Iftekhar Hasan – Deming Wu

Credit Default Swaps and Bank Loan Sales: Evidence from Bank Syndicated Lending

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Iftekhar Hasan [a], Deming Wu [b]

Abstract

Do banks use credit default swap hedging to substitute for loan sales? By tracking banks' lending exposures and CDS positions on individual firms, we find that banks use CDS hedging to complement rather than to substitute for loan sales. Consequently, bank loan sales are higher for firms that are actively traded in the CDS market. In addition, we find evidence that suggests that banks sell CDS protection as credit enhancements to facilitate loan sales. This study employs identification strategies similar to the "twin study" design to separate the effects of borrower-side and lender-side factors, and to minimize the omitted-variables bias.

JEL classification: G14; G21; G23; G28; G32;
Key words: CDS; Loan sales; Hedging; Credit enhancement; Regulatory capital relief; Banking

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[a] Corresponding author, Gabelli School of Business, Fordham University, New York, and Bank of Finland, Helsinki, Finalnd. Address: 45 Columbus Avenue, Room 511, New York, NY 10023, E-mail: ihasan@fordham.edu.

[b] Office of the Comptroller of the Currency, U.S. Department of the Treasury,
400 7th Street SW, Mail Stop 6E-3, Washington, DC 20219, phone: (202) 649-5543, fax: (202) 649-5742, e-mail: Deming.Wu@occ.treas.gov. The views expressed in this paper are those of the authors, and do not necessarily reflect those of the Office of the Comptroller of the Currency, the U.S. Department of the Treasury, or the Bank of Finland.

Securitization and credit default swap (CDS)[1] are two of the most successful and controversial financial innovations over the past two decades. Both have enjoyed explosive growth, and both have been blamed for contributing to or exacerbating the 2007–2009 financial crisis. Securitization has transformed the banking industry, bringing into prominence the originate-to-distribute business model. Accompanying this change is the explosive growth of the secondary loan market.[2] Both loan sales and CDS contracts can be used to transfer credit risk from one party to another (Allen and Carletti (2006); Duffee and Zhou (2001); Parlour and Winton (2013)), which raises the question of whether banks use CDS hedging to substitute for loan sales. For instance, if a bank buys CDS protection to hedge its lending exposure to a firm, it may have less incentive to cut its lending exposure to that firm. Therefore, the ability to hedge through CDS reduces the need to sell a loan in the secondary market. On the other hand, banks can also sell CDS protection as credit enhancements to facilitate loan sales to investors unwilling to hold credit risk (Minton, Stulz, and Williamson (2009)). To this end, the ability to hedge through CDS increases the demand in the secondary loan market. In this study, we examine whether banks use CDS contracts to substitute for or to facilitate loan sales using new data that track each bank's lending exposure in each syndicated credit facility over time.

Data limitations create major impediments in empirical studies on banks' CDS uses and loan sales. For instance, researchers on corporate loan sales rely on the Loan Syndications and Trading Association (LSTA) mark-to-market pricing database, which collects only loan bid and

[1] A CDS contract is a credit derivative contract that transfers the default risk of one or more reference entities from the protection buyer to the protection seller.

[2] According to a report from the Loan Syndications and Trading Association, secondary trading volume in the U.S. loan market reached an all-time high of $628 billion in 2014, up 21% from $517 billion in 2013, and topping the previous high of $520 billion recorded in 2007.

ask prices from market makers and provides no information about transactions of loan sales. Therefore, researchers do not know whether a loan sale actually occurred, let alone the identity or other information about the seller, buyer, or amount involved in a loan sale. Consequently, researchers must infer that a loan sale has occurred when the LSTA database reports a quote on a loan. Obviously, this approach of identifying loan sales can be very imprecise. Other studies rely on the Thomson-Reuters Loan Pricing Corporation's (LPC) Dealscan database to identify lenders of corporate loans. This database, however, does not include information about each participating lender's share in a syndicated loan over time. Finally, the lack of timely and accurate information about how banks use CDS greatly hindered policymakers' ability to develop effective responses during the 2007–2009 financial crisis (Financial Stability Board (2009)).

The data used in our study overcome some of these aforementioned limitations. Our main data come from the Shared National Credit (SNC) Program, an interagency effort established in 1977 to provide a periodic credit risk assessment of large syndicated credits held by federally supervised financial institutions. Importantly, the SNC data track each lender's exposure in each syndicated credit facility in each year. A lender's exposure to a facility is its share commitment, which is the total amount that a lender has legally committed to a syndicated credit facility. Specifically, a lender's exposure to a facility includes both utilized and unutilized commitments to the facility.

We define a variable, *exposure cut*, as an approximate measure of loan sales. Specifically, a lender's exposure cut on a facility is the difference in its lending exposure to the facility between the previous year and the current year. A positive exposure cut generally implies that a lender

has sold part or all of its exposure to a facility in the secondary market.[3] Since positive exposure cuts can occasionally be caused by loan amendments, we explicitly control for loan amendments in our analyses. Therefore, our approximate measure of loan sales reflects a significant improvement over measures used in previous studies.

We further employ identification strategies similar to the "twin study" design[4] to separate the effects of borrower-side and lender-side factors, and to minimize the omitted-variables bias. One main empirical challenge in evaluating a bank's decision to sell loans is the difficulty in separating the effects of borrower-side factors from those of lender-side factors. For instance, a bank can sell loans because the risk of its borrowers has escalated, or because it has encountered a liquidity shock. Consequently, the estimated results will be biased if one does not properly control for either the borrower-side or the lender-side effects. Additionally, a researcher may either be unaware of or lack access to all relevant variables, so the omitted-variables bias could also arise. To overcome these problems, we employ two identification strategies: The first identification strategy allows us to focus on the effects of borrower-side factors without worrying about lender-side factors, and the second identification strategy allows us to focus on the effects of lender-side factors without worrying about borrower-side factors.

These identification strategies leverage one prominent feature of syndicated lending: Each syndicated facility has multiple lenders, and each lender participates in multiple facilities. To control for lender-side factors, we compare exposure cuts on different facilities by the same

[3]A lender's exposure to a facility includes both utilized and unutilized commitments. Principal and interest payments change the utilized commitment but not the total commitment. In other words, principal and interest payments do not lead to positive exposure cuts.

