How Large Banks Use CDS to Manage Risks: Bank-Firm-Level Evidence

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Abstract

We test five hypotheses on whether banks use CDS to hedge corporate loans, provide credit enhancements, obtain regulatory capital relief, and exploit banking relationship and private information. Linking large banks' CDS positions and syndicated lending on individual firms, we observe strong evidence for the credit enhancement and regulatory capital relief hypotheses, but mixed evidence for the hedging, banking relationship, and private information hypotheses. Banks buy and sell more CDS on their borrowers, but their net CDS positions and lending status are largely unrelated. We find no evidence of bank using CDS to exploit private information.

JEL classification: G14; G21; G23; G28; G32;
Key words: CDS; hedging; credit enhancement; regulatory capital relief; banking relationship; private information

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1. Introduction

The explosive growth of the credit default swap (CDS) market had sparked considerable controversy even before the 2007–2009 financial crisis. Some applauded CDS as "one of the greatest financial innovations that enable financial institutions to transfer risk" (Greenspan, 2004). Other regarded them as "weapons of mass destruction" (Buffet, 2002). Following the crisis, many blamed CDS for the collapse of insurance giant American International Group and the 2012 "London Whale" trading scandal at JPMorgan Chase.[1] Despite this prolonged controversy, little is known about how banks use CDS to manage their credit risk exposures (Minton, Stulz, and Williamson, 2009; Stulz, 2010). To facilitate informed debates over the risks and benefits of CDS, this study investigates banks' CDS usage by tracking the CDS positions on and syndicated lending to individual firms for some of the largest banks in the United States from 2009 to 2012.

The five hypotheses examined in this study are the hedging, regulatory capital relief, credit enhancement, banking relationship, and private information hypotheses. These hypotheses are designed to provide empirical evidence on the theoretical literature of why and how banks use credit derivatives to manage risks associated with corporate lending. Because banks can engage in CDS trading for multiple purposes, these hypotheses are not necessarily mutually exclusive.

CDS contracts transfer the credit risk of one or more reference entities[2] from protection buyers to protection sellers. For instance, in a single-name CDS contract, the protection buyer

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[1] The London Whale trading scandal refers to the large CDS trading losses that occurred at JPMorgan Chase's Chief Investment Office in 2012. JPMorgan Chase lost at least $6.2 billion on transactions booked through its London branch by a trader named Bruno Iksil (known as the London Whale).

[2] A reference entity can be a corporation, government or other legal entity that issues debts.

receives protection on a specified notional amount of a reference entity's debt. If the reference entity defaults, the protection seller must pay the agreed amount to the buyer. Duffee and Zhou (2001) and Parlour and Winton (2013) propose theoretical models that show banks can use CDS to hedge the risks of high-quality borrowers when the information asymmetry problem is less severe and when monitoring costs are low. It is unclear, however, why banks would want to hedge the risks of such low-risk borrowers. On the other hand, Pennacchi (1988) and Allen and Carletti (2006) suggest that banks may choose to transfer credit risks when facing capital and liquidity constraints. Therefore, these models imply that banks can buy CDS to obtain regulatory capital relief by reducing the risk weights of their loans. Alternatively, banks can serve as market makers by selling CDS protection to clients that want to hedge and buying CDS protection from clients that want to speculate. Furthermore, the CDS market allows banks to bet on the credit quality of a particular firm, regardless of whether they have exposures to that firm.

Investigating how banks use CDS has important policy implications, as policymakers are concerned about whether banks use CDS to hedge the risk of corporate lending, provide credit enhancement, obtain regulatory capital relief (Saretto and Tookes, 2013; Shan, Tang, and Yan, 2014), or exploit private information. Understanding these issues is thus crucial for regulators to design better banking regulations. Nevertheless, since CDS contracts are traded in the over-the-counter (OTC) market with low transparency, data limitations hinder empirical studies on these important questions. This study fills this void.

We design the hedging hypothesis to test whether a bank buys CDS to hedge the credit risk of corporate loans. Specifically, the hedging hypothesis predicts that the amount of CDS protection a bank buys on a firm is positively correlated with its lending exposure to the firm. Importantly, this hypothesis implies a one-to-one relationship between the amount of CDS protection that a bank has bought against a firm and its lending exposure to the same firm. In particular, a bank may wish to use CDS to hedge against a high risk borrower.

The regulatory capital relief hypothesis tests whether a bank with a low regulatory capital ratio has an incentive to buy CDS to obtain regulatory capital relief by reducing the risk weights of corporate loans. This hypothesis thus predicts that the CDS protection that a bank has bought against each borrower is negatively correlated with the bank's regulatory capital ratio.

When a bank buys CDS to hedge a credit exposure, the regulatory risk weight of this credit exposure decreases. Consequently, the hedging and regulatory capital relief hypotheses may overlap. Unlike the hedging hypothesis, the regulatory capital relief hypothesis implies a one-to-many relationship between a bank's regulatory capital ratio and its CDS positions on all firms, as a low capital ratio may push the bank to buy CDS protection against all borrowers. In particular, a bank may buy CDS on low-risk borrowers just for the purpose of regulatory capital relief. Therefore, these hypotheses encompass different motivations for banks to buy CDS and can be tested separately.

Next, we design a hypothesis to test whether banks sell CDS to provide credit enhancements to their customers. Banks can offer credit support in transactions they underwrite, as the ability to hedge through CDS can increase the supply of credit to firms by making corporate debts more attractive to a broad group of investors that are unwilling to hold credit risk (Minton, Stulz, and Williamson, 2009). More specifically, the credit enhancement hypothesis predicts that the amount of CDS protection a bank sells a firm is positively correlated with its lending exposure to that firm.

Finally, we design two hypotheses to test whether banks use CDS to exploit banking relationship and private information. The banking relationship hypothesis posits that the lending relationship between a bank and a firm affects how the bank buys or sells CDS on that firm, and the private information hypothesis postulates that banks use private information about their borrowers in CDS trading.

To evaluate these hypotheses, we construct a novel data set by linking a data set from the Depository Trust & Clearing Corporation (DTCC) with the Shared National Credit (SNC) Program database. The DTCC data set contains the weekly CDS positions on each reference entity for each bank holding companies (BHC) in the United States. Therefore, this data set tracks the changes in each lender's CDS positions on each reference entity over time. Importantly, the six largest BHCs in our sample account for the majority of CDS trading by all U.S. BHCs. For instance, Minton, Stulz, and Williamson (2009) report that only 23 of the 395 BHCs in their sample traded credit derivatives in 2005. Furthermore, the total amount of credit protection bought and sold by the top three BHCs in 2005 was $5.2 trillion, which accounted for 94.5% of the total amount of credit protection bought and sold by all BHCs in 2005.

Established in 1977, the SNC Program is an interagency effort to provide a periodic credit risk assessment of the largest and most complex credits held by federally supervised financial institutions. An SNC facility is any loan or credit line of $20 million or more extended to a borrower and shared by three or more unaffiliated supervised institutions. One important advantage of the SNC database is that it tracks the share of each lender in each syndicated credit facility in each year. By linking the DTCC data with the SNC data, we can examine the relationship between a bank's CDS trading positions on a given firm and its lending position to the same firm.

Overall, we find that these banks' CDS positions on most firms are unrelated to their syndicated lending exposures to these firms. In addition, we find mixed evidence for the hedging hypothesis. Specifically, we find no significant difference in net CDS positions on a firm between banks with and without lending exposures to that firm. Furthermore, the net notional amount of CDS protection that a bank has bought on a firm accounts for only a small portion of the bank's lending exposure to that firm.

On the other hand, we find strong evidence that supports the credit enhancement hypothesis and the regulatory capital relief hypothesis. Specifically, we find that the CDS protection a bank sells on a firm is positively correlated with its lending exposure to that firm. We also find a negative and significant correlation between net CDS protection and the regulatory capital ratio.

