Sample Loan

Year	Number of Syndicated Loans	Number of Unique Firms	Loan Amount ($ Million)	Spread (Basis Points)	Maturity (Years)	Number of Lenders
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 CDS Trading on Bank Risk

This table reports the estimation results of panel regressions that examine how a bank's CDS trading affects its risk. The sample is composed of quarterly observations of Compustat banks which can be identified as syndicate loan lead arrangers in Dealscan from 1994 to 2009. CDS active bank is an indicator taking the value of one if the bank is active in CDS trading in the bank-quarter, and zero otherwise. Columns 1 to 5 report regression results of five alternative bank risk measures. Definitions of variables are listed in Appendix. Distance-to-default is computed for public listed banks only. The raw loan loss provision is multiplied by 100 in regressions. All control variables are extracted one quarter prior to the bank-quarter. 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.

Variable	Log (Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier 1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
CDS Active Bank	-0.172***	-1.505***	-0.005***	-0.013***	0.076***
	(0.045)	(0.368)	(0.001)	(0.001)	(0.012)
Total Assets	0.821***	6.166	-0.035***	-0.047***	-0.074*
	(0.200)	(4.606)	(0.007)	(0.008)	(0.043)
Total Assets Squared	-0.047***	2.011	0.011***	0.015***	-0.002
	(0.014)	(9.452)	(0.002)	(0.002)	(0.017)
Sales Growth	-0.398***	-0.010	-0.001*	-0.001	-0.004
	(0.079)	(0.014)	(0.001)	(0.001)	(0.004)
Deposits/Assets	0.275*	4.593***	-0.055***	-0.007	-0.404***
	(0.141)	(1.527)	(0.011)	(0.013)	(0.152)
Loan/Assets	0.634***	1.185	0.036***	-0.010	0.366***
	(0.135)	(1.328)	(0.010)	(0.012)	(0.143)
Market Share	-405.95***	-1126.8***	-0.472*	-0.543*	-0.030
	(80.645)	(274.242)	(0.256)	(0.284)	(2.900)
Intercept	2.720***	-6.119***	0.179***	0.152***	0.853***
	(0.087)	(0.770)	(0.006)	(0.007)	(0.020)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	26.96	18.36	11.62	14.28	66.41
Observations	4280	1423	4280	4280	4280

Table III

Effects of CDS Trading on Bank Risk: Instrumental Variable Approach

This table reports the second-stage OLS regression results of bank risk measures on the fitted value of CDS active bank indicator using instrumental variable approach. The fitted value is estimated from probit regressions on two instruments: (1) a dummy that equals one if the bank-quarter observation is after year 2001, zero if the observation is during or before year 2001; (2) a loan concentration index for each bank-quarter which is calculated as the sum of the squared ratio of individual loan amount out of the bank's total loan portfolio in the same quarter. A larger index represents a more concentrated loan portfolio by construction. The instruments are lagged one quarter in the first-stage probit regression. We calculate the loan concentration ratio by extracting loan amount information from Dealscan. Results of the first-stage probit regressions are reported in Table A4 of Internet Appendix. Control variables in the second stage regression are the same as those in Table II. We do not report the coefficients of the control variables to conserve space. 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.

Panel A. Instrument 1: Post Year 2001 Dummy

Variable	Log (Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier 1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
IV (CDS Active Bank)	-0.860***	-9.456*	-0.031***	-0.044***	-0.039*
	(0.172)	(4.889)	(0.003)	(0.003)	(0.022)
Intercept	3.148***	-3.397	0.189***	0.148***	0.985***
	(0.130)	(4.061)	(0.008)	(0.006)	(0.027)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	31.34	29.22	30.65	19.57	70.49
Observations	1296	353	1296	1296	1296

Panel B. Instrument 2: Loan Concentration

Variable	Log (Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier 1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
IV (CDS Active Bank)	-0.561***	-4.320***	-0.017***	-0.033***	-0.003
	(0.129)	(1.349)	(0.004)	(0.003)	(0.019)
Intercept	2.896***	-0.823	0.179***	0.137***	0.971***
	(0.122)	(3.964)	(0.008)	(0.006)	(0.028)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	31.01	24.84	31.61	15.57	71.55
Observations	1296	353	1296	1296	1296

Table IV

CDS Trading and Bank Risk: Effects of Lending to CDS Firm

This table reports the estimation results of panel regressions that examine how a bank's risk is affected by their lending to CDS firms. The sample of banks and bank risk measures are the same as we used in Table II and III. CDS bank refers to banks that ever traded CDS at any time during the sample period. CDS firms refer to borrowers that have an active CDS market referencing its debt in the quarter of loan initiation. Loans to CDS firm ratio is the ratio of syndicated loan issuance amount issued to CDS firms relative to the total amount of all syndicated loan issuance amount from the same bank in the same year. Loan to CDS firm ratio is lagged one year in the regressions. All control variables are extracted one quarter prior to the bank-quarter. 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	Log (Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
Loan to CDS	-0.093**	-1.021**	-0.002	-0.007**	0.118***
Firm Ratio	(0.046)	(0.499)	(0.002)	(0.003)	(0.021)
Total Assets	-0.154	1.333	-0.016***	-0.032***	-0.228***
	(0.276)	(1.043)	(0.004)	(0.005)	(0.055)
Total Assets Squared	-0.025	-1.844***	0.005***	0.011***	0.041**
	(0.016)	(0.048)	(0.001)	(0.002)	(0.021)
Sales Growth	-0.627***	0.000	0.000	0.001	-0.000
	(0.087)	(0.001)	(0.001)	(0.001)	(0.001)
Deposits/Assets	0.443	0.021	-0.005	0.045***	0.039
	(0.659)	(0.030)	(0.007)	(0.007)	(0.034)
Loan/Assets	-0.446	-0.005	-0.002	-0.051***	-0.023
	(0.643)	(0.028)	(0.007)	(0.007)	(0.032)
Market Share	-397.64***	-3.008	-0.108	0.068	0.141
	(104.470)	(3.504)	(0.240)	(0.294)	(4.303)
Intercept	3.051***	5.298***	0.168***	0.140***	1.002***
	(0.101)	(0.724)	(0.003)	(0.003)	(0.014)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	7.95	24.41	18.66	28.22	86.43
Observations	2638	858	2638	2638	2638