[4]Because identical twins share nearly 100% of their genes, most differences between them are due to their environments.

lender in the same year. To this end, we include the lender-time fixed effects, which are lender fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved lender-side factors, and macroeconomic factors. Likewise, to control for all borrower-side factors, we compare exposure cuts by different lenders on the same facility in the same year. Specifically, we include the facility-time fixed effects, which are facility fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved facility-level factors, firm-level factors, and macroeconomic factors.

We perform additional analyses using a secondary sample obtained through linking the SNC data with a data set from the Depository Trust & Clearing Corporation (DTCC). The DTCC data set tracks the weekly CDS positions on each reference entity for each of the six largest banks in the United States. By linking the SNC data with the DTCC data, we can examine the relationship between a bank's exposure cut and its CDS positions on the same firm.

We find that banks' exposure cuts are higher on firms that are actively traded in the CDS market. Additionally, a bank's exposure cut on a firm is higher if the bank has also bought CDS on that firm. These findings do not support the view that banks use CDS hedging to substitute for loan sales, but rather suggest that banks tend to use CDS hedging and loan sales concomitantly. Moreover, we find a positive and significant correlation between a bank's exposure cut and its sold CDS protection on the same firm, which suggests that banks are likely to sell CDS protection as credit enhancements to facilitate loan sales to investors unwilling to bear credit risk.

To the best of our knowledge, the current study is the first to examine the relationship between U.S. large banks' use of CDS and loan sales using data that track each bank's lending exposures on individual firms. Our study complements that of Minton, Stulz, and Williamson

(2009), who find that only a few large banks use credit derivatives and these large banks' derivative positions are predominantly for dealer activities. Because Minton, Stulz, and Williamson (2009) rely on a data set that reports only each bank's aggregate lending exposures and CDS positions across all firms, they do not examine the relationship between banks' uses of CDS and loan sales at the individual firm level. Our study fills this gap.

This paper is broadly related to the literature on bank loan sales (Dahiya, Puri, and Saunders (2003); Drucker and Puri (2009); Gande and Saunders (2012); Parlour and Plantin (2008); Parlour and Winton (2013); Pennacchi (1988)). Empirical studies within this literature are predominantly based on the Dealscan and LSTA databases that are subject to the aforementioned data limitations. Although there are a few studies that use the SNC data, these studies have different focuses than ours. For instance, Bord and Santos (2011) investigate whether the securitization of corporate loans affected banks' lending standards, and Irani and Meisenzahl (2014) focus on the role of wholesale funding on bank loan sales. In contrast, we examine whether banks use CDS to substitute for or facilitate loan sales.

Additionally, this study is broadly related to the literature that examines the implications and consequences of CDS trading. Within this literature, Ashcraft and Santos (2009) find that the onset of CDS trading does not lower the cost of debt financing for the average borrower, and Saretto and Tookes (2013) find that firms with traded CDS contracts on their debts are associated with higher leverage ratios and longer debt maturities. Finally, Subrahmanyam, Tang, and Wang (2014) find declines in the credit quality of reference entities following the introduction of CDS.

The DTCC data are also used in a few recent studies that have different focuses, empirical designs, or sample periods than ours. Among these studies, Choi and Shachar ((2014)) focus on CDS-bond basis trades, and Shachar ((2012)) examines the impacts of the daily aggregate order

imbalance on CDS spreads. Siriwardane ((2015)) studies the relationship between concentrated capital losses of CDS sellers and changes in CDS spreads, and Gehde-Trapp, Gündüz, and Nasev (2015) focus on the liquidity premium in CDS transactions. Oehmke and Zawadowski (2014) examine the hedging and speculation motives of CDS trading, and Gündüz et al. (2015) focus on a sample of German banks and firms. Our study complements these studies by focusing on whether large U.S. banks use CDS to substitute for or facilitate loan sales.

The rest of this paper proceeds as follows. Section I describes the data and empirical design. Section II presents and discusses the estimation results, and Section III concludes.

I. Data and methods

A. Data

We construct two data samples. The primary sample, at the lender-facility level, links the SNC data with the Markit CDS data, the Federal Reserve Consolidated Financial Statements for Holding Companies (i.e., FR Y-9C), and the Consolidated Reports of Condition and Income for Commercial Banks (i.e., call reports). To obtain additional information about the obligors, as well as pricing information about syndicated credit facilities, we link this sample with the Compustat, Center for Research in Security Price (CRSP), and LPC Dealscan databases. Our main analyses use the primary sample, which covers the period from 2001 to 2013. For additional analyses, we construct a secondary sample that is at the lender-borrower level. To create the secondary sample, we aggregate the primary sample from the lender-facility level to the lender-borrower level, and then link it with the DTCC data. Because the DTCC data are available only after 2009 and we need a one-year lag to construct variables to measure changes in lending exposures, the secondary sample covers the period from 2010 to 2013. Table I defines all variables used in this study.

The SNC data set is an annual panel data set that contains basic information about facility, borrower, and syndicate structure. The SNC program covers any loan, loan commitment, or group of commitments, aggregating $20 million or more at origination, and shared by three or more unaffiliated supervised institutions. 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. The SNC data are reported at both the facility level and the lender-facility level. At the facility level, the SNC reports information about the total committed amount and the total utilized amount of each facility in each year. It also includes information about facility type, facility purpose, origination date, maturity date, agent lender, and internal risk ratings assigned by the agent bank. Each facility in the SNC data is assigned an internal risk rating, which is one of the five regulatory rating categories with increasing levels of 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. On the other hand, the "special mention", "substandard", "doubtful", and "loss" ratings are broadly referred to as "criticized" ratings that indicate elevated levels of default risk.