We also find mixed evidence for the banking relationship hypothesis: Although a firm's agent lenders tend to buy more CDS on that firm, banks also refrain from buying or selling CDS on firms that rely heavily on them for credit. Furthermore, we find no evidence of banks using CDS to exploit private information about their borrowers. Banks may not be able to exploit private information if they could not find counterparties in the CDS market, or if CDS transaction costs are high (Hilscher, Pollet, and Wilson, 2015).

This paper contributes to the emerging empirical literature that examines how banks use credit derivatives to manage risks. Within this literature, our study complements two studies that use bank-level aggregate CDS position data (Minton, Stulz, and Williamson, 2009; Shan, Tang, and Yan, 2014). When examining a sample of U.S. BHCs with assets exceeding $1 billion from 1999 to 2005, Minton, Stulz, and Williamson (2009) find that only a small number of large banks use credit derivatives. In addition, these banks held credit derivatives primarily for dealer activities rather than for hedging loans. Additionally, Shan, Tang, and Yan (2014) find that the CDS market allows banks to assume more risk.

Because the data used in both studies report only each bank's aggregate CDS positions across all firms, neither study examines how each bank manages its CDS positions at the firm level. More specifically, a bank can simultaneously buy CDS contracts on one firm for hedging purposes and sell CDS contracts on another firm for credit enhancement purposes, but researchers cannot detect these different purposes by looking at the aggregate CDS positions across all firms. For instance, a bank's aggregate net CDS position across all firms can be zero if the bought CDS contracts on one firm offset the sold CDS contracts on another firm.

By using data on banks' CDS positions and their lending exposures to individual firms, our study overcomes this data limitation in previous studies. To the best of our knowledge, this paper is the first to provide micro-level evidence on how each bank manages its CDS positions at the firm level.

Furthermore, our study complements the studies by Oehmke and Zawadowski (2014) and Gündüz et al. (2015). Specifically, Oehmke and Zawadowski (2014) study the hedging and speculation motives of CDS trading. Because their study relies on the net notional CDS amount on each firm, which is the sum of net protection bought by counterparties that are net buyers of protection for that firm, they do not examine the relationship between individual banks' uses of CDS and their lending exposures to individual firms. In an independent study based on a cross-sectional design, Gündüz et al. (2015) use a sample of German banks and firms to investigate whether the default risk in bank-firm exposures before the "CDS Small Bang"[3] affects changes in CDS hedging by banks. In contrast, our study employs panel data analyses and focuses on U.S. banks and firms.

Although there are a few recent studies that use the DTCC data, these studies have different

[3] The "CDS Big Bang", which went into effect on April 8, 2009, refers to the global contract changes and convention changes to North American CDS contracts. The "CDS Small Bang" refers to European convention changes that were implemented on June 20, 2009.

focuses, empirical designs, or sample periods than ours. For instance, Choi and Shachar (2014) study CDS-bond basis trades, and Shachar (2012) focuses on the impacts of the daily aggregate order imbalance on CDS spreads. In a separate study, Siriwardane (2015) examines the relationship between concentrated capital losses of CDS sellers and changes in CDS spread. Additionally, Gehde-Trapp, Gündüz, and Nasev (2015) focus on the liquidity premium in CDS transactions. In comparison, our study tests different hypotheses on how banks use CDS in relation to their credit risk exposures.

The rest of this paper proceeds as follows. Section 2 describes the data and empirical design. Section 3 presents and discusses the estimation results. Section 4 concludes.

2. Data and empirical design

2.1. Data

We construct our data set by linking a data set from the DTCC with another data set from the SNC. Our DTCC data set contains the weekly CDS positions on each reference entity for each of the six largest banks in the United States from 2009 to 2012.[4] DTCC states that its Trade Information Warehouse (TIW) is the only comprehensive trade repository and post-trade processing infrastructure for OTC credit derivatives. The TIW electronically matches and confirms more than 98% of CDS transactions globally. This global repository currently holds more than 2.3 million contracts. It handles event lifecycle processing and the calculation, netting, and central settlement of payment obligations between counterparties.

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[4]The six largest banks account for the majority of CDS transactions of all BHCs. For instance, Minton, Stulz, and Williamson (2009) report that the total amount of credit protection bought and sold by the top three BHCs in 2005 was $5.2 trillion, which accounted for 94.5% of the total amount of credit protection bought and sold by all BHCs in 2005.

The SNC data set is an annual panel data set that contains basic information about facility, borrower and syndicate structure. A syndicated credit facility can be either a loan facility or a credit line facility. A firm can have multiple facilities, and each facility can have multiple lenders. For each facility, the SNC database reports information about the type, credit limit, current balance, maturity, risk rating assigned by the agent bank, obligor information (name, location, and industry), and share of each participating syndicate member.

By linking the SNC data with the DTCC data, we can examine the relationship between a bank's CDS trading position on a given firm and its lending position to the same firm. We construct a quarterly panel data sample of CDS trading positions of all bank-firm pairs from the DTCC data set and link this sample to the SNC data set to obtain the lending exposures for a subsample of bank-firm pairs. Each observation contains a bank's notional amounts of bought, sold, and net CDS protection on a firm in each quarter. In addition, each observation in a subset of bank-firm pairs also contains a bank's syndicated lending exposure to a firm in the fourth quarter of the preceding year. A bank's syndicated lending exposure is the sum of its used and unused lending commitment to that borrower.

To obtain additional information about obligors, lenders, and pricing information for syndicated credit facilities and CDS contracts, we also link this data set to six additional databases: Compustat, the Center for Research in Security Prices (CRSP), the Consolidated Reports of Condition and Income for Commercial Banks (Call Report), the Federal Reserve Consolidated Financial Statements for Holding Companies (FR Y-9C), Thomson Reuters LPC's Dealscan, and the Markit CDS database.

2.2. Empirical design

The regression design can be summarized as follows:

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\begin{aligned}
&(\text{Bought/Sold/Net CDS position})_{i,j,t} = A_0 + A_1 \bullet (\text{Bank-firm lending exposure})_{i,j,t-1} \\
&+A_2 \bullet (\text{Bank RBCR})_{i,t-1} + A_3 \bullet (\text{Bank-firm private information})_{i,j,t-1} \\
&+A_4 \bullet (\text{Bank-level control variables})_{i,t-1} + A_5 \bullet (\text{Firm-level control variables})_{j,t-1} \\
&+(\text{Bank fixed effects})_i + (\text{Firm fixed effects})_j + (\text{Time fixed effects})_t ,
\end{aligned} \tag{1}
$$

where *i, j*, and *t* index banks, firms, and time (i.e., the bought CDS position of bank *i* on firm *j* at time *t*). The dependent variables in Eq. (1) are the bought, sold, and net CDS positions of bank *i* on firm *j* at time *t*. These variables are expressed in millions of U.S. dollars. Table 1 defines all variables used this paper. To avoid reverse causality, the dependent variables are observed at time *t*, and the explanatory variables are observed at time *t-1*.

In all regressions, the estimation method is ordinary least squares (OLS) with bank, firm, and time fixed effects. In other words, we include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors.

Under the hedging hypothesis, banks buy CDS protection to hedge the credit risk of their borrowers. Therefore, this hypothesis predicts that a bank's net CDS position on a given firm is positively correlated with its lending exposure to the same firm. Under the credit enhancement hypothesis, banks sell CDS protection to their customers in order to sell loans to these customers. Therefore, this hypothesis predicts that a bank's sold CDS position on a given firm is positively correlated with its lending exposure to that firm.

We construct two different variables to measure a bank's lending exposure to a firm. First, we create a dummy variable, *has lending exposure*, which equals one if bank *i* has lent to firm *j* at time *t-1* and equals zero otherwise. We use this variable to compare the CDS positions between banks with and without syndicated lending exposures to a firm. The second variable, *lending exposure*, is a continuous variable that equals the total syndicated lending exposure of bank *i* to firm *j* at time *t-1*. This variable, expressed in millions of U.S. dollars, is used to compare CDS positions among banks that have lending exposures to a firm.