Table V

CDS Trading, Loan Amount and Loan Spread: Baseline Regression

This table presents OLS regression results of loan amount and loan spread on CDS trading in borrower's name, controlling for loan and borrower characteristics. In Panel A, the dependent variable is loan amount relative to the firm's total assets at the end of quarter *t-1*. In Panel B, the dependent variable is the all-in-drawn spread. The independent variable of interest is CDS trading, a dummy equal to one if the firm has quoted CDS contracts referencing its debt in the quarter of loan origination. CDS traded is a dummy equal to one if the firm ever had a CDS market on its debt at any time during the 1994-2009 sample period. Firm-level control variables are extracted at the end of the quarter prior to 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		
Variable	(1)	(2)
CDS Trading	0.145***	0.185***
	(0.029)	(0.031)
CDS Traded	0.064**	
	(0.026)	
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 (Total Assets)	-0.166***	-0.162***
	(0.022)	(0.021)
Cash/Assets	1.351***	1.350***
	(0.389)	(0.389)
Leverage	0.142	0.142
	(0.136)	(0.136)
Log (1+Number of Lenders)	3.437***	3.439***
	(0.671)	(0.672)
Log (1+Firm Age)	-0.008	-0.006
	(0.019)	(0.019)
Market-to-Book	-1.522	-1.348
	(5.538)	(5.538)
Rated	0.010	0.018
	(0.019)	(0.019)
Sales/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)
Prime Rate	-4.718	-4.658
	(4.149)	(4.141)
Intercept	0.472	0.442
	(0.323)	(0.322)
Fixed Year, Industry, and Loan Purpose Controls	Yes	Yes
R-squared (%)	41.14	41.12
Observations	15546	15546

Table V — *Continued*

Panel B. Loan Spread		
Variable	(1)	(2)
CDS Trading	15.499***	7.218*
	(3.896)	(3.736)
CDS Traded	-13.204***	
	(3.408)	
Loan Amount/Assets	2.243***	2.185***
	(0.816)	(0.816)
Maturity	8.202***	8.380***
	(2.783)	(2.794)
Secured	73.631***	73.976***
	(2.565)	(2.564)
Term Loan	18.290***	18.518***
	(3.122)	(3.118)
Log (Total Assets)	-19.104***	-19.930***
	(1.073)	(1.045)
Cash/Assets	60.604***	60.888***
	(13.615)	(13.637)
Leverage	161.722***	162.081***
	(9.899)	(9.874)
Log (1+Number of Lenders)	-156.462***	-157.016***
	(10.040)	(10.499)
Log (1+Firm Age)	-5.200***	-5.503***
	(1.489)	(1.482)
Market-to-Book	-546.20	-584.06
	(519.952)	(519.425)
Rated	5.865**	4.135
	(2.898)	(2.857)
Sales/Assets	1.526	1.485
	(3.326)	(3.325)
Tangibility	-12.505**	-12.941**
	(5.776)	(5.816)
Z-score	-5.452***	-5.499***
	(0.479)	(0.480)
Prime Rate	-681.87***	-695.77***
	(161.772)	(161.828)
Intercept	428.997***	435.597***
	(25.967)	(25.673)
Fixed Year, Industry, and Loan Purpose Controls	Yes	Yes
R-squared (%)	49.51	49.43
Observations	15546	15546

Table VI

CDS Trading, Loan Amount and Loan Spread: Instrumental Variable Approach

This table presents OLS regression results of loan amount and loan spread on instrumented CDS trading. In the first stage we estimate a probit 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 FR Y-9C. The presence of bond market is a dummy indicating whether the firm has a bond market prior to its issuance of loan. Bond trading information is from Mergent Fixed Income Securities Database (FISD). The first-stage probit regression results are report in Table A9 of Internet Appendix. In the third probit regression we incorporate both instruments as the independent variables. In the second stage we regress loan amount relative to total assets and loan spread on the fitted value of CDS trading from the first stage, with the same controls as in the baseline regression in Table V. We do not report the coefficients of the controls to conserve space. Columns 1 to 3 report regression results on the fitted value of CDS trading in borrowers' name obtained from first-stage probit regressions 1 to 3, respectively. 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.

Panel A. Loan Amount/Total Assets			
Variable	(1)	(2)	(3)
Instrument1 (FX Derivatives)	0.781***		
	(0.110)		
Instrument2 (Presence of Bond Trading)		0.260***	
		(0.037)	
Instrument3 (FX Derivatives 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)
Fixed Year, Industry, Loan Purpose Controls	Yes	Yes	Yes
R-squared (%)	28.25	29.29	28.74
Observations	14416	14416	14416

Panel B. Loan Spread			
Variable	(1)	(2)	(3)
Instrument1 (FX Derivatives)	15.841***		
	(4.437)		
Instrument2 (Presence of Bond Trading)		14.612**	
		(7.179)	
Instrument3 (FX Derivatives and Presence of Bond Trading)			21.427***
			(6.104)
Loan Amount/Assets	-5.666***	-5.568***	-5.769***
	(1.459)	(1.452)	(1.471)
Intercept	253.952***	251.399***	256.268***
	(11.837)	(12.260)	(12.082)
Fixed Year, Industry and Loan Purpose Controls	Yes	Yes	Yes
R-squared (%)	48.97	48.91	48.96
Observations	14416	14416	14416

Table VII

CDS Trading, Loan Amount and Loan Spread: Propensity Score Matching

This table presents regression results of loan amount and loan spread on CDS trading in borrower's name, with a matched sample, based on the propensity score estimated from a probit model of the likelihood of CDS trading. The treatment group is confined to CDS firms that borrow both before and after their CDS started to be traded. To form the matched sample, we keep firm-quarters only from the first quarter of 1994 until the first quarter that CDS trading begins. We add firms that remain untraded through the end of our sample period (non-CDS firm). Then we obtain propensity scores by estimating a probit model where the dependent variable is one if the firm has active CDS trading in the current quarter. The explanatory variables for the probit regressions are the same as we used in Table A9 of Internet Appendix. We pair each treatment firm with a matching by selecting from the control group the one with nearest propensity score from the same 2-digit SIC industry. The control group of loans for the matched sample is formed of syndicated loans issued by matching firms in the same year. 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 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.