At the lender-facility level, each observation is identified by a facility identifier, a lender identifier, and a year variable (e.g., a lender-facility-year triple), and contains information about each lender's committed amount and utilized amount for each facility in each year. The SNC database includes each lender's *RSSD_ID*, the primary identifier for the bank holding company (BHC) and commercial bank databases. Therefore, we use the *RSSD_ID* field to link the SNC data with these databases. We aggregate lenders to the top holder level. Therefore, except for stand-alone banks, lenders are defined at the BHC level.

The data set from the DTCC contains the weekly CDS positions on each reference entity for

each of the six largest banks in the United States from 2009 to 2012. Therefore, this data set allows us to track each lender's CDS position on each reference entity over time. According to the DTCC, the Trade Information Warehouse (TIW) is the only comprehensive trade repository and post-trade processing infrastructure for over-the-counter (OTC) credit derivatives in the world. This global repository, which holds more than 2.3 million contracts, electronically matches and confirms more than 98% of CDS transactions globally, and handles the calculation, netting, and central settlement of payment obligations between counterparties.

The secondary sample is an annual panel data sample of lender-borrower pairs. Each observation in this sample contains a lender's syndicated lending exposure to a borrower in the fourth quarter of each year. For a subset of lender-borrower pairs that are matched with the DTCC data, each observation also contains the lender's notional amounts of bought CDS protection, sold CDS protection, and net CDS protection on the firm in the fourth quarter of the same year. Therefore, we can use the secondary sample to examine the relationship between a bank's CDS trading positions on a given firm and its exposure cut to the same firm.

B. Definition of exposure cut in the primary sample

For regressions based on the primary sample, the dependent variable is *exposure cut*, which is the difference in a lender's lending exposure to a facility between the end of year *t-1* and the end of year *t*:

$$\text{Exposure cut}_{i,j,t} = \text{Lender-facility exposure}_{i,j,t-1} - \text{Lender-facility exposure}_{i,j,t}, \qquad (1)$$

where *i*, *j*, and *t* index facilities, banks, and time. According to this definition, a lender's exposure cut on a facility is positive if the lender reduces its exposure to the facility. Although exposure cuts can occasionally be caused by loan amendments, they are generally caused by loan

sales. As will be discussed in subsequent sections, we specifically control for loan amendments in our analyses.

C. Empirical design that controls for lender-side factors

Analogous to the classic "twin study" design in behavioral genetics, we can control for lender-side factors by comparing exposure cuts on different facilities by the same lender in the same year. Specifically, we include the lender-time fixed effects to absorb the effects of lender-level and macroeconomic variables. This identification strategy allows us to focus on the effects of borrower-side factors without worrying about the lender-side factors. Specifically, the regression design can be summarized using the following equation:

$$\begin{aligned}\text{Exposure cut}_{i,j,t} &= (\text{Lender-time fixed effects})_{j,t} + A_1 \bullet (\text{CDS traded firm})_k \\ &+ A_2 \bullet (\text{CDS active firm})_{k,t-1} + A_3 \bullet (\text{Facility-level variables})_{i,t-1} \\ &+ A_4 \bullet (\text{Lender-facility-level variables})_{i,j,t-1} + A_5 \bullet (\text{Lender-borrower-level variables})_{j,k,t-1} \\ &+ A_6 \bullet (\text{Borrower-level variables})_{k,t-1} + \varepsilon_{i,j,t},\end{aligned} \tag{2}$$

where *i*, *j*, *k*, and *t* index facilities, lenders, firms, and time.

Using an empirical design similar to Ashcraft and Santos (2009), Saretto and Tookes (2013), and Subrahmanyam, Tang, and Wang (2014), we construct two variables by linking the SNC data with the Markit CDS data. The first variable is *CDS traded firm*, a dummy variable created to control for selection bias and other time-invariant differences between CDS-referenced and non-CDS-referenced firms. If any of a firm's debts was referenced in the CDS market at any time during the sample period of 2001–2013, the *CDS traded firm* dummy for this firm equals one for all years. The second variable, *CDS active firm*, is designed to capture CDS trading effects. The *CDS active firm* dummy for a firm equals one in a given year if any of the firm's debts was referenced in the CDS market in that year.

Facility-level variables include *credit line*, *amended facility*, and *high-risk internal rating*. A

syndicated credit facility can be either a loan facility (e.g., term loan) or a credit line facility (e.g., revolving or non-revolving credit). We use the *credit line* dummy to capture the difference in exposure cuts between loan and line facilities. Specifically, the *credit line* dummy variable equals one if a facility is a credit line and zero if a facility is a loan facility.

As mentioned before, exposure cuts can occasionally be caused by loan amendments. To differentiate exposure cuts caused by loan sales from those caused by loan amendments, we create a dummy variable, *amended facility*, which equals one if a facility was amended between year *t-1* and year *t*. Therefore, this dummy captures the effects of loan amendments.

A bank's exposure cut on a facility can also be driven by the bank's private information about the credit risk of this facility. To control for the private information effects, we employ the *high-risk internal rating* dummy, which equals one if a facility has one of the following "criticized" internal risk ratings: "special mention", "substandard", "doubtful" and "loss".

We use two variables to measure the lender-facility relationship. The *agent lender* dummy indicates whether the lender is the agent for a given facility, and *Lender-facility exposure* is a lender's share commitment to a facility (expressed in millions of U.S. dollars). Finally, *lender-borrower exposure* is the sum of a lender's exposure to all facilities of a given lender-borrower pair, which is used as a measure for the lender-borrower relationship.

The borrower-level explanatory variables include a firm's trailing 12-month stock return, firm size, leverage, earning-to-asset ratio, tangibility, current ratio, Altman's Z, and Tobin's Q. In addition, we create a dummy variable, *investment-grade firm*, to indicate whether a firm has an investment-grade credit rating (i.e., a long-term S&P rating above BBB-). We calculate the *distance-to-default* measure using Merton's model (Bharath and Shumway (2008)).