Under the regulatory capital relief hypothesis, banks with low regulatory capital ratios are more likely to buy CDS protection to obtain regulatory capital relief by reducing the risk weights of their loans. Therefore, this hypothesis predicts that a bank's net CDS position on a borrower is negatively correlated with its regulatory capital ratio. We test this hypothesis by examining the coefficient of the regulatory-based capital ratio (*bank RBCR*).

We use two variables to test the banking relationship hypothesis. The first variable, *agent lender*, is a dummy variable that equals one if the bank is the agent of one syndicated facility of the firm. We use this variable to examine whether a firm's agent lender is different from other lenders when buying and selling CDS on the firm. The second variable, *lender-borrower utilization ratio*, calculates the total amount that a firm has already borrowed from the bank divided by the bank's total lending commitments to that firm. A high utilization ratio indicates that the firm relies heavily on the bank. The lender-borrower utilization ratio thus provides another measure of the banking relationship between a bank and a firm.

The agent of a syndicated facility may have superior private information about the borrower. In addition, the lender-borrower utilization ratio may also contain private information about a borrower. Therefore, the coefficients of these variables may also reflect the effects of a bank's private information about the firm. To control for private information effects, we construct two variables based on banks' internal rating of each facility.

Each facility in the SNC dataset has a regulatory rating, which is one of the five regulatory rating categories with increasing credit risk: "pass", "special mention", "substandard", "doubtful" and "loss". Specifically, the "pass" rating indicates that a facility is in good standing with little credit risk, and the "special mention" rating indicates that a facility shows sign of weakness that may result in further deterioration of repayment prospects. Although a facility with a "special mention" rating has a higher probability of default than a facility with a "pass" rating, its default is not imminent. On the other hand, the "substandard", "doubtful", and "loss" ratings are broadly referred to as "classified" ratings that indicate elevated levels of default risk. In particular, facilities with "substandard" ratings have a high probability of payment default and other well-defined weaknesses, and a "doubtful" rating indicates that the borrowers usually are in default, lack adequate liquidity or capital, and lack the resources necessary to continue operating. Finally, a "loss" rating indicates that the underlying borrower is in bankruptcy, has formally suspended debt repayments, or has otherwise ceased normal business operations.

With this information, we create two dummy variables to measure a bank's private information about a firm. The first dummy, *special mention rating,* equals one if any facility of the firm has a rating of "special mention". We create a second dummy, *classified rating*, which equals one if any facility of a firm has a rating of "substandard", "doubtful", or "loss".[5] Therefore, given that these dummy variables can properly capture the effects of private information that a bank has about its customer, the coefficients of *agent lender* and *lender-borrower utilization ratio* should capture the effects of banking relationship.

Additional bank-level control variables include bank size (*bank size*), return on assets (*bank ROA*), non-performing assets to total assets ratio (*bank NPA ratio*), and wholesale funding ratio (*bank wholesale funding ratio*). Because bank fixed effects are included in all regressions, only the within-bank variations of these control variables contribute to the estimation results.

[5] Because there are only a small number of facilities with classified ratings, we do not further divide these facilities into subcategories.

Additional firm-level control variables include *firm size*, *leverage*, *earning-to-asset ratio*, *tangibility*, *current ratio*, *Tobin's Q*, *Altman's Z*, and *firm stock return*. We also calculate the *distance-to-default* measure using Merton's model (Bharath and Shumway, 2008). In addition, we construct two dummy variables to indicate whether a firm has a Standard and Poor's (S&P) credit rating and whether it has an investment-grade rating. Moreover, we include the level and change of five-year CDS spread to measure the cost of CDS. Again, because firm fixed effects are included in all regressions, only the within-firm variations of these control variables contribute to the estimation results.

3. Empirical results

We report empirical results in seven subsections. Section 3.1 reports the summary statistics of bank-firm CDS positions and other related variables. We test the hedging, credit enhancement, regulatory capital relief, banking relationship, and private information hypotheses in Sections 3.2 through 3.7, respectively.

3.1. Summary statistics

Because our access to the DTCC data starts in 2009, our sample runs from 2009 Q1 to 2012 Q4. We construct a quarterly panel sample of bank-firm pairs because financial data for firms and lenders are available only on a quarterly basis. The final sample contains 28,385 bank-firm-quarter observations, including six banks, 541 firms, and 2,665 bank-firm pairs.[6] Panel A of Table 2 reports the summary statistics of bank-firm CDS positions by quarter.

We calculate three CDS position to lending exposure ratios: *bought CDS position/lending*

[6] We do not identify the banks in the sample to protect the confidential nature of supervisory information.

exposure, *sold CDS position/lending exposure*, and *net CDS position/lending exposure*. Panel B of Table 2 shows that the average *bought CDS position/lending exposure* ratio (549.9%) and the average *sold CDS position/lending exposure* ratio (560.6%) are substantially larger than the average *net CDS position/lending exposure* ratio (-10.8%).

Panel C of Table 2 reports the summary statistics of net CDS positions by different categories. Although the whole sample consists of 28,385 bank-firm-quarter observations for which a bank has CDS positions on a firm, in only 11,820 observations does a bank also have a syndicated lending exposure to a firm. In other words, more than 58% of observations in our sample consist of bank-firm pairs in which a bank has no syndicated lending exposure to a firm.

Hence, most CDS trading by these banks is unrelated to their syndicated lending exposures. Because the SNC data cover only syndicated lending, a bank could buy CDS protection to hedge the credit risk of a loan in its portfolio that is not part of any syndicated lending. In addition, a bank may sell CDS protection on its low-risk borrowers of non-syndicated loans to profit from its own private information. Nevertheless, this data limitation is unlikely to have a dramatic impact on the conclusions of our analyses because syndicated lending is the dominant form of the large corporate lending. Additionally, a bank's CDS trading can also be related to its holding of corporate bonds. Unfortunately, we are unaware of any data source with information about a bank's corporate bonds holdings.

Furthermore, to be consistent with the hedging hypothesis, the value of the *net CDS position/lending exposure* ratio, as an example, should be between zero and one. A bank is unlikely to use CDS for hedging purposes if this ratio is negative or far above one. Panel D of Table 2 reports the distribution of this ratio. First, there are 16,565 observations for which a bank has no lending exposure to the firm. Second, the *net CDS position/lending exposure* ratio is negative for 4,945 observations, is between zero and one for 5,665 observations, and exceeds one for 1,210 observations. Overall, these results suggest that these banks' CDS positions on most firms are unrelated to their syndicated lending exposures to these firms.

3.2. Hedging hypothesis

Under the hedging hypothesis, a bank's net CDS position on a given firm is positively correlated with its lending exposure to that firm. To test this hypothesis, we run two sets of regressions of net CDS positions. The first set of regressions are based on a sample of all bank-firm pairs regardless of whether a bank has a lending exposure to a firm, and the second set of regressions are based on a subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The sample period is 2009–2012. The dependent variable is *net CDS position*, which is the net notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars).

Table 3 compares the net CDS positions on a firm between banks with and without syndicated lending exposures to the firm. The key explanatory variable is *has lending exposure*. For a bank-firm pair in each quarter, this dummy variable equals one if the bank was a lender to the firm in that quarter and zero otherwise. This table consists of four regressions. Regression (1) includes only *has lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy. Regression (3) adds bank-level explanatory variables. Regression (4) adds firm-level explanatory variables.

The regression results of Table 3 reject the hedging hypothesis, as the coefficient of *has lending exposure* is insignificant in all regressions, which suggests that there is no significant difference in net CDS positions on a firm between banks with and without syndicated lending exposures to that firm.