Panel A. Loan Amount/Total Assets		
Variable	(1)	(2)
CDS Trading	0.032*	0.044***
	(0.018)	(0.016)
CDS Traded	0.019	
	(0.022)	
Loan Spread	0.023	0.023
	(0.015)	(0.015)
Intercept	0.391***	0.396***
	(0.123)	(0.123)
Fixed Loan Purpose Controls	Yes	Yes
Fixed Year Controls	Yes	Yes
Fixed Industry Controls	Yes	Yes
R-squared (%)	40.09	40.07
Observations	6740	6740

Panel B. Loan Spread		
Variable	(1)	(2)
CDS Trading	10.299**	8.498*
	(5.216)	(5.172)
CDS Traded	-2.901	
	(5.243)	
Loan Amount/Assets	-0.777	-0.823
	(2.956)	(2.943)
Intercept	307.970***	307.352***
	(37.120)	(36.872)
Fixed Loan Purpose Controls	Yes	Yes
Fixed Year Controls	Yes	Yes
Fixed Industry Controls	Yes	Yes
R-squared (%)	51.73	51.72
Observations	6740	6740

Table VIII

CDS Trading on Bank Lending Practice: CDS-active versus CDS-inactive Banks

This table reports regression results of loan amount and loan spread on lead banks' CDS activities of a matched sample of loans in Panels A and B, respectively. CDS bank refers to lead banks that ever traded CDS in the sample period. CDS inactive bank refers to banks that never traded CDS during the sample period. We pair each CDS inactive bank with one CDS bank by selecting from the CDS bank group the one with nearest total asset value in the same quarter. Then we extract syndicated loans from each paired banks in the same quarter to form the matched loan sample. Specifications in even columns control for CDS firm fixed effects (CDS traded). The other control variables in the OLS regression are the same as we used in baseline regression reported 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 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.

Panel A. Loan Amount/Total Assets				
	CDS-active Bank		CDS-inactive Bank	
Variable	(1)	(2)	(3)	(4)
CDS Trading	0.197***	0.149**	0.055	-0.224
	(0.068)	(0.064)	(0.076)	(0.171)
CDS Traded		0.063		0.398*
		(0.047)		(0.208)
Loan Spread	-0.001	-0.001	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	1.500**	1.526**	0.449	0.760
	(0.698)	(0.703)	(0.727)	(0.581)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	27.52	27.54	39.35	41.19
Observations	3830	3830	734	734

Panel B. Loan Spread				
	CDS-active Bank		CDS-inactive Bank	
Variable	(1)	(2)	(3)	(4)
CDS Trading	17.661***	20.882***	-22.571	-10.295
	(5.366)	(6.755)	(16.055)	(18.181)
CDS Traded		-4.223		-17.580
		(7.176)		(12.342)
Loan Amount/Assets	-0.600	-0.579	-2.947	-1.597
	(2.234)	(2.234)	(7.699)	(7.782)
Intercept	645.806***	643.991***	558.041***	541.975***
	(23.802)	(24.732)	(43.009)	(45.242)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	48.43	48.44	48.18	48.34
Observations	3830	3830	734	734

Table IX

CDS Trading and Bank Resilience: Effects of Negative Banking Shocks

This table reports estimation results of regressions that examine how the effects of CDS trading on loan spread is impacted by negative banking shocks. Banking shocks are measured by state-level default and lender portfolio default. In columns 1 and 2, the independent variable of interest is the interaction of CDS trading and state-level default. Default in same state is a dummy taking one if any firms located in the same state as the lead lender filed for bankruptcy. Percent of default in same state is the percentage of firms filing for bankruptcy out of all firms in the lender's state. In columns 3 and 4, 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 (CDS traded). The 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.

Dependent Variable: Loan Spread				
Variable	(1)	(2)	(3)	(4)
CDS Trading*Default in Same State	-12.805**			
	(5.531)			
Default in Same State	4.855			
	(5.597)			
CDS Trading*Fraction of Default in Same State		-4.079*		
		(2.414)		
Fraction of Default in Same State		3.714***		
		(1.270)		
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	21.877***	16.765***	18.014***	16.414***
	(5.680)	(4.260)	(4.892)	(4.426)
CDS Traded	-14.413***	-14.316***	-5.330	-5.205
	(3.141)	(3.150)	(4.405)	(4.397)
Intercept	451.520***	453.137***	366.934***	366.766***
	(21.003)	(20.835)	(27.558)	(27.733)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	51.15	51.13	55.62	55.73
Observations	16416	16416	7057	7057

Table X

CDS Trading and Bank Behavior during 2007-2009 Credit Crisis

This table reports the regression results of bank risk-taking 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. The sample is composed of banks that can be identified as syndicate lead arrangers in Dealscan. 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-period: 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 prior quarter. 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.

Panel A. Bank Capitalization				
	Full Sample		2005-2009 Sample	
Variable	Tier-1 Capital Ratio	Total Risk-Weighted Capital Ratio	Tier-1 Capital Ratio	Total Risk-Weighted Capital Ratio
	(1)	(2)	(3)	(4)
CDS Active Bank*Crisis 07-08	-0.003	0.007*	-0.003	0.006
	(0.004)	(0.004)	(0.005)	(0.004)
CDS Active Bank*Crisis 08-09	0.012**	0.020***	0.009*	0.016***
	(0.005)	(0.004)	(0.005)	(0.005)
CDS Active Bank	-0.015***	-0.006***	-0.010***	0.000
	(0.001)	(0.002)	(0.002)	(0.002)
Crisis 07-08	-0.002	-0.009**	-0.001	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)
Crisis 08-09	-0.004	-0.008*	-0.000	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)
Total Assets	-0.049***	-0.044***	-0.027***	-0.012
	(0.008)	(0.009)	(0.010)	(0.011)
Total Assets Squared	-0.002***	-0.001*	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Sales Growth	-0.000	-0.002	-0.012***	-0.018***
	(0.003)	(0.004)	(0.005)	(0.005)
Deposits/Assets	0.092***	0.075***	0.129***	0.127***
	(0.007)	(0.008)	(0.019)	(0.018)
Loan/Assets	-0.132***	-0.118***	-0.144***	-0.150***
	(0.008)	(0.009)	(0.019)	(0.017)
Market Share	17.126***	15.432***	6.101	-0.350
	(3.272)	(3.742)	(4.966)	(5.077)
Intercept	0.152***	0.187***	0.133***	0.160***
	(0.004)	(0.007)	(0.005)	(0.005)
Fixed Year Controls	Yes	Yes	Yes	Yes
R-squared (%)	42.77	31.16	50.18	46.13
Observations	4280	4280	1150	1150