D. Empirical design that controls for borrower-side factors

To control for borrower-side factors, we compare exposure cuts by different lenders on the same facility in the same year. We do so by including the facility-time fixed effects, which control for the combined effects of observed and unobserved facility-level, firm-level, and macroeconomic factors. As a result, we can focus on the effects of lender-side factors without worrying about borrower-side factors. Specifically, the regression design can be summarized using the following equation:

$$\begin{aligned}\text{Exposure cut}_{i,j,t} &= (\text{Facility-time fixed effects})_{i,t} + B_1 \bullet (\text{Bank net CDS ratio})_{j,t-1} \\ &+ B_2 \bullet (\text{Lender-facility-level variables})_{i,j,t-1} + B_3 \bullet (\text{Lender-borrower-level variables})_{j,k,t-1} \\ &+ B_4 \bullet (\text{Other lender-level variables})_{j,t-1} + \varepsilon_{i,j,t},\end{aligned} \tag{3}$$

where *i*, *j*, *k*, and *t* index facilities, banks, firms, and time. The variable, *bank net CDS ratio*, is the ratio of the net notional amount of bought CDS protection to total assets. It is an aggregate measure of a bank's hedging activities.

We include lender-level variables commonly used in the existing literature (Berger et al. (2014); Boyson, Helwege, and Jindra (2014); Duchin and Sosyura (2014); Li (2013)). The selection of lender-level variables is largely based on the six key components regulators use to assess an institution's financial condition and operations: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk. Specifically, the risk-based-capital ratio (*bank RBCR*) is a measure of capital adequacy. The non-performing asset ratio (*bank NPA ratio*) is a measure of asset quality. The net interest margin (*bank NIM*) and return on assets (*bank ROA*) are measures of earning. The wholesale funding ratio (*bank wholesale funding ratio*) is a measure of liquidity. The volatility of ROA (*bank ROA volatility*) is a measure of management capability. The securitized assets to total assets ratio (*bank securitized assets ratio*) is a measure of bank securitization activities. Finally, *bank size* is a measure of size effects, or

the too-big-to-fail (TBTF) factor.

E. Empirical design for estimations on the secondary sample

For regressions based on the secondary sample, the definition of *exposure cut* is slightly different:

$$\text{Exposure cut}^{B}_{k,j,t} = \text{Lender-borrower exposure}_{k,j,t-1} - \text{Lender-borrower exposure}_{k,j,t}, \qquad (4)$$

where *k*, *j*, and *t* index borrowers, lenders, and time. The regression design can be summarized using the following equation:

$$\begin{aligned}\text{Exposure cut}^{B}_{k,j,t} &= D_0 + D_1 \bullet (\text{Lender-borrower CDS positions variables})_{k,j,t-1} \\ &+ D_2 \bullet (\text{Lender-borrower level variables})_{j,t-1} + D_3 \bullet (\text{Borrower-level variables})_{k,t-1} \\ &+ (\text{Lender-time fixed effects})_{j,t},\end{aligned} \qquad (5)$$

where *k*, *j*, and *t* index borrowers, lenders, and time.

We use two sets of lender-borrower CDS position variables in the regressions. First, we create two dummy variables to indicate whether a lender is a net protection buyer (*net CDS buyer*) or a net protection seller on a borrower (*net CDS seller*). Using these variables, we can run regressions on the entire sample and examine whether the coefficients of these variables are significant. For a subsample of lender-borrower pairs in which the lender holds CDS positions on the firm, we include the *net CDS protection* and the *sold CDS protection* of a lender on a borrower to examine the effects of these positions on exposure cut.

We use *agent lender* and *lender-borrower exposure* to measure the lender-borrower relationship, and we use *high-risk internal rating* to measure a lender's private information about a borrower. The *high-risk internal rating* dummy equals one if any facility of the borrower has one of the following "criticized" internal ratings: "special mention", "substandard", "doubtful" and "loss". Finally, we include lender-time fixed effects to absorb the combined effects of

observed and unobserved lender-level factors, as well as macroeconomic factors.

II. Results

The empirical results are reported in four subsections. Section A reports the summary statistics. Section B estimates the relationship between banks' CDS uses and loan sales by comparing exposure cuts on different facilities by the same lender in the same year. Section C compares exposure cuts by different lenders on the same facility in the same year. Section D reports the estimation results based on the secondary sample.

A. Summary statistics

The sample period of the primary sample is 2001–2013, including six years before the most recent financial crisis (2001–2006), three years during the crisis (2007–2009), and four years after the crisis (2010–2013). Panel A of Table II reports the summary statistics of the observations included in the primary sample as well as those of the excluded observations. A lender-facility observation is included in the final sample if the following three conditions are met: First, the facility has at least two distinct lenders; second, the lender filed a FR-Y9C or a Call Report; and third, the borrower of the facility can be matched using Compustat. The resulting final sample consists of 129,180 lender-facility-year observations, including 402 lenders, 2,718 borrowers, and 10,158 facilities. There are 1,736 observations excluded from the final sample, accounting for 1.34% of the total number of observations, and 0.80% of the total lending exposure in the original sample. Finally, the minimum number of distinct lenders for each facility in the final sample is 2, and the median is 8. Panel B of Table II reports the distribution of *CDS traded firm* and *CDS active firm* in the primary sample.

Panel C of Table II reports the summary statistics of exposure cuts by year at the lender-

facility level. As this panel shows, the average exposure cut varies substantially from year to year, fluctuating between $11.1 million (in 2009) and $24.0 million (in 2011). The average exposure cut for the entire sample is $15.0 million. Panel D reports the summary statistics of continuous variables, and Panel E reports the summary statistics of exposure cuts by different categories.

The sample period of the secondary sample is from 2010 to 2013. The final sample contains 12,604 lender-borrower-year observations, including six lenders, 1438 borrowers and 4,288 lender-borrower pairs. Panel A of Table III reports the summary statistics of exposure cuts by year. Panel B reports the summary statistics of exposure cuts by different categories, and Panel C reports the summary statistics of continuous variables.

B. Comparing exposure cuts by the same bank on different facilities

Table IV reports the estimation results on the relationship between CDS trading and loan sales by comparing exposure cuts on different facilities by the same bank in the same year. The sample period is from 2001 through 2013. The dependent variable is *exposure cut*, which is the difference in lender-facility exposure between the end of year *t-1* and the end of year *t* for each lender-facility pair (expressed in millions of U.S. dollars). To avoid reverse causality, the explanatory variables are observed at the end of year *t-1*. Table IV consists of five regressions. All regressions include lender-time fixed effects to absorb the combined effects of lender-side variables and macroeconomic variables.