The regression results in Table 4, however, provide weak evidence for the hedging hypothesis. Regressions in this table are based on the subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The key explanatory variable is *lending exposure*, which is a bank's syndicated lending exposure to the firm in each year (expressed in millions of U.S. dollars). This table consists of five regressions. Regression (1) includes only *lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy. Regression (3) includes bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. Finally, regression (5) adds *special mention rating* and *classified rating* to measure a bank's private information about the firm, and *lender-borrower utilization ratio* to measure a firm's reliance on a lender for banking.

As Table 4 shows, the coefficient of *lending exposure* is positive and statistically significant in all regressions, suggesting that banks with higher lending exposures to a firm tend to have higher net CDS positions on that firm. Although this positive coefficient is consistent with the hedging hypothesis, its magnitude is very small. For instance, this coefficient is 0.04 in regression (5) of Table 4. In other words, if a bank's lending exposure to a firm increases by $1 million, its net CDS position on the firm increases by only $0.04 million.

Overall, Tables 3 and 4 provide mixed evidence for the hedging hypothesis. Specifically, the hedging hypothesis is rejected by Table 3 but not by Table 4. Nevertheless, Table 4 also shows that the net notional amount of CDS protection a bank buys on a firm accounts for only a tiny fraction of its lending exposure to that firm.

3.3. Regulatory capital relief hypothesis

The regulatory capital relief hypothesis postulates that a bank's net CDS positions are negatively correlated with its regulatory capital ratio. This section tests this hypothesis by examining the coefficient of *bank RBCR*, which is the ratio of risk-based capital (RBC) to total risk-weighted assets (RWA).

Overall, we find evidence that supports the regulatory capital relief hypothesis, as the coefficient of *Bank RBCR* is negative and statistically significant in all regressions of Table 4. Importantly, regressions in Table 4 are based on the sample of bank-firm pairs in which a bank has a lending exposure to a firm. Since banks without lending exposures to a firm cannot use CDS protection on that firm to obtain regulatory capital relief, one needs to exclude bank-firm pairs in which a bank has no lending exposure to a firm. For this reason, the estimation results in Table 3 cannot be used to test the regulatory capital relief hypothesis, as regressions in this table are based on the entire sample of all bank-firm pairs regardless of whether a bank has a lending exposure to a firm.

Hedging through CDS increases a bank's regulatory capital ratio. In other words, there is a reverse causality between the net CDS position and the regulatory capital ratio. This reverse causality may be strong when a bank's CDS positions on all firms are aggregated at the bank level. Because the current study examines data at the bank-firm level, it is less likely that a change in the CDS position on a single firm would significantly affect a bank's capital ratio. Furthermore, reverse causality is not a concern in this study because the dependent variable is measured at time *t* and the explanatory variables are measured at time *t-1*.

3.4. Credit enhancement hypothesis

Under the credit enhancement hypothesis, a bank's sold CDS position on a given firm is positively correlated with its lending exposure to that firm. We run two sets of regressions of sold CDS positions. Regressions in Table 5 are based on a sample of all bank-firm pairs regardless of whether a bank has a lending exposure to a firm, and regressions in Table 6 are based on a subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The dependent variable is *sold CDS position*, which is the notional amount of CDS protection that a bank has sold on a firm at time *t* (expressed in millions of U.S. dollars). Table 5 is structured like Table 3, and Table 6 is structured like Table 4.

The regression results in Table 5 provide support to the credit enhance hypothesis. Specifically, the coefficient of *has lending exposure* is positive and statistically significant in all specifications, which suggests that banks with syndicated lending exposures to a firm tend to sell more CDS protection on this firm compared with banks without such exposures. For instance, this coefficient is 11.4 in regression (4), which implies that for banks with lending exposures to a firm, the average notional amount of CDS protection they have sold on the firm is $11.4 million higher than that of banks without lending exposure to the firm.

Table 6 provides further support to the credit enhancement hypothesis. Specifically, the coefficient of *lending exposure* is positive and statistically significant in all regressions, which suggests that banks with higher lending exposures to a firm tend to sell more CDS protection on that firm.

3.5. Regressions of bought CDS positions

In addition to regressions of net and sold CDS positions, we also run regressions of bought CDS positions. Regressions in Table 7 are based on the sample of all bank-firm pairs regardless of whether a bank has a lending exposure to a firm, and regressions in Table 8 are based on the subsample of bank-firm pairs where a bank has a lending exposure to a firm. The dependent variable is *bought CDS position*, which is the notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars). Again, Tables 7 and 8 are structured like Tables 3 and 4, respectively.

Table 7 shows that banks with syndicated lending exposures to a firm tend to buy more CDS protection on that firm compared with banks without such exposures. Specifically, the coefficient of *has lending exposure* is positive and statistically significant in all regressions. For instance, this coefficient is 11.1 in regression (4), which implies that for banks with lending exposures to a firm, the average notional amount of CDS protection they bought on the firm is $11.1 million higher than that of banks without lending exposure to the firm.

Table 8 shows that banks with higher syndicated lending exposures to a firm tend to buy more CDS protection on that firm, as the coefficient of *lending exposure* is positive and statistically significant in all regressions. For instance, this coefficient is 0.23 in regression (5), which suggests that the bought CDS position increases by $0.23 million for a $1 million increase in syndicated lending exposure.

Therefore, we find that banks with lending exposures to a firm tend to buy more CDS protection on that firm than banks without syndicated such exposures. In addition, banks with higher lending exposures on a firm tend to buy more CDS protection on that firm.

3.6. Banking relationship hypothesis

This section examines whether the banking relationship between a bank and a firm affects how the bank buys or sells CDS on that firm. As discussed in Section 2, we test the banking relationship hypothesis by examining the coefficients of *agent lender* and *lender-borrower utilization ratio* variables.

We find mixed evidence for the banking relationship hypothesis. On the one hand, we find that a firm's agent lenders tend to buy and sell more CDS on that firm. Specifically, the coefficient of *agent lender* is positive and statistically significant in regressions of bought CDS positions in Tables 7 and 8. In addition, this coefficient is positive in all regressions of sold CDS positions in Tables 5 and 6, and is statistically significant in most regressions in Table 5.

On the other hand, we also find evidence suggesting that banks refrain from selling or buying CDS on firms that rely heavily on them for banking needs, as the coefficient of *lender-borrower utilization ratio* is negative and statistically significant at the 10% level in both Tables 6 and 8.[7]

3.7. Private information hypothesis

This section tests whether a bank's private information about the credit quality of a firm affects how the bank trades CDS on that firm. We examine the coefficients of two variables that reflect banks' internal credit ratings on the firm: *special mention rating* and *classified rating*.

On the one hand, we find that banks tend to sell and buy more CDS protection on firms with deteriorating credit quality, as the coefficient of *classified rating* is positive and statistically significant in the regressions of sold and bought CDS positions in Tables 6 and 8. On the other hand, we find that banks are not net buyers of CDS protection on firms with deteriorating credit quality, as none of the coefficients of *special mention rating* and *classified rating* is statistically significant in the regressions of net CDS positions in Table 4.

Therefore, although banks' internal ratings on borrowers may provide early warnings about borrowers with elevating risks, banks are not net buyers of CDS protection on these firms. This finding suggests that banks either do not or could not use CDS to exploit private information about their borrowers. For instance, it may be difficult for banks to find counterparties in the CDS market when severe information asymmetry exists. This finding is also consistent with Hilscher, Pollet, and Wilson (2015), who find that informed traders are deterred from trading in the CDS market because of high transaction costs.

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[7] This result is somewhat puzzling and may be due to the reputation risk arising from conflict of interest.