Table X — *Continued*

Panel B. New Loan Issuance Amount						
Variable	Total Loan/Assets	Revolver/ Assets	Total Loan/Assets	Revolver/ Assets	Total Loan/Assets	Revolver/ Assets
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Active Bank*Crisis 07-08	-0.008	-0.011**				
	(0.007)	(0.005)				
CDS Active Bank*Crisis 08-09	-0.021***	-0.016***				
	(0.006)	(0.005)				
CDS Active Bank	0.024***	0.019***				
	(0.005)	(0.004)				
Total CDS/Bank Assets*Crisis 07-08			-0.017***	-0.017***		
			(0.004)	(0.003)		
Total CDS/Bank Assets*Crisis 08-09			-0.023***	-0.023***		
			(0.003)	(0.003)		
Total CDS/Bank Assets			0.030***	0.028***		
			(0.003)	(0.003)		
Net CDS/Bank Assets*Crisis 07-08					-1.852***	-1.998***
					(0.648)	(0.478)
Net CDS/Bank Assets*Crisis 08-09					-2.275***	-2.372***
					(0.642)	(0.470)
Net CDS/Bank Assets					2.500***	2.528***
					(0.634)	(0.467)
Crisis 07-08	-0.009***	-0.005*	-0.011***	-0.009***	-0.011***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Crisis 08-09	-0.013***	-0.010***	-0.022***	-0.016***	-0.022***	-0.014***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)
Total Assets	0.009	0.015***	-0.005	0.001	0.005	0.009**
	(0.006)	(0.006)	(0.004)	(0.003)	(0.005)	(0.004)
Total Assets Squared	-0.003	-0.004***	0.002*	0.000	-0.001	-0.003**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Sales Growth	0.009**	0.006*	0.009***	0.006**	0.010***	0.006**
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Deposits/Assets	0.059	0.030	0.083	0.051	0.170	0.132
	(0.162)	(0.136)	(0.161)	(0.137)	(0.174)	(0.141)
Market Share	0.330	0.512	0.043	0.166	1.090	1.231*
	(0.817)	(0.740)	(0.479)	(0.400)	(0.707)	(0.652)
Intercept	0.015***	0.006**	0.030***	0.018***	0.025***	0.013***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
R-square (%)	31.26	8.12	58.72	53.85	43.11	41.35
Observations	937	937	937	937	937	937

Table XI

Stock Market Reaction to Bank CDS Trading: 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 column 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 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 Active Bank in 2008:Q2	-0.245**		
	(0.106)		
CDS Active Bank in 2007:Q2		-0.292**	
		(0.136)	
CDS Active Bank 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)
Beta	-0.009	0.065	-0.070*
	(0.123)	(0.076)	(0.037)
Deposits/Assets	-0.520	0.832	0.079
	(0.597)	(0.753)	(0.124)
Leverage	-1.945***	-0.033	0.289
	(0.653)	(1.368)	(0.292)
Loan/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-1Capital 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

Table XII
CDS Trading and Bank Profitability

This table reports regression results of bank profit on bank CDS trading. Bank profit is measured by net interest margin and ROA. Net interest margin is the difference between the interest income of a bank and the amount of interest paid out to its lenders, relative to the amount of its interest-earning assets. ROA is multiplied by 100 in regressions. The sample of banks used in columns 1 and 2 is all sample banks that we used in regressions in Table II. Columns 3 and 4 employ the sample of CDS banks, which are banks that ever traded CDS at some point during the sample period. Columns 5 and 6 employ the sample of CDS inactive banks, which are banks that never traded CDS during the sample period. The independent variable of interest in columns 1 and 2 is CDS active bank, an indicator taking the value of one if the lead lender is active in CDS trading in the quarter of loan initiation. The independent variable of interest in columns 3 to 6 is the loan to CDS firm ratio, which is calculated as the ratio of syndicated loan issuance amount to CDS firms relative to the total issuance amount of syndicated loan from the same bank in the same year. Loan to CDS firm ratio is lagged one year when entering 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.

	All Banks		CDS-active Bank		CDS-inactive Bank	
Variable	Net Interest Margin	ROA	Net Interest Margin	ROA	Net Interest Margin	ROA
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Active Banks	0.004***	0.002				
	(0.000)	(0.015)				
Loan to CDS Firm Ratio			0.003***	0.067**	-0.009***	0.041
			(0.001)	(0.032)	(0.001)	(0.035)
Total Assets	-0.023***	-0.105*	-0.009***	-0.053	-0.031***	-0.346***
	(0.002)	(0.063)	(0.003)	(0.114)	(0.002)	(0.092)
Total Assets Squared	0.001***	-0.015***	-0.000***	-0.001	0.003***	-0.032***
	(0.000)	(0.005)	(0.000)	(0.007)	(0.001)	(0.009)
Sales Growth	0.002***	0.018	0.003***	0.007	0.003*	0.021
	(0.001)	(0.023)	(0.001)	(0.027)	(0.001)	(0.040)
Deposits/Assets	0.016***	0.098	0.017***	0.519***	0.006	-0.180***
	(0.005)	(0.152)	(0.005)	(0.140)	(0.009)	(0.070)
Total Loan/Assets	-0.009**	-0.111	-0.009**	-0.472***	-0.009	0.044
	(0.005)	(0.152)	(0.004)	(0.143)	(0.009)	(0.078)
Market Share	2.707***	37.109*	1.761	-22.364	-3.317***	98.157***
	(0.756)	(21.879)	(1.315)	(39.188)	(0.869)	(32.241)
Intercept	0.032***	0.225***	0.030***	0.206***	0.037***	0.306***
	(0.001)	(0.025)	(0.001)	(0.027)	(0.001)	(0.048)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	63.99	9.57	23.53	14.65	30.85	10.51
Observations	4280	4280	2638	2638	1642	1642

Internet Appendix for Additional Results

Figure A1. Bank CDS Position around 2007-2009 Credit Crisis

This figure plots lead banks' CDS position by quarter around the 2007-2009 credit crisis. Bank CDS position is calculated as the sum of CDS long and short position (CDS bought + CDS sold). Bars represent total CDS position aggregated across banks (left y-axis). The line with stars represents averaged CDS position by bank (right y-axis). Bank CDS position data are from Federal Reserve Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) and Quarterly Report on Bank Derivatives from Office of the Comptroller of Currency (OCC).