Regression (1), the baseline regression, shows a positive correlation between banks' loan sales and firms' CDS trading status. We use the *credit line* dummy to differentiate between loan facilities and credit line facilities. This dummy equals one if a facility is a credit line facility, and it equals zero if a facility is a loan facility. Consequently, the coefficient of *CDS active firm*

measures the effects of CDS trading on banks' exposure cuts for loan facilities, and the coefficient of *CDS active firm*Credit line* measures the effects of CDS trading on banks' exposure cuts for credit line facilities. Therefore, the positive and statistically significant coefficient of *CDS active firm* suggests that banks' exposure cuts on loan facilities are larger for firms that are actively traded in the CDS market than for firms not actively traded in the CDS market. On the other hand, the coefficient of *CDS active firm*Credit line* is negative and statistically significant, which suggests that banks' exposure cuts on credit line facilities are smaller for firms that are actively traded in the CDS market.

In regression (2), we control for the differences over three sub-periods: before (2001–2006), during (2007–2009), and after (2010–2013) the recent financial crisis. Specifically, the *crisis* dummy equals one if the year is between 2007 and 2009, and the *post crisis* dummy equals one if the year is between 2010 and 2013. As this regression shows, the coefficients of *CDS active firm*Crisis* and *CDS active firm*Post crisis* are both negative and statistically significant, which suggest that banks' exposure cuts on CDS-active firms were smaller during and after the financial crisis than before the crisis.

In regression (3), we control for the differences between firms with and without investment-grade ratings. As this regression shows, the coefficient of *investment-grade firm* is negative and statistically significant, which suggests that banks' exposure cuts are smaller on firms with investment-grade ratings than on firms without investment-grade ratings. Furthermore, the coefficient of *CDS active firm*Investment-grade firm* is also negative and statistically significant, suggesting that banks' exposure cuts are even smaller when firms with investment-grade ratings are actively traded in the CDS market.

In regression (4), we control for the differences between firms with and without high-risk

internal ratings. If a facility receives a high-risk internal rating, the bank observes the deterioration of credit quality of that facility. Therefore, the positive and statistically significant coefficient of *high-risk internal rating* suggests that banks' exposure cuts are higher on firms with deteriorating credit quality. Further, the coefficient of *CDS active firm*high-risk internal rating* is also positive and statistically significant, suggesting that banks' exposure cuts are even higher when firms with high-risk internal ratings are actively traded in the CDS market.

Regression (5) controls for the differences between amended facilities and facilities that have not been amended. As described in Section 2, the *amended facility* dummy variable equals one if the facility was amended during the period from year *t-1* to year *t*. As this regression shows, the positive and statistically significant coefficient of *amended facility* suggests that banks' exposure cuts are larger on amended facilities than on facilities that have not been amended. Furthermore, the coefficient of *CDS active firm*Amended facility* is also positive and statistically significant, suggesting that banks' exposure cuts on amended facilities are even higher when the borrowers are actively traded in the CDS market.

Among other control variables, we find that banks' exposure cuts are smaller on firms with high stock returns, high profit margins, stable collateral, or high market valuation, as the coefficients of *firm stock return*, *firm earning-to-asset ratio*, *firm tangibility*, and *firm Tobin's Q* are all negative and statistically significant. These findings are consistent with conventional wisdom. For instance, if a firm has more tangible assets that can be used as collateral, banks are less likely to sell loans on this firm.

Next, the coefficients of *lender-facility exposure* and *lender-borrower exposure* are both positive and statistically significant. For each lender-facility pair, if the values of these variables are high, the bank is facing high funding pressure from the borrower of this facility. Therefore,

the positive coefficients for these variables suggest that a bank's exposure cut on a facility is higher if the bank faces high funding pressure from the borrower this facility. Finally, the coefficient of *agent lender* is negative and statistically significant, which suggests that the exposure cut by a facility's agent is smaller.

Overall, we find a positive correlation between banks' loan sales and firms' CDS trading status, and a negative correlation between banks' exposure cuts on credit line facilities and firms' CDS trading status. In addition, we find that banks' loan sales on CDS-active firms were smaller during and after the financial crisis than before the crisis.

C. Comparing exposure cuts by different banks on the same facility

Table V reports the estimation results on the relationship between banks' CDS uses and loan sales by comparing exposure cuts by different banks on the same facility in the same year. This table consists of two regressions. Regression (1) is the baseline regression, and regression (2) controls for differences over three sub-periods: before (2001–2006), during (2007–2009), and after (2010–2013) the recent financial crisis. Both regressions include the facility-time fixed effects to absorb the combined effects of observed and unobserved facility-level factors, firm-level factors, and macroeconomic factors. The key explanatory variable in these regressions is *bank net CDS ratio*, which is the ratio of the net notional amount of bought CDS protection to total assets. This variable provides an aggregate measure of CDS hedging activities at the bank level.

In regression (1), the coefficient of *bank net CDS ratio* is positive and statistically significant, which suggests that banks that hedge through CDS also tend to cut more exposures on loan facilities. On the other hand, the coefficient of *Bank net CDS ratio*Credit line* is negative and statistically significant, which suggest that banks using CDS hedging tend to cut less exposures

on credit line facilities.

In regression (2), we include two dummy variables to control for the differences in exposure cuts during and after the financial crisis. As this regression shows, the coefficient of *Bank net CDS ratio*Crisis* is 0.607 and is statically significant. By contrast, the coefficient of *bank net CDS ratio* is reduced to 0.06 and is no longer statistically significant. Therefore, these results suggest the positive relationship between exposure cuts and bank hedging activities is concentrated in the crisis period.

The variable, *bank RBCR*, measures a bank's risk-based capital ratio. Therefore, the negative and statistically significant coefficient of *bank RBCR* suggests that banks are less likely to cut exposure when their risk based capital ratios are high. In other words, banks are under less pressure to sell loans to obtain capital relief if their capital ratios are high. Next, the negative and statistically significant coefficient of *bank wholesale funding ratio* suggests that a bank is less likely to sell loans if it has a stable channel of wholesale funding. The coefficients of other variables are largely consistent with existing theories.