4. Conclusion

Using new data that track the CDS positions and syndicated lending on individual firms for each of the six largest banks in the United States, we test five hypotheses about how large banks use CDS to manage risks. Overall, we find that these banks' CDS positions on most firms are unrelated to their syndicated lending exposures to these firms. Because the SNC data cover only syndicated lending, a bank might buy CDS to hedge the credit risk of a loan in its portfolio that is not part of any syndicated lending. Nevertheless, because the syndicated loan market is the dominant form of large corporate lending, we expect any bias arising from this data limitation to be minimal. Another important caveat is that a bank's CDS positions can also be related to its holding of corporate bonds. Unfortunately, the data used in this study do not include information on banks' corporate bond holdings. To the best of our knowledge, no data sources that contain such information exist.

In addition, we find mixed evidence for the hedging hypothesis. Although banks with lending exposures to a firm tend to buy more CDS on that firm than banks without such exposures, they also sell more CDS on the same firm. Consequently, we find no significant difference in net CDS positions on a firm between banks with and without lending exposures to that firm. Moreover, the net notional amount of CDS protection a bank buys on a firm covers only a tiny fraction of its lending exposure to that firm. Overall, the weight of evidence seems to reject the hedging hypothesis.

On the other hand, our findings are consistent with the credit enhancement and the regulatory capital relief hypotheses. Specifically, we find that the CDS protection a bank sells on a firm is positively correlated with its lending exposure to that firm. In addition, banks with lower regulatory capital ratios tend to buy more CDS protection.

We find mixed evidence for the banking relationship hypothesis. On the one hand, we find that a firm's agent lenders tend to buy and sell more CDS on that firm. On the other hand, we find banks also refrain from buying and selling CDS on firms that rely heavily on them for credit.

Furthermore, we find that banks either do not or could not use CDS to exploit private information about their borrowers. One possible explanation for this finding is that banks may not be able to find counterparties in the CDS market when severe information asymmetry exists. Additionally, banks may be deterred from trading in the CDS market because of high transaction costs (Hilscher, Pollet, and Wilson, 2015).

Because we use data on each bank's CDS positions at the individual firm level, our findings are less prone to a reverse causality problem that is inherent in studies using aggregate bank-level data. Specifically, studies at the individual bank level have to deal with an inherent endogeneity problem arising from reverse causality. For instance, it may be reasonable to argue that a change in aggregate CDS position at the individual bank level affects a bank's regulatory capital ratio. In other words, bank-level explanatory variables on the right hand side of a regression could be endogenous. Although one could use lagged explanatory variables, the endogeneity bias could still arise from serial correlations of these explanatory and dependent variables. On the other hand, a change in a bank's CDS position on a single firm (at time *t*) would be unlikely to affect the bank's capital ratio (at time *t-1*).

References

Allen, F., Carletti, E., 2006. Credit risk transfer and contagion. Journal of Monetary Economics 53, 89-111

Bharath, S.T., Shumway, T., 2008. Forecasting default with the merton distance to default model. Review of Financial Studies 21, 1339-1369

Buffet, W., 2002. Remarks by warren buffet on derivatives. In: Berkshire Hathaway Annual Report for 2002. Berkshire Hathaway

Choi, J., Shachar, O., 2014. Did liquidity providers become liquidity seekers? Evidence from the CDS-bond basis during the 2008 financial crisis. Federal Reserve Bank of New York Staff Report No. 650.

Duffee, G.R., Zhou, C., 2001. Credit derivatives in banking: Useful tools for managing risk? Journal of Monetary Economics 48, 25-54

Gehde-Trapp, M., Gündüz, Y., Nasev, J., 2015. The liquidity premium in CDS transaction prices: Do frictions matter? Journal of Banking & Finance 61, 184-205

Greenspan, A., 2004. Economic flexibility. In: Remarks by Chairman Alan Greenspan before the HM Treasury Enterprise Conference, London, England. Federal Reserve Board, Washington, DC

Gündüz, Y., Ongena, S., Tumer-Alkan, G., Yu, Y., 2015. Testing the small bang theory of the financial universe from bank-firm exposures to changes in CDS trading and credit. SSRN Working Paper Series, Rochester, NY

Hilscher, J., Pollet, J.M., Wilson, M., 2015. Are credit default swaps a sideshow? Evidence that information flows from equity to CDS markets. Journal of Financial and Quantitative Analysis 50, 543-567

Minton, B.A., Stulz, R., Williamson, R., 2009. How much do banks use credit derivatives to hedge loans? Journal of Financial Services Research 35, 1-31

Oehmke, M., Zawadowski, A., 2014. The anatomy of the CDS market. SSRN Working Paper Series, Rochester, NY

Parlour, C.A., Winton, A., 2013. Laying off credit risk: Loan sales versus credit default swaps. Journal of Financial Economics 107, 25-45

Pennacchi, G.G., 1988. Loan sales and the cost of bank capital. Journal of Finance 43, 375-396

Saretto, A., Tookes, H.E., 2013. Corporate leverage, debt maturity, and credit supply: The role of credit default swaps. Review of Financial Studies 26, 1190-1247

Shachar, O., 2012. Exposing the exposed: Intermediation capacity in the credit default swap market. Working paper, Federal Researve Bank of New York

Shan, S.C., Tang, D.Y., Yan, H., 2014. Did CDS make banks riskier? The effects of credit default swaps on bank capital and lending. In: SSRN Working Paper Series. Social Science Research Network, Rochester

Siriwardane, E., 2015. Concentrated capital losses and the pricing of corporate credit risk. SSRN Working Paper Series, Rochester, NY

Stulz, R.M., 2010. Credit default swaps and the credit crisis. Journal of Economic Perspectives 24, 73-92

Table 1
Variable definitions

Panel A: Bank-firm CDS position variables

Variable	Definition
Bought CDS position	For a bank-firm pair at time *t*, this variable equals the notional amount of CDS protection that the bank has bought against the firm (expressed in millions of U.S. dollars).
Sold CDS position	For a bank-firm pair at time *t*, this variable equals the notional amount of CDS protection that the bank has sold against the firm (expressed in millions of U.S. dollars).
Net CDS position	For a bank-firm pair at time *t*, this variable equals the notional amount of CDS protection that the bank has bought against the firm minus the notional amount of CDS protection that the bank has sold against the firm (expressed in millions of U.S. dollars).

Panel B: Bank-firm lending exposure variables

Variable	Definition
Lending exposure	For a bank-firm pair in each year, this variable measures the bank's total syndicated lending exposure to the firm. It equals the sum of the bank's used and unused syndicated lending commitments to the firm (expressed in millions of U.S. dollars).
Has lending exposure	For a bank-firm pair in each year, this dummy variable equals one if the bank was a lender to the firm in that year and zero otherwise.
Lender-borrower utilization ratio	This variable is the sum of the share utilized of all facilities of a lender-borrower pair divided by the sum of the share commitment of all facilities of that lender-borrower pair. A high utilization ratio implies that the borrower's reliance on the lender is high.
Agent lender	For a bank-firm pair in each year, this dummy variable equals one if the bank is the syndication agent of the firm in a syndicated facility

Panel C: Bank-level variables

Variable	Definition
Bank size	The total assets of a bank (expressed in billions of U.S. dollars)
Bank RBCR	The bank's risk based capital (RBC) to total risk-weighted assets (RWA) ratio
Bank ROA	The bank's return on assets
Bank NPA ratio	The bank's non-performing assets to total assets ratio
Bank wholesale funding ratio	The sum of total borrowing and brokered deposits divided by the sum of total borrowing and deposits

Panel D: Bank-firm private information variables

Variable	Definition
Special mention rating	This dummy equals one if any facility of the firm has a rating of "special mention". Special mention assets have potential weaknesses that deserve management's close attention. If left uncorrected, these potential weaknesses may result in further deterioration of the repayment prospects or in the institutions' credit position in the future. Special mention assets are not adversely classified and do not expose institutions to sufficient risk to warrant adverse classification.
Classified rating	This dummy equals one if any facility of the firm has a classified rating of "substandard", "doubtful", or "loss". Substandard assets are inadequately protected by the current sound worth and paying capacity of the obligor or of the pledged collateral, if any. Assets so classified have a well-defined weakness or weaknesses that jeopardize the liquidation of the debt and present the distinct possibility that the institution will sustain some loss if the deficiencies are not corrected. Doubtful assets have all the weaknesses of assets classified as substandard when those weaknesses make collection or liquidation in full, on the basis of available current information, highly questionable or improbable. Assets classified as loss are considered uncollectible and of so little value that their continuance as bankable assets is not warranted. Amounts classified as loss should be promptly charged off. This classification does not mean that there is no recovery or salvage value, but rather that it is not practical or desirable to defer writing off this asset even though some value may be recovered in the future.