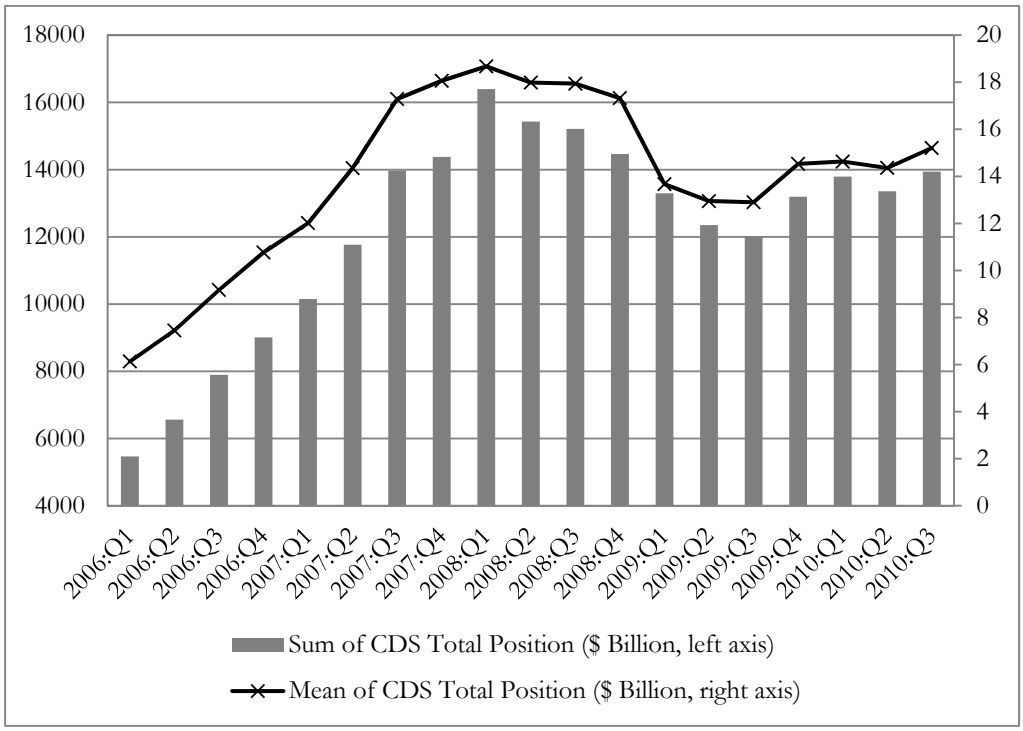


Table A1. Summary Statistics of Syndicated Loan Sample

This table summarizes loan and borrower characteristics of our sample syndicated loans and borrowing fimrs. Syndicated loan information is extracted from Dealscan from 1994 to 2009. Loan characteristics are reported at deal (package) level. Maturity and spread are the averaged maturity (in years) and all-in-drawn spread (in basis points) across tranches at loan-level. Secured is a dummy indicating whether the loan is secured by collateral. Rated is dummy taking one if the borrower has an S&P long-term issuer rating at loan initiation. Multiple tranche indicator, term tranche indicator and multiple lead arranger indicator are indicators taking one if the loan is composed of multiple tranches, contains term tranches and involves multiple syndicate leaders, respectively. Rows under "Type of Syndicate Members" report the fraction of loans involving each type of lenders. Variables describing borrower characteristics are extracted at the end of quarter prior to loan initiation. Leverage is calculated as (short-term debt+0.5*long-term debt)/total assets. Tangibility refers to the ratio of tangible assets relative to total assets. Current ratio is the ratio of current assets relative to current liability. Q is the sum of market value of equity plus book value of debt divided by total assets, where market value of equity equals price per share times the total number of shares outstanding, and book value of debt equals total assets minus book value of equity. Firm age refers to years since the firm first appears in Compustat. Fixed charge coverage is computed as sum of rolling four quarter operating income before depreciation) / (sum of rolling four quarter interest expenses + debt in current liabilities one year prior). Z-score developed by Altman (1968) is 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.

Variable	Mean	St Dev	Min	Max
Loan Characteristics				
Loan Amount ($ Million)	400.32	731.763	0.094	4300.000
Maturity (Years)	5.360	5.120	0.33	28.33
Secured	0.309	0.458	0	1
Loan Spread	169.62	131.358	13.000	650.000
Rated	0.360	0.480	0	1
Multiple Tranche Indicator	0.272	0.445	0	1
Term Tranche Indicator	0.263	0.440	0	1
Multiple Lead Arranger Indicator	0.261	0.439	0	1
Loan Purpose: CP Backup	0.056	0.230		
Loan Purpose: Debt Refinancing	0.179	0.383		
Loan Purpose: Takeover	0.065	0.247		
Loan Purpose: Working Capital	0.149	0.356		
Type of Syndicate Members				
Commercial Bank	0.952	0.214		
Insurance Company	0.027	0.161		
Investment Bank	0.124	0.330		
Finance Company	0.196	0.397		
Mutual Fund	0.013	0.113		
Hedge Fund	0.000	0.000		
Other	0.136	0.343		
Borrower Characteristics				
Total Assets ($ Million)	1376.416	8.087	5.448	837101.000
Leverage	0.199	0.144	0	0.754
Cash/Total Assets	0.055	0.077	0	0.473
Tangibility	0.348	0.263	0	0.915
Market-to-Book	1.376	2.315	0.000	15.067
Q	1.650	0.937	0.702	6.405
Current Ratio	1.781	1.271	0.236	8.885
Firm Age	18.342	16.141	0	61
Log (1+Fixed Charge Coverage)	0.013	0.010	-0.007	0.049
Return-on-assets	0.005	0.036	-0.227	0.088
Z-score	3.021	3.427	-4.047	26.906

Table A2. Effects of CDS Trading on Bank Risk: All Compustat Banks

This table reports the estimation results of regressions that examine how bank risk is affected by bank CDS trading, using an alternative sample. The sample is composed of all Compustat bank-quarter from 1994 to 2009. CDS active bank is an indicator taking the value of one if the bank is active in CDS trading in the quarter of observation. Bank risk measures are the same as in Table II. Loan loss provision is multiplied by 100 when entering regressions. All control variables are extracted one quarter prior to the observation. 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	Log(Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier 1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
CDS Active Bank	-0.185***	-0.472*	-0.007***	-0.011***	0.068***
	(0.071)	(0.259)	(0.001)	(0.001)	(0.011)
Total Assets	-868.32***	3.156***	-0.048***	-0.061***	-0.282***
	(119.986)	(1.093)	(0.004)	(0.004)	(0.053)
Total Assets Squared	1.837***	-1.112*	0.005***	0.006***	-0.009
	(0.041)	(0.604)	(0.001)	(0.001)	(0.010)
Sales Growth	1.667***	-0.094	-0.022***	-0.006***	-0.002
	(0.249)	(0.107)	(0.001)	(0.001)	(0.004)
Deposits/Assets	-0.071**	2.673***	0.021***	0.043***	0.016
	(0.036)	(0.693)	(0.003)	(0.004)	(0.016)
Total Loan/Assets	0.018	-2.933***	-0.045***	-0.049***	-0.009
	(0.038)	(0.777)	(0.003)	(0.005)	(0.020)
Market Share	1.979***	-3230.9***	-5.994***	-3.682**	0.115
	(0.174)	(659.769)	(1.708)	(1.504)	(20.048)
Intercept	-0.783***	5.746***	0.114***	0.081***	0.132***
	(0.199)	(0.276)	(0.001)	(0.001)	(0.017)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	9.03	10.29	11.62	14.28	66.41
Observations	36696	17383	36696	36696	36696