D. Estimation results based on the secondary sample

In this subsection, we examine the effects of CDS trading on bank exposure cuts using the secondary sample. As described in Section 2, the secondary sample is at the lender-borrower level, and tracks each bank's syndicated lending exposures and CDS positions on individual firms for the six largest banks in the United States. The sample period is from 2010 through 2013.

Table VI reports the estimation results on the effects of CDS trading on bank exposure cuts using the entire sample of lender-borrower pairs regardless of whether a lender holds CDS positions on a borrower. The key explanatory variables are *net CDS buyer* and *net CDS seller*.

For a lender-borrower pair in a given year, the *net CDS buyer* dummy equals one if the lender is a net CDS protection buyer on the borrower and zero otherwise. The dummy variable, *net CDS seller*, equals one if the lender is a net CDS protection seller on the borrower and zero otherwise. Because the entire sample includes all lender-borrower pairs regardless of whether a lender holds CDS positions on a borrower, there are lender-borrower pairs in which a lender is neither a net CDS buyer nor a net CDS seller on the borrower. For this reason, we can include both *net CDS buyer* and *net CDS seller* dummies in the same regression.

Table VI consists of four regressions. Regression (1) is the baseline regression that includes *net CDS buyer* and *net CDS seller* as the explanatory variables, and regression (2) adds *agent lender* and *lender-borrower exposure* to measure the lender-borrower relationship. Regression (3) adds *high-risk internal rating* to measure a lender's private information about a borrower. Finally, regression (4) adds borrower-level explanatory variables. All regressions include lender-time fixed effects, which are lender fixed effects interacted with time fixed effects, to absorb the combined effects of lender-side and macroeconomic variables.

The regression results in Table VI suggest that banks use CDS hedging to complement rather than to substitute for loan sales. Specifically, the coefficient of *net CDS buyer* is positive and statistically significant in all regressions, which suggests a bank's exposure cut on a firm is higher if it is a net CDS buyer on that firm. Furthermore, the coefficient of *net CDS seller* is positive and statistically significant in all regressions, suggesting that a bank's exposure cut on a borrower is also higher if it is a net CDS seller on the borrower. Therefore, this evidence is consistent with the notion that banks sell CDS protection as credit enhancements to facilitate loan sales.

Table VII provides further evidence that banks use CDS hedging to complement loan sales.

Regressions in this table are based on a subsample of lender-borrower pairs in which a lender holds CDS positions on a borrower. As this table shows, the coefficient of *net CDS protection* is positive and statistically significant at either 1% or 10% level in all regressions. This positive coefficient suggests that banks tend to use CDS hedging and loan sales concurrently. Further, Table VII shows that a bank's exposure cut on a firm correlates positively with its sold CDS position on the same firm. This positive correlation seems to suggest that banks sell CDS protection as credit enhancements to facilitate loan sales.

III. Conclusion

Both CDS and loan sales can be used to transfer risk or to obtain regulatory capital relief. For these purposes, banks can use CDS hedging to substitute for or to complement loan sales. Tracking banks' lending exposures and CDS positions on individual firms, we observe that banks use CDS hedging to complement rather than to substitute for loan sales. In addition, loan sales can also be driven by funding purposes. We find a positive and significant correlation between a bank's exposure cut and its sold CDS protection on the same firm, which suggests that banks are likely to sell CDS as credit enhancements to facilitate loan sales to investors unwilling to hold credit risk.

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Table I
Variable Definitions

Variable	Definition
Facility-Level Variables	
Credit line	This dummy variable equals one if a facility is a credit line facility, and it equals zero if a facility is a loan facility.
Amended facility	This dummy variable equals one if the facility was amended between year *t-1* and year *t* and zero otherwise.
High-risk internal rating	This dummy equals one if a facility has one of the following "criticized" internal risk ratings: "special mention", "substandard", "doubtful", and "loss".
Lender-Facility-Level Variables	
Lender-facility exposure	A lender's exposure to a facility is its share commitment to that facility (expressed in millions of U.S. dollars). Share commitment is the maximum amount that a lender has legally committed to a syndicated credit facility according to the credit agreement.
Exposure cut	For a lender-facility pair in each year, this variable is the difference in a lender's exposure to a facility between the end of year *t-1* and the end of year *t* (expressed in millions of U.S. dollars).
Agent lender	At the lender-facility level, this dummy indicates whether the lender is the agent for a given facility.
Lender-Borrower-Level Variables	
Lender-borrower exposure	For a lender-borrower pair in each quarter, this variable measures a lender's total syndicated lending exposure to the borrower (expressed in millions of U.S. dollars). It equals the sum of a lender's used and unused syndicated lending commitments to a borrower.
Exposure cut	For a lender-borrower pair in each year, this variable is the sum of exposure cuts of all syndicated facilities of a lender-borrower pair between year *t-1* and year *t* (expressed in millions of U.S. dollars).
High-risk internal rating	This indicator equals one if any facility of the borrower has one of the following "criticized" internal ratings: "special mention", "substandard", "doubtful", and "loss".
Agent lender	For a lender-borrower pair in each quarter, this dummy variable equals one if the lender is the syndication agent of the borrower in a syndicated facility
Bought CDS protection	For a lender-borrower pair in each quarter, this variable equals the notional amount of total CDS protection that the lender bought against the borrower (expressed in millions of U.S. dollars).
Sold CDS protection	For a lender-borrower pair in each quarter, this variable equals the notional amount of total CDS protection that the lender sold against the borrower (expressed in millions of U.S. dollars).
Net CDS protection	For a lender-borrower pair in each quarter, this variable is the difference between the bought CDS protection and the sold CDS protection (expressed in millions of U.S. dollars).
Net CDS buyer	For a lender-borrower pair in a given year, this dummy variable equals one if the lender is a net CDS protection buyer on the borrower and zero otherwise.
Net CDS seller	For a lender-borrower pair in a given year, this dummy variable equals