Panel E: Firm-level variables

Variable	Definition
Firm distance-to-default	Firm's distance-to-default calculated using the Black-Sholes-Merton model. The value is calculated following Bharath and Shumway (2008).
Firm leverage	Firm's total debt to total assets ratio
Firm earning-to-asset ratio	Firm's earning to total assets ratio
Firm tangibility	Property, plant and equipment to asset ratio (ppentq/asset)
Firm current ratio	The current assets to current liabilities ratio
Firm Tobin's Q	Firm's market value of assets to book value of assets ratio
Firm Altman's Z	The Altman's Z-score
Investment grade firm	The firm's S&P long-term rating is above BBB-
Firm has credit rating	The firm has a S&P long-term rating
Firm stock return	The firm's trailing 12-month stock return
Firm size	The total assets of a firm (expressed in billions of U.S. dollars)
5-year CDS spread	5-year CDS spread
5-year CDS spread change	5-year CDS spread change

Table 2

Summary statistics of the bank-firm CDS positions and related variables

Panel A reports the summary statistics of bank-firm CDS positions by quarter. Panel B reports the summary statistics of continuous variables. Panel C reports the summary statistics of net CDS positions by different categories. Panel D reports the distribution of the net CDS position to lending exposure ratio. Variables are defined in Table 1. Bank size and firm size are expressed in billions of U.S. dollars. Bought CDS position, sold CDS position, net CDS position, lending exposure, loan exposure, and line exposure are expressed in millions of U.S. dollars. All other values are expressed in real value. "N" denotes number of observations; "Std" denotes standard deviation; "P5" and "P95" denote the 5th and 95th percentiles.

Panel A: Distribution of bank-firm CDS positions by quarter

		Bought CDS position		Sold CDS position		Net CDS position	
Quarter	N	Mean	Median	Mean	Median	Mean	Median
2009-03-31	2,037	$294.8	$100.6	$290.8	$95.0	$4.0	$0.0
2009-06-30	2,385	$238.0	$86.9	$226.3	$72.6	$11.7	$1.4
2009-09-30	2,394	$242.5	$102.5	$231.4	$97.0	$11.1	$2.9
2009-12-31	2,284	$179.0	$68.1	$178.0	$63.8	$1.1	$0.3
2010-03-31	2,361	$251.4	$117.2	$246.6	$109.8	$4.8	$0.8
2010-06-30	2,037	$162.4	$39.6	$115.5	$31.2	$46.9	$11.1
2010-09-30	2,042	$160.4	$36.6	$146.3	$38.8	$14.1	$1.1
2010-12-31	2,024	$167.2	$37.1	$154.7	$38.9	$12.5	$1.0
2011-03-31	1,369	$129.1	$56.3	$120.4	$46.1	$8.7	$2.9
2011-06-30	1,336	$124.8	$63.7	$29.6	$8.9	$95.2	$47.4
2011-09-30	1,377	$124.5	$60.8	$104.1	$43.7	$20.4	$7.7
2011-12-31	945	$50.1	$31.5	$38.6	$20.6	$11.5	$5.5
2012-03-31	1,326	$132.6	$70.0	$116.7	$57.8	$15.9	$4.7
2012-06-30	1,293	$119.9	$63.8	$103.2	$47.5	$16.8	$5.0
2012-09-30	1,305	$110.2	$50.6	$94.3	$37.3	$15.9	$4.6
2012-12-31	1,870	$136.7	$31.2	$86.5	$23.2	$50.2	$10.0
All	28,385	$177.6	$60.6	$157.8	$47.4	$19.8	$4.1

Table 2 (continued)

Panel B: Summary statistics of continuous variables

	N	Mean	Median	Std	P5	P95
Bought CDS position	28,385	$177.6	$60.6	$310.7	$0.0	$729.9
Sold CDS position	28,385	$157.8	$47.4	$299.4	$0.0	$686.9
Net CDS position	28,385	$19.8	$4.1	$90.3	$-66.6	$157.3
Lending exposure	11,820	$156.1	$100.0	$199.9	$20.0	$496.0
Loan exposure	11,820	$12.0	$0.0	$83.2	$0.0	$51.2
Line exposure	11,820	$144.1	$100.0	$180.5	$6.4	$445.0
Bought CDS position/lending exposure	11,820	549.9%	69.0%	10503.4%	0.0%	1038.1%
Sold CDS position/lending exposure	11,820	560.6%	56.3%	11928.3%	0.0%	984.0%
Net CDS position/lending exposure	11,820	-10.8%	3.6%	2014.5%	-101.1%	186.2%
Bank RBCR	28,385	16.2%	15.8%	3.1%	12.3%	23.7%
Bank wholesale funding ratio	28,385	45.4%	48.7%	7.2%	25.9%	48.7%
Bank ROA	28,385	0.1%	0.2%	0.7%	-1.3%	1.0%
Bank NPA ratio	28,385	2.6%	2.5%	1.3%	0.1%	4.8%
Firm stock return	28,385	8.8%	5.8%	49.5%	-60.3%	85.2%
Firm earning-to-asset ratio	28,385	1.9%	1.9%	2.8%	-1.1%	5.3%
Firm leverage	28,385	31.0%	28.6%	17.6%	5.6%	62.5%
Firm current ratio	28,385	143.8%	121.0%	72.5%	67.5%	284.5%
Firm tangibility	28,385	31.6%	26.0%	26.1%	0.0%	77.7%
Firm Altman Z	28,385	228.9%	201.4%	219.0%	13.9%	520.6%
Firm Tobin Q	28,385	138.9%	120.5%	60.9%	85.1%	246.5%
Lender-borrower utilization ratio	28,385	7.6%	0.0%	20.2%	0.0%	56.4%
5-year CDS spread	28,385	2.5%	1.2%	6.6%	0.4%	7.6%
5-year CDS spread change	28,385	-0.2%	-0.1%	5.1%	-1.9%	1.0%
Bank size	28,385	$1,524.0	$1,893.4	$721.8	$340.3	$2,323.4
Firm size	28,385	$62.2	$15.3	$212.6	$2.3	$202.9
Firm distance-to-default	28,385	5.6	4.8	5.1	-0.4	14.0

Table 2 (continued)

Panel C: Summary statistics of net CDS positions by different categories

	Net CDS position					
	N	Mean	Median	Std	P5	P95
Has lending exposure						
No (0)	16,565	$18.2	$4.2	$88.3	$-53.9	$134.2
Yes (1)	11,820	$22.0	$3.9	$93.0	$-82.9	$184.9
Agent lender						
No (0)	25,172	$18.9	$4.0	$88.3	$-62.8	$149.8
Yes (1)	3,213	$26.4	$5.4	$104.7	$-99.4	$198.7
Investment grade firm						
No (0)	6,451	$13.3	$1.1	$77.7	$-61.3	$125.3
Yes (1)	21,934	$21.7	$5.1	$93.6	$-68.2	$165.5
Special mention rating						
No (0)	27,799	$20.0	$4.2	$90.5	$-65.6	$157.9
Yes (1)	586	$9.6	$2.0	$78.1	$-100.5	$142.5
Classified rating						
No (0)	27,873	$19.8	$4.1	$89.8	$-65.7	$156.4
Yes (1)	512	$18.0	$2.0	$113.8	$-134.0	$189.7

Panel D: Summary statistics of the net CDS position by the net CDS position/lending exposure ratio

	Net CDS position					
Net CDS position/lending exposure ratio	N	Mean	Median	Std	P5	P95
No lending exposure	16,565	$18.2	$4.2	$88.3	$-53.9	$134.2
<0	4,945	$-36.1	$-15.7	$59.3	$-138.4	$-0.9
Between 0 and 1	5,665	$40.4	$18.4	$58.6	$0.8	$148.7
>1	1,210	$173.1	$141.4	$125.5	$30.4	$412.9

Table 3

Regressions of net CDS positions, entire sample, 2009–2012

This table reports the regressions of net CDS positions, on a sample of all bank-firm pairs regardless of whether a bank has lending exposure to the firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *net CDS position*, which is the net notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *has lending exposure*. For a bank-firm pair in each quarter, this dummy variable equals one if the bank was a lender to the firm in that quarter and zero otherwise.