Table A3. Effects of CDS Trading on Bank Risk: Excluding Big Banks

This table reports the regression results of bank risk measures on bank CDS activities for the sample that are identified as syndicate lead arrangers in Dealscan, excluding banks with deposits exceeding 10% of the total deposits aggregated across banks in the same quarter. CDS active bank is an indicator taking the value of one if the bank is active in CDS trading in the quarter of observation. Bank risk measures are the same as in Table II. Loan loss provision is multiplied by 100 when entering regressions. All control variables are extracted one quarter prior to the observation. 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	Log(Z-score)	Distance-to-Default	Total Risk-Weighted Capital Ratio	Tier 1 Capital Ratio	Loan Loss Provision
	(1)	(2)	(3)	(4)	(5)
CDS Active Bank	-0.394***	-1.280***	-0.006***	-0.007***	0.071***
	(0.052)	(0.357)	(0.001)	(0.001)	(0.013)
Total Assets	1.105***	3.676*	-0.018***	-0.018***	-0.031
	(0.249)	(2.147)	(0.005)	(0.005)	(0.077)
Total Assets Squared	-0.063***	-3.002***	0.002***	0.001**	-0.014
	(0.018)	(0.453)	(0.001)	(0.000)	(0.011)
Sales Growth	-0.456***	0.872*	0.001	-0.000	-0.049**
	(0.098)	(0.479)	(0.003)	(0.003)	(0.020)
Deposits/Assets	0.449***	4.420***	-0.033***	0.111***	-0.198*
	(0.169)	(1.640)	(0.008)	(0.009)	(0.111)
Total Loan/Assets	0.710***	-3.151**	0.018**	-0.106***	0.177*
	(0.162)	(1.602)	(0.008)	(0.009)	(0.102)
Market Share	-472.53***	-853.76	-9.868***	-2.034	-72.399***
	(100.525)	(859.282)	(1.844)	(2.065)	(28.077)
Intercept	2.325***	6.923***	0.108***	0.061***	0.100***
	(0.102)	(1.128)	(0.002)	(0.002)	(0.019)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes
R-squared (%)	27.12	16.97	16.84	37.09	65.98
Observations	4099	1410	4099	4099	4099

Table A4. Probit Regression of the Likelihood of Bank Trading CDS

This table reports estimation results of the first-stage probit regression of banks trading CDS on the instrumental variables. The dependent variable is an indicator equal to one if the bank is active in CDS trading in the bank-quarter. The instrumental variables are: (1) a dummy equal to one if the observation is after year 2001, zero otherwise; (2) a loan concentration index for each bank-quarter which is calculated as the sum of the squared ratio of individual loan issuance amount out of the bank's total loan issuance amount in the same quarter. The loan concentration index is lagged one quarter in regression. Controls include variables that describe bank characteristics, capital, risk, 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. 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)
Instrument		
Post Year 2001	0.382***	
	(0.140)	
Loan Concentration		0.709***
		(0.198)
Bank Characteristics		
Total Assets	6.126***	8.667***
	(0.811)	(1.591)
Total Assets Squared	-1.210***	-2.363***
	(0.259)	(0.514)
Sales Growth	-0.388**	-0.845***
	(0.197)	(0.281)
Market Share	0.003	0.266***
	(0.010)	(0.066)
Market-to-Book	1.596**	-0.165
	(0.708)	(0.886)
Leverage	-0.144	-7.538***
	(1.128)	(1.626)
Beta	-0.530***	-0.192
	(0.091)	(0.160)
ROA	0.352**	-0.027
	(0.176)	(0.189)
Net Interest Margin	-5.462	-22.479*
	(8.424)	(11.630)
Deposit/Total Assets	-3.041***	-1.650**
	(0.579)	(0.647)
Loan/Total Assets	2.129***	3.816***
	(0.574)	(0.707)
ROA Volatility	-0.108	-0.069
	(0.258)	(0.341)
Net Interest Margin Volatility	2.250***	1.404**
	(0.546)	(0.708)
Z-score	-0.001	-0.001
	(0.001)	(0.001)
Tier 1 Ratio	-50.165***	-42.668***
	(5.653)	(7.720)
Risk-Weighted Capital Ratio	2.369	19.624***
	(4.961)	(7.414)
Bank Other Derivatives Trading		
Has Other Derivatives for Hedging	-0.384**	-0.220
	(0.181)	(0.230)
Has Other Derivatives for Trading	0.827***	0.362*
	(0.186)	(0.219)
Intercept	3.234***	-19.959
	(0.630)	(163.338)
Fixed Year Controls	No	Yes
Adjusted R-squared (%)	49.04	51.65
Observations	4280	4280

Table A5. 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 by lead bank-quarter; (2) the number of CDS trades referencing the borrower's debt extracted in the quarter of loan initiation. Other explanatory variables which are composed of three sets: (1) bank characteristics; (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	0.026***	0.016***	0.009**			
Borrowers	(0.007)	(0.006)	(0.004)			
Number of CDS Trades				0.091***	0.047***	0.025*
Referencing Borrower Debt				(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	0.188	0.381***	0.135***
		(0.231)	(0.180)		(0.010)	(0.009)
Have Other Derivatives Position for Trading		-0.387*	-0.170	-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)
Fixed Year Controls	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 A6. Effects of Bank CDS Positions on C&I Loans

This table reports estimation results of regressions that examine how banks' outstanding commercial and industrial loan amount (C&I loans) is affected by their CDS trading. The dependent variable is banks' outstanding C&I loans scaled by the bank's total loan outstanding in the same quarter. The independent variables of interest are indicators representing whether the bank is active in CDS trading in the current and previous quarters. CDS active bank is an indicator equal to one if the bank is active in CDS trading in the quarter of observation. Quarterly C&I loan data are extracted from Federal Reserve Consolidated Financial Statements for Bank Holding Companies (FR Y-9C). Control variables are from Compustat Bank and FR Y-9C. 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)
CDS Active Bank	0.035***					0.020***
	(0.012)					(0.006)
CDS Active Bank Lag 1 Quarter		0.033***				0.008**
		(0.012)				(0.003)
CDS Active Bank Lag 2 Quarters			0.032**			0.009***
			(0.013)			(0.003)
CDS Active Bank Lag 3 Quarters				0.031**		0.006
				(0.014)		(0.005)
CDS Active Bank Lag 4 Quarters					0.029**	0.001
					(0.014)	(0.007)
Total Assets	0.105*	0.113*	0.113*	0.110*	0.109*	0.088
	(0.057)	(0.058)	(0.060)	(0.062)	(0.064)	(0.063)
Total Assets Squared	-0.002	-0.003	-0.003	-0.003	-0.004	-0.002
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Sales Growth	0.002	0.002	0.004	0.003	0.003	0.003
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Deposits/Assets	-0.034	-0.036	-0.038	-0.039	-0.040	-0.032
	(0.040)	(0.040)	(0.040)	(0.041)	(0.041)	(0.040)
Loan/Assets	0.236***	0.236***	0.237***	0.237***	0.238***	0.236***
	(0.042)	(0.042)	(0.042)	(0.043)	(0.043)	(0.042)
Market Share	-64.244**	-65.995**	-64.997**	-63.186*	-62.505*	-60.660*
	(32.518)	(32.726)	(32.962)	(33.556)	(33.789)	(33.244)
Intercept	-0.008	-0.007	-0.010	-0.013	-0.016	-0.011
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	36.20	35.92	35.80	35.54	35.32	36.64
Observations	4280	4280	4280	4280	4280	4280

Table A7. CDS Trading, Loan Amount and Loan Spread: Both Syndicated Loans and Sole Lender Loans

This table presents estimation results of regressions that examine how loan amount and loan spread are affected by CDS trading in the borrower's name, using an alternative sample. The sample includes syndicated loans and loans from sole lender 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. Columns 1 and 3 control for CDS firm fixed effects (CDS traded). We control for fixed loan initiation year, borrower industry and loan purposes 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.