	one if the lender is a net CDS protection seller on the borrower and zero otherwise.
Borrower-Level Variables	
CDS traded firm	The *CDS traded firm* dummy equals one for a firm in all years if any of the firm's debts was referenced in the CDS market at any time during the period of 2001–2013. This variable controls for time-invariant unobservable differences between CDS and non-CDS firms.
CDS active firm	The *CDS active firm* dummy equals one for a firm in a given year if any of the firm's debts was referenced in the CDS market in that year.
Firm distance-to-default	Firm's distance-to-default calculated using 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	This dummy equals one if a firm's S&P long-term rating is above BBB-
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)
Lender-Level Variables	
Bank RBCR	The bank's risk based capital (RBC) to total risk-weighted assets (RWA) ratio
Bank NIM	The bank's net interest margin
Bank ROA	The bank's return on assets
Bank ROA volatility	The standard deviation of bank ROA over the past 8 quarters
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
Bank net CDS ratio	The net notional amount of bought CDS protection to total assets ratio
Bank securitized assets ratio	Securitization balance to total assets ratio
Bank size	The total assets of a bank (expressed in billions of U.S. dollars)
Crisis Indicators	
Crisis	This dummy equals one if the year is between 2007 and 2009
Post crisis	This dummy equals one if the year is between 2010 and 2013

Table II
Summary Statistics of the Primary Data Sample, 2001–2013

This table reports the summary statistics of the primary data sample, which is at the lender-facility level and covers the period from 2001 through 2013. Panel A reports the summary statistics of the observations included in the final sample and the excluded observations. Panel B reports the distribution of *CDS traded firm* and *CDS active firm*. Panel C reports the summary statistics of exposure cuts by year. Panel D reports the summary statistics of continuous variables. Panel E reports the summary statistics of exposure cuts by different categories. Variables are defined in Table I. Bank size and firm size are expressed in billions of U.S. dollars. Lender-facility exposure, lender-borrower exposure, and lender 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: Sample Selection

	Included	Excluded	Exclusion percentage
Number of observations	129,180	1,736	1.34%
Total lending exposure ($ millions)	$5,394,835	$42,915	0.80%
Number of borrowers	2,718		
Number of lenders	402		
Number of facilities	10,158		
Number of distinct bank lenders in each facility	Minimum: 2; median: 8; mean: 8; maximum: 51		

Panel B: Distribution of CDS Traded Firm and CDS Active Firm

	CDS Active Firm	
	No (0)	Yes (1)
CDS Traded Firm		
No (0)	62,740	0
Yes (1)	19,758	46,682

Panel C: Summary Statistics of Exposure Cuts by Year

	Exposure Cuts ($ millions)					
	N	Mean	Median	Std	P5	P95
2001	9,935	$14.7	$3.7	$42.3	$-6.3	$70.0
2002	8,676	$11.6	$1.3	$40.4	$-6.0	$56.9
2003	9,166	$11.3	$1.2	$39.7	$-6.2	$53.1
2004	8,388	$17.0	$4.8	$51.4	$-7.5	$75.0
2005	8,352	$14.5	$2.0	$48.3	$-10.0	$70.0
2006	8,583	$13.7	$0.0	$47.3	$-11.0	$71.6
2007	9,121	$12.4	$0.0	$43.7	$-12.6	$72.5
2008	10,573	$18.8	$2.6	$46.5	$-4.3	$85.0
2009	10,910	$11.1	$0.0	$46.4	$-0.1	$55.0
2010	10,756	$17.0	$0.8	$50.3	$-0.0	$75.0
2011	10,515	$24.0	$6.3	$57.7	$-6.9	$102.9
2012	11,495	$15.2	$0.0	$61.0	$-7.9	$75.0
2013	12,710	$13.3	$0.0	$49.8	$-10.0	$70.0
All	129,180	$15.0	$0.7	$48.9	$-6.7	$75.0

Table II—Continued

Panel D: Summary Statistics of Continuous Variables

	N	Mean	Median	Std	P5	P95
Firm stock return	129,180	12.1%	9.7%	46.7%	-59.1%	85.5%
Firm earning-to-asset ratio	129,180	1.4%	1.8%	3.7%	-2.2%	4.9%
Firm leverage	129,180	31.8%	30.4%	18.5%	3.6%	64.2%
Firm current ratio	129,180	155.7%	129.2%	93.0%	65.5%	326.7%
Firm tangibility	129,180	28.9%	20.8%	25.5%	0.0%	79.3%
Firm Altman's Z	129,180	263.2%	223.9%	220.2%	31.9%	623.0%
Bank RBCR	129,116	13.6%	12.8%	4.4%	10.7%	17.3%
Bank wholesale funding ratio	129,180	34.9%	35.4%	13.0%	11.9%	48.7%
Bank net CDS ratio	129,180	1.5%	0.1%	4.3%	-2.2%	8.2%
Bank sold CDS ratio	129,180	29.7%	0.6%	59.7%	0.0%	169.5%
Bank securitized assets ratio	119,245	2.2%	3.5%	1.6%	0.0%	3.5%
Bank ROA	129,180	0.9%	1.1%	0.8%	-0.1%	1.9%
Bank NIM	129,180	2.8%	2.9%	0.9%	1.2%	4.3%
Bank NPA ratio	129,180	1.4%	0.9%	1.2%	0.2%	3.9%
Bank ROA volatility	128,784	0.5%	0.3%	0.7%	0.1%	1.5%
Lender-facility exposure ($ millions)	129,180	$41.8	$25.0	$63.8	$3.3	$130.0
Lender-firm exposure ($ millions)	129,180	$70.8	$37.5	$127.4	$8.0	$225.0
Lender exposure ($ millions)	129,180	$82,383.0	$51,371.5	$71,521.9	$1,301.7	$194,922.1
Bank size ($ billions)	129,180	$667.3	$291.1	$725.9	$13.7	$2,187.6
Firm size ($ billions)	129,180	$24.8	$3.5	$119.0	$0.3	$67.8
Firm distance-to-default	129,180	6.8	6.0	5.5	0.3	15.2