This table consists of four regressions. Regression (1) includes only *has lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if the bank is the syndication agent of the firm in a syndicated facility. Regression (3) adds bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations

	(1)	(2)	(3)	(4)
Has lending exposure	0.790	-1.227	-1.291	-1.143
	[1.346]	[1.405]	[1.405]	[1.403]
Agent lender		7.256***	7.326***	7.253***
		[1.674]	[1.665]	[1.664]
Bank RBCR			1.141***	1.138***
			[0.214]	[0.214]
Bank wholesale funding ratio			-0.569***	-0.562***
			[0.209]	[0.210]
Bank ROA			-4.137***	-4.131***
			[1.105]	[1.104]
Bank NPA ratio			7.524***	7.511***
			[1.002]	[1.003]
Bank size			0.004	0.004
			[0.006]	[0.006]
Investment grade firm				-9.793***
				[3.669]
Firm has credit rating				25.486*
				[13.619]
Firm stock return				0.040**
				[0.016]
Firm distance-to-default				-0.519*
				[0.273]
Firm size				0.058
				[0.049]
Firm earning-to-asset ratio				0.108
				[0.255]
Firm leverage				0.089

				[0.117]
Firm current ratio				-0.007
				[0.015]
Firm tangibility				0.018
				[0.142]
Firm Altman's Z				-0.002
				[0.014]
Firm Tobin's Q				0.005
				[0.032]
5-year CDS spread				0.096
				[0.326]
5-year CDS spread change				0.396
				[0.447]
Bank fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	28,385	28,385	28,385	28,385
Adjusted R^2	0.208	0.208	0.212	0.213

Table 4

Regressions of net CDS positions, subsample, 2009–2012

This table reports the regressions of net CDS positions on a subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *net CDS position*, which is the net notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *lending exposure*, which is a bank's syndicated lending exposure to the firm in each year (expressed in millions of U.S. dollars).

This table consists of five regressions. Regression (1) includes only *lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if the bank is the syndication agent of the firm in a syndicated facility. Regression (3) includes bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. Regression (5) adds *special mention rating* and *classified rating* to measure a bank's private information about a firm, and *lender-borrower utilization ratio* to measure a firm's reliance on a lender for banking. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

	(1)	(2)	(3)	(4)	(5)
Lending exposure	0.046***	0.041***	0.041***	0.041***	0.041***
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Agent lender		6.244***	6.080***	6.041***	6.034***
		[1.757]	[1.737]	[1.732]	[1.733]
Bank RBCR			-4.358***	-4.332***	-4.334***
			[1.190]	[1.189]	[1.189]
Bank wholesale funding ratio			-0.965***	-0.944***	-0.949***
			[0.333]	[0.335]	[0.335]
Bank ROA			-14.670***	-14.869***	-14.886***
			[3.228]	[3.232]	[3.234]
Bank NPA ratio			11.225***	11.158***	11.129***
			[2.614]	[2.611]	[2.612]
Bank size			0.010	0.009	0.009
			[0.010]	[0.010]	[0.010]
Investment grade firm				-15.822**	-15.988**
				[6.207]	[6.242]
Firm has credit rating				92.138***	92.085***
				[32.530]	[32.791]
Firm stock return				0.065**	0.065**
				[0.027]	[0.027]
Firm distance-to-default				-1.165**	-1.121**
				[0.549]	[0.550]
Firm size				0.162*	0.167*
				[0.098]	[0.098]
Firm earning-to-asset ratio				0.459	0.465
				[0.481]	[0.482]

Firm leverage				-0.234	-0.207
				[0.210]	[0.209]
Firm current ratio				-0.025	-0.024
				[0.027]	[0.027]
Firm tangibility				-0.566**	-0.564**
				[0.268]	[0.270]
Firm Altman's Z				-0.021	-0.023
				[0.027]	[0.027]
Firm Tobin's Q				0.096	0.095
				[0.061]	[0.061]
5-year CDS spread				0.677	0.736
				[0.553]	[0.560]
5-year CDS spread change				0.631	0.571
				[0.720]	[0.721]
Special mention rating					-1.908
					[4.334]
Classified rating					-2.502
					[6.292]
Lender-borrower utilization ratio					-0.029
					[0.040]
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
N	11,820	11,820	11,820	11,820	11,820
Adjusted R^2	0.251	0.252	0.264	0.266	0.266

Table 5

Regressions of sold CDS positions, entire sample, 2009–2012

This table reports the regressions of net CDS positions, on a sample of all bank-firm pairs regardless of whether a bank has lending exposure to the firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *sold CDS position*, which is the notional amount of CDS protection that a bank has sold on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *has lending exposure*. For a bank-firm pair in each quarter, this dummy variable equals one if the bank was a lender to the firm in that quarter and zero otherwise.

This table consists of four regressions. Regression (1) includes only *has lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if a bank is the syndication agent of a firm in a syndicated facility. Regression (3) adds bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations

	(1)	(2)	(3)	(4)
Has lending exposure	13.712***	11.026***	10.976***	11.426***
	[3.577]	[3.714]	[3.691]	[3.670]
Agent lender		9.666**	9.269**	8.961**
		[4.219]	[4.166]	[4.163]
Bank RBCR			3.556***	3.540***
			[0.554]	[0.552]
Bank wholesale funding ratio			-6.693***	-6.725***
			[0.623]	[0.621]
Bank ROA			12.213***	12.020***
			[2.405]	[2.403]
Bank NPA ratio			-23.880***	-24.084***
			[2.749]	[2.744]
Bank size			0.069***	0.070***
			[0.022]	[0.022]
Investment grade firm				-9.471
				[11.482]
Firm has credit rating				-13.092
				[49.216]
Firm stock return				-0.044
				[0.041]
Firm distance-to-default				0.074
				[0.659]
Firm size				0.310**
				[0.130]
Firm earning-to-asset ratio				-2.367***
				[0.751]
Firm leverage				-0.024

				[0.319]
Firm current ratio				0.077**
				[0.036]
Firm tangibility				0.139
				[0.384]
Firm Altman's Z				-0.158***
				[0.037]
Firm Tobin's Q				0.001
				[0.080]
5-year CDS spread				-1.982*
				[1.047]
5-year CDS spread change				0.459
				[1.361]
Bank fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	28,385	28,385	28,385	28,385
Adjusted R^2	0.581	0.581	0.587	0.588

Table 6

Regressions of sold CDS positions, subsample, 2009–2012

This table reports the regressions of sold CDS positions on a subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *sold CDS position*, which is the notional amount of CDS protection that a bank has sold on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *lending exposure*, which is a bank's syndicated lending exposure to the firm in each year (expressed in millions of U.S. dollars).