	Loan Amount/Assets		Loan Spread	
Variable	(1)	(2)	(3)	(4)
CDS Trading	0.019*	0.026**	23.692***	15.275***
	(0.011)	(0.013)	(3.803)	(3.643)
CDS Traded	0.010		-13.052***	
	(0.007)		(3.402)	
All-in-Drawn Spread	-0.001	-0.001		
	(0.000)	(0.000)		
Loan Amount/Assets			-2.670	-2.703
			(2.091)	(2.086)
Maturity	0.031	0.031	3.841	4.054
	(0.020)	(0.020)	(2.699)	(2.709)
Secured	-0.038*	-0.039*	76.166***	76.528***
	(0.021)	(0.021)	(2.429)	(2.427)
Term Loan	-0.031**	-0.031**	16.375***	16.617***
	(0.014)	(0.014)	(2.882)	(2.879)
Log (Total Assets)	-0.033***	-0.033***	-23.689***	-24.447***
	(0.009)	(0.009)	(0.916)	(0.887)
Cash/Assets	-0.120	-0.120	89.755***	90.353***
	(0.093)	(0.093)	(12.109)	(12.126)
Leverage	0.199	0.200	162.624***	163.165***
	(0.136)	(0.139)	(9.345)	(9.313)
Log (1+Number of Lenders)	1.325***	1.325***	-135.74***	-136.50***
	(0.287)	(0.287)	(9.402)	(9.418)
Log (1+Firm Age)	-0.007	-0.006	-4.801***	-5.033***
	(0.020)	(0.019)	(1.566)	(1.587)
Market-to-Book	0.286***	0.292***	1605.29***	1619.97***
	(0.039)	(0.039)	(510.399)	(508.928)
Rated	0.028	0.031	-176.76***	-180.58***
	(0.061)	(0.061)	(41.637)	(41.504)
Tangibility	-0.035*	-0.034*	-17.237***	-17.604***
	(0.018)	(0.018)	(5.282)	(5.316)
Z-score	-0.002	-0.002	-5.001***	-5.019***
	(0.005)	(0.005)	(0.399)	(0.399)
Prime Rate	-3.298	-3.935	-500.455***	-567.397***
	(3.295)	(3.582)	(135.389)	(143.295)
Intercept	0.436***	0.434***	267.686***	268.943***
	(0.071)	(0.071)	(14.975)	(14.888)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	9.22	9.21	49.09	49.02
Observations	17268	17268	17268	17268

Table A8. CDS Trading, Loan Amount and Loan Spread: Simultaneous Equations

This table reports simultaneous regression results of loan amount and loan spread on CDS trading in borrower's name, estimated by two-stage-least-square. In the loan amount regressions we incorporate industry loan amount/assets, which refers to the mean of loan amounts/assets of all syndicated loans to firms in the same 2-SIC industry in the same quarter; in the loan spread regressions we include industry loan spread, which is the mean of all-in-drawn spreads of all syndicated loans to firms in the same 2-SIC industry in the same quarter. 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. Coefficients of control variables are not reported to conserve space. Columns 1 and 3 control for CDS firm fixed effects (CDS traded). We control for fixed loan initiation year, borrower industry and loan purposes 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.

	Loan Amount/Total Assets		Loan Spread	
Variable	(1)	(2)	(3)	(4)
CDS Trading	0.149***	0.187***	15.877***	7.811***
	(0.033)	(0.028)	(3.410)	(2.833)
Loan Spread	-0.001	-0.001		
	(0.001)	(0.001)		
Industry Loan Amount/Assets	0.013	0.014		
	(0.018)	(0.018)		
Loan Amount/Assets			-35.468***	-36.010***
			(7.950)	(7.977)
Industry Loan Spread			0.297***	0.300***
			(0.042)	(0.042)
CDS Traded	0.060**		-12.849***	
	(0.030)		(3.049)	
Intercept	0.737***	0.710***	421.783***	428.034***
	(0.262)	(0.262)	(24.854)	(24.897)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	40.91	40.88	43.61	43.39
Observations	15546	15546	15546	15546

Table A9. Probit Model for Firm CDS Trading

This table presents estimation results of a probit model of the likelihood of CDS trading referencing the borrower's debt on instrumental variables. The sample is composed of loans issued before CDS introduction and 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 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 probit regression. All variables are winsorized at 1% level. We control for fixed firm, year and industry 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)
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)
Tangibility	-0.141	0.140	-0.111
	(0.148)	(0.139)	(0.149)
Market-to-Book	155.743***	149.841***	152.318***
	(17.382)	(14.625)	(17.425)
Profitability	-2.124*	-2.272**	-2.171*
	(1.140)	(1.012)	(1.145)
Z-score	-0.063***	-0.107***	-0.060***
	(0.021)	(0.019)	(0.021)
Intercept	-11.782***	-10.992***	-11.774***
	(0.343)	(0.303)	(0.344)
Fixed Firm Effects	Yes	Yes	Yes
Fixed Year Controls	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes
R-squared (%)	38.05	34.41	38.65
Observations	21640	21640	21640

Table A10. Firm Characteristics before and after Propensity Score Matching

This table 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. The explanatory variables are the same as we used in Table A9 of Internet Appendix. 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 a matching firm. 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; the second column shows difference in the same variables between CDS firms and their one-to-one matched sample. ***, ** 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.