This table consists of five regressions. Regression (1) includes only *lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if the bank is the syndication agent of the firm in a syndicated facility. Regression (3) includes bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. Regression (5) adds *special mention rating* and *classified rating* to measure a bank's private information about a firm, and *lender-borrower utilization ratio* to measure a firm's reliance on a lender for banking. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

	(1)	(2)	(3)	(4)	(5)
Lending exposure	0.189***	0.187***	0.200***	0.197***	0.195***
	[0.026]	[0.026]	[0.026]	[0.026]	[0.026]
Agent lender		2.640	1.037	1.205	1.008
		[4.214]	[4.111]	[4.092]	[4.093]
Bank RBCR			-29.493***	-29.763***	-29.819***
			[3.039]	[3.020]	[3.009]
Bank wholesale funding ratio			-8.005***	-8.124***	-8.095***
			[0.988]	[0.986]	[0.984]
Bank ROA			85.642***	85.448***	85.536***
			[8.910]	[8.892]	[8.886]
Bank NPA ratio			46.282***	46.136***	46.093***
			[7.650]	[7.628]	[7.623]
Bank size			0.237***	0.239***	0.238***
			[0.032]	[0.031]	[0.031]
Investment grade firm				-48.236**	-53.327***
				[19.189]	[19.299]
Firm has credit rating				-298.132*	-297.169*
				[157.973]	[157.909]
Firm stock return				-0.021	-0.027
				[0.071]	[0.071]
Firm distance-to-default				1.942	1.345
				[1.256]	[1.261]
Firm size				-0.412**	-0.406**
				[0.178]	[0.179]
Firm earning-to-asset ratio				-2.400*	-2.341
				[1.443]	[1.444]

Firm leverage				0.023	-0.087
				[0.557]	[0.555]
Firm current ratio				0.089	0.084
				[0.066]	[0.066]
Firm tangibility				1.154*	0.901
				[0.687]	[0.693]
Firm Altman's Z				-0.120*	-0.102
				[0.063]	[0.063]
Firm Tobin's Q				-0.366***	-0.378***
				[0.135]	[0.135]
5-year CDS spread				-7.134***	-7.653***
				[1.609]	[1.614]
5-year CDS spread change				1.222	1.604
				[2.076]	[2.081]
Special mention rating					24.145**
					[12.165]
Classified rating					58.239***
					[17.906]
Lender-borrower utilization ratio					-0.185*
					[0.111]
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
N	11,820	11,820	11,820	11,820	11,820
Adjusted R^2	0.626	0.626	0.639	0.642	0.642

Table 7

Regressions of bought CDS positions, entire sample, 2009–2012

This table reports the regressions of bought CDS positions, on a sample of all bank-firm pairs regardless of whether a bank has lending exposure to the firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *bought CDS position*, which is the notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *has lending exposure*. For a bank-firm pair in each quarter, this dummy variable equals one if the bank was a lender to the firm in that quarter and zero otherwise.

This table consists of four regressions. Regression (1) includes only *has lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if a bank is the syndication agent of a firm in a syndicated facility. Regression (3) adds bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

	(1)	(2)	(3)	(4)
Has lending exposure	15.610***	10.470***	10.347***	11.131***
	[3.644]	[3.789]	[3.768]	[3.747]
Agent lender		18.488***	18.174***	17.716***
		[4.298]	[4.255]	[4.250]
Bank RBCR			5.128***	5.114***
			[0.572]	[0.570]
Bank wholesale funding ratio			-7.376***	-7.398***
			[0.659]	[0.657]
Bank ROA			5.766**	5.564**
			[2.529]	[2.526]
Bank NPA ratio			-15.760***	-15.980***
			[2.850]	[2.844]
Bank size			0.074***	0.074***
			[0.022]	[0.022]
Investment grade firm				-18.949*
				[11.471]
Firm has credit rating				2.241
				[48.215]
Firm stock return				-0.022
				[0.044]
Firm distance-to-default				-0.578
				[0.661]
Firm size				0.475***
				[0.134]
Firm earning-to-asset ratio				-2.052***
				[0.774]
Firm leverage				0.086

				[0.324]
Firm current ratio				0.074**
				[0.037]
Firm tangibility				0.170
				[0.387]
Firm Altman's Z				-0.169***
				[0.038]
Firm Tobin's Q				0.038
				[0.084]
5-year CDS spread				-2.059*
				[1.068]
5-year CDS spread change				1.659
				[1.375]
Bank fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	28,385	28,385	28,385	28,385
Adjusted R^2	0.601	0.602	0.606	0.607

Table 8

Regressions of bought CDS positions, subsample, 2009–2012

This table reports the regressions of bought CDS positions on a subsample of bank-firm pairs in which a bank has a lending exposure to a firm. The estimation sample is a quarterly panel of bank-firm pairs. The sample period is 2009–2012. The estimation method is OLS with bank, firm, and time fixed effects. Variables are defined in Table 1. The dependent variable is *bought CDS position*, which is the notional amount of CDS protection that a bank has bought on a firm at time *t* (expressed in millions of U.S. dollars). The explanatory variables are observed at time *t-1*. The key explanatory variable is *lending exposure*, which is a bank's syndicated lending exposure to the firm in each year (expressed in millions of U.S. dollars).

This table consists of five regressions. Regression (1) includes only *lending exposure* as the explanatory variable. Regression (2) adds the *agent lender* dummy, which equals one if a bank is the syndication agent of a firm in a syndicated facility. Regression (3) includes bank-level explanatory variables. Regression (4) adds firm-level explanatory variables. Regression (5) adds *special mention rating* and *classified rating* to measure a bank's private information about a firm, and *lender-borrower utilization ratio* to measure a firm's reliance on a lender for banking. All regressions include bank fixed effects to control for unobserved time-invariant bank-level factors, firm fixed effects to control for unobserved time-invariant firm-level factors, and time fixed effects to control for the combined effects of observed and unobserved macroeconomic factors. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

	(1)	(2)	(3)	(4)	(5)
Lending exposure	0.234***	0.225***	0.238***	0.234***	0.233***
	[0.028]	[0.028]	[0.027]	[0.027]	[0.027]
Agent lender		10.893**	9.130**	9.177**	8.987**
		[4.308]	[4.198]	[4.187]	[4.187]
Bank RBCR			-33.536***	-33.737***	-33.792***
			[3.050]	[3.036]	[3.028]
Bank wholesale funding ratio			-9.033***	-9.110***	-9.093***
			[1.061]	[1.061]	[1.060]
Bank ROA			69.856***	69.413***	69.465***
			[9.043]	[9.029]	[9.021]
Bank NPA ratio			58.956***	58.730***	58.644***
			[7.852]	[7.841]	[7.837]
Bank size			0.249***	0.250***	0.249***
			[0.032]	[0.031]	[0.031]
Investment grade firm				-65.046***	-69.815***
				[17.907]	[18.016]
Firm has credit rating				-256.136	-255.412
				[160.086]	[160.069]
Firm stock return				0.021	0.017
				[0.073]	[0.073]
Firm distance-to-default				0.170	-0.293
				[1.303]	[1.307]
Firm size				-0.028	-0.014
				[0.204]	[0.204]
Firm earning-to-asset ratio				-1.615	-1.550
				[1.446]	[1.447]

Firm leverage				-0.283	-0.336
				[0.556]	[0.555]
Firm current ratio				0.078	0.074
				[0.066]	[0.066]
Firm tangibility				0.626	0.402
				[0.684]	[0.689]
Firm Altman's Z				-0.142**	-0.128**
				[0.063]	[0.063]
Firm Tobin's Q				-0.215	-0.226
				[0.146]	[0.146]
5-year CDS spread				-6.579***	-6.945***
				[1.597]	[1.603]
5-year CDS spread change				2.654	2.903
				[2.007]	[2.009]
Special mention rating					19.513
					[11.953]
Classified rating					47.759***
					[17.073]
Lender-borrower utilization ratio					-0.211*
					[0.109]
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
N	11,820	11,820	11,820	11,820	11,820
Adjusted R^2	0.646	0.646	0.659	0.661	0.661