Variable	Before Matching	After Matching
Propensity Score	0.063***	0.007
Loan Characteristics		
Loan Amount/Total Assets	0.034***	0.005
All-in-Drawn 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***
Current Ratio	-0.537***	-0.005
Cash/Total Assets	-0.018***	0.001
Leverage	0.016***	0.001
Log (1+Fixed Charge Coverage)	-0.001***	0.000
Q	0.015	-0.012
Profitability	0.008***	0.000
Z-score	-0.544***	-0.145*

Table A11. Effects of CDS Trading on Bank Lending Practice: Full Sample Results

This table reports estimation results of regressions that examine how loan amount and spread are affected by lead banks' CDS activities for the full sample of syndicated loans. CDS bank refers to lead banks that ever traded CDS in the sample period. CDS inactive bank refers to banks that never have CDS trading during the sample period. The control variables in the OLS regression are the same as we used in baseline regression in Table V. Coefficients of control variables are not reported to conserve space. All variables are winsorized at 1% level. We control for fixed year, borrower industry and loan purposes 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				
	CDS-active Bank		CDS-inactive 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 Traded		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)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	34.19	34.18	41.34	41.14
Observations	10624	10624	938	938

Panel B. Loan Spread				
	CDS-active Bank		CDS-inactive Bank	
Variable	(1)	(2)	(3)	(4)
CDS Trading	7.837***	13.971***	-4.822	5.177
	(3.698)	(3.813)	(14.375)	(14.425)
CDS Traded		-9.879***		-15.573**
		(3.564)		(7.724)
Loan Amount/Assets	0.537	0.583	-0.099	0.126
	(1.229)	(1.233)	(1.948)	(1.918)
Intercept	485.548***	490.697***	418.286***	428.440***
	(17.115)	(16.839)	(53.039)	(50.773)
Fixed Year Controls	Yes	Yes	Yes	Yes
Fixed Industry Controls	Yes	Yes	Yes	Yes
Fixed Loan Purpose Controls	Yes	Yes	Yes	Yes
R-squared (%)	52.87	52.81	49.72	49.56
Observations	10624	10624	938	938

Table A12. CDS Trading and 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 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, etc). 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 traded). 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 is active in CDS trading at loan initiation. All variables are winsorized at 1% level. We control for fixed year, borrower industry and loan purposes 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 Traded		-0.385***
		(0.119)
Log (Loan Amount)	0.060	0.061
	(0.039)	(0.039)
All-in-Drawn Spread	0.011***	0.011***
	(0.000)	(0.000)
Maturity	0.127	0.130
	(0.098)	(0.098)
Secured	0.914***	0.913***
	(0.092)	(0.091)
>1 Tranche	-0.184**	-0.185**
	(0.086)	(0.086)
Log (Total Assets)	-0.726***	-0.725***
	(0.049)	(0.049)
Market-to-Book	245.385***	245.386***
	(27.943)	(27.858)
Q	-0.770***	-0.769***
	(0.063)	(0.063)
Cash/Total Assets	3.992***	3.985***
	(0.645)	(0.643)
Leverage	4.680***	4.679***
	(0.459)	(0.459)
Tangibility	-0.210	-0.211
	(0.211)	(0.212)
Term Loan Indicator	0.151*	0.152*
	(0.089)	(0.089)
Z-score	-0.180***	-0.190***
	(0.029)	(0.029)
Performance Pricing Dummy	0.365***	0.345***
	(0.083)	(0.072)
Loan Purpose: CP Backup	-0.724***	-0.718***
	(0.086)	(0.096)
Loan Purpose: Debt Refinancing	0.128	0.128
	(0.079)	(0.079)
Loan Purpose: Takeover	-0.475***	-0.476***
	(0.098)	(0.099)
Loan Purpose: Working Capital	-0.012	-0.013
	(0.077)	(0.077)
Intercept	14.103***	15.119***
	(0.548)	(0.548)
Fixed Year Controls	Yes	Yes
Fixed Industry Controls	Yes	Yes
R-squared (%)	68.86	68.98
Observations	8110	8110

Table A12 — *Continued*

Panel B. Changes in Loan Quality						
	Δ in Issuer Rating in 1 Year		Δ in Issuer Rating in 2 Years		Δ in Issuer Rating 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 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)
CDS Traded	-0.096*	-0.095*	-0.179**	-0.177**	-0.265***	-0.263***
	(0.050)	(0.050)	(0.083)	(0.083)	(0.104)	(0.103)
S&P Issuer Rating	-0.221***	-0.222***	-0.282***	-0.282***	-0.333***	-0.333***
at Loan Issuance	(0.024)	(0.024)	(0.028)	(0.028)	(0.029)	(0.029)
Log (Loan Amount)	0.070***	0.069***	0.038	0.037	0.018	0.016
	(0.021)	(0.021)	(0.029)	(0.029)	(0.036)	(0.036)
All-in-Drawn Spread	0.003***	0.003***	0.004***	0.004***	0.003***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Secured	0.176***	0.178***	0.223***	0.225***	0.171*	0.173*
	(0.052)	(0.052)	(0.076)	(0.076)	(0.091)	(0.091)
Term Loan Indicator	0.154**	0.150**	0.185**	0.178*	0.184*	0.177*
	(0.064)	(0.064)	(0.093)	(0.093)	(0.106)	(0.106)
Log (Total Assets)	-0.171***	-0.171***	-0.207***	-0.208***	-0.233***	-0.233***
	(0.026)	(0.026)	(0.037)	(0.037)	(0.048)	(0.048)
Q	-0.082**	-0.082**	-0.070	-0.069	-0.126*	-0.124
	(0.038)	(0.038)	(0.059)	(0.059)	(0.076)	(0.076)
Leverage	-0.375	-0.375	-0.710*	-0.712**	-0.891**	-0.894**
	(0.315)	(0.315)	(0.363)	(0.362)	(0.444)	(0.444)
Z-score	-0.122***	-0.122***	-0.156***	-0.157***	-0.162***	-0.162***
	(0.022)	(0.022)	(0.028)	(0.028)	(0.030)	(0.030)
Performance	0.068	0.069	0.103	0.107	0.229**	0.231**
Pricing Dummy	(0.055)	(0.055)	(0.079)	(0.079)	(0.096)	(0.097)
Loan Purpose:	-0.124***	-0.121***	-0.159**	-0.153**	-0.114	-0.108
CP Backup	(0.045)	(0.045)	(0.069)	(0.069)	(0.087)	(0.087)
Loan Purpose:	0.026	0.027	0.036	0.037	0.063	0.065
Debt Refinancing	(0.049)	(0.049)	(0.071)	(0.071)	(0.080)	(0.080)
Loan Purpose:	-0.088	-0.086	-0.081	-0.080	-0.112	-0.109
Takeover	(0.058)	(0.058)	(0.094)	(0.094)	(0.100)	(0.100)
Loan Purpose:	-0.027	-0.024	-0.006	0.001	0.047	0.053
Working Capital	(0.046)	(0.046)	(0.060)	(0.060)	(0.074)	(0.075)
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)
Fixed Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Industry Controls	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