Panel E: Summary Statistics of Exposure Cuts by Different Categories

	Exposure Cuts ($ millions)					
	N	Mean	Median	Std	P5	P95
CDS traded firm						
0	57,609	$9.2	$0.6	$25.1	$-6.5	$45.5
1	62,624	$20.9	$0.2	$64.1	$-7.3	$100.0
CDS active firm						
0	75,515	$10.4	$0.5	$30.3	$-7.3	$50.0
1	44,718	$23.5	$0.1	$70.7	$-5.7	$111.1
Investment-grade firm						
0	65,350	$9.2	$1.2	$27.1	$-6.3	$45.0
1	54,883	$22.5	$0.0	$66.7	$-7.5	$107.5
Agent lender						
0	102,497	$13.7	$0.4	$43.6	$-5.8	$66.0
1	17,736	$24.5	$0.7	$75.4	$-12.5	$113.3
Credit line						
0	16,431	$11.0	$2.9	$53.4	$-1.5	$40.5
1	103,802	$16.0	$0.0	$49.1	$-8.0	$78.5
High-risk internal rating						
0	112,012	$15.2	$0.0	$49.7	$-7.5	$75.0
1	8,221	$16.4	$5.1	$49.9	$-0.0	$68.4

Table III
Summary Statistics of the Secondary Data Sample, 2010–2013

This table reports the summary statistics of the secondary data sample, which is at the lender-firm level, and covers the period from 2010 through 2013. Panel A reports the summary statistics of exposure cuts by year. Panel B reports the summary statistics of exposure cuts by different categories. Panel C reports the summary statistics of continuous variables. Variables are defined in Table I. Bank size and firm size are expressed in billions of U.S. dollars. Bought CDS protection, sold CDS protection, net CDS protection, exposure cut, and lending 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 Exposure Cuts by Year

	Exposure Cuts ($ millions)					
	N	Mean	Median	Std	P5	P95
2010	3,083	$34.5	$2.1	$88.8	$0.0	$145.0
2011	3,066	$48.5	$15.5	$102.2	$0.0	$180.0
2012	3,220	$31.6	$0.0	$104.5	$0.0	$141.8
2013	3,235	$31.7	$0.0	$95.3	$0.0	$137.5
All	12,604	$36.4	$1.3	$98.2	$0.0	$153.4

Panel B: Summary Statistics of Exposure Cuts by Different Categories

	Exposure Cuts ($ millions)					
	N	Mean	Median	Std	P5	P95
Has CDS position						
0	9,758	$26.0	$1.1	$65.4	$0.0	$112.8
1	2,846	$72.1	$5.1	$162.4	$0.0	$281.0
Net CDS buyer						
0	10,964	$30.4	$1.2	$79.4	$0.0	$130.0
1	1,640	$76.7	$5.1	$173.4	$0.0	$300.0
Net CDS seller						
0	11,418	$33.3	$1.2	$91.0	$0.0	$141.0
1	1,186	$66.3	$5.0	$147.1	$0.0	$255.0
Agent lender						
0	8,910	$33.6	$1.3	$87.2	$0.0	$145.0
1	3,694	$43.4	$1.4	$120.4	$0.0	$183.8
High-risk internal rating						
0	11,864	$36.6	$0.6	$99.9	$0.0	$153.0
1	740	$33.9	$10.3	$64.1	$0.0	$170.2

Panel C: Summary Statistics of Continuous Variables

	N	Mean	Median	Std	P5	P95
Bought CDS ($ millions)	2,848	$172.0	$51.0	$255.4	$0.0	$686.9
Sold CDS ($ millions)	2,848	$150.4	$46.2	$234.2	$0.0	$641.7
Net CDS ($ millions)	2,848	$21.6	$3.3	$87.5	$-73.0	$182.4
Lending exposure ($ millions)	12,604	$92.0	$60.0	$132.9	$10.2	$250.0
Loan exposure ($ millions)	12,604	$7.4	$0.0	$49.2	$0.0	$38.1
Line exposure ($ millions)	12,604	$84.7	$54.0	$121.7	$3.7	$240.6
Bought CDS/Lending exposure	2,846	448.2%	46.8%	8028.0%	0.0%	822.3%
Sold CDS/Lending exposure	2,846	419.8%	39.6%	7647.9%	0.0%	762.7%
Net CDS/Lending exposure	2,846	28.4%	3.0%	816.0%	-92.0%	167.6%
CDS spread change (5 year)	4,637	0.1%	-0.1%	6.0%	-1.5%	1.1%
Firm stock return	12,604	23.5%	16.3%	47.0%	-32.8%	104.0%
Firm earning-to-asset ratio	12,604	1.8%	1.9%	2.6%	-1.1%	5.0%
Firm leverage	12,604	29.0%	26.9%	18.5%	2.0%	62.1%
Firm current ratio	12,604	172.2%	143.7%	103.5%	68.5%	367.2%
Firm tangibility	12,604	29.2%	18.6%	27.2%	0.0%	83.0%
Firm Altman's Z	12,604	269.7%	235.1%	217.7%	29.4%	632.6%
Bank RBCR	12,604	15.4%	15.3%	1.0%	13.3%	17.0%
Bank wholesale funding ratio	12,604	40.9%	48.7%	10.8%	21.3%	48.7%
Bank ROA	12,604	0.6%	0.6%	0.5%	-0.1%	1.4%
Bank NIM	12,604	2.6%	2.5%	0.6%	1.9%	3.7%
Bank NPA ratio	12,604	3.1%	3.3%	1.2%	1.1%	5.3%
Bank ROA volatility	12,604	0.4%	0.2%	0.4%	0.1%	0.9%
Bank size ($ billions)	12,604	$1,902.8	$2,032.0	$392.7	$1,243.6	$2,359.1
Firm size ($ billions)	12,604	$19.4	$3.9	$96.7	$0.4	$56.3
Firm distance-to-default	12,604	7.7	6.6	6.7	1.5	16.2

Table IV
CDS and Loan Sales: Comparing Exposure Cuts on Different Facilities by the Same Lender, 2001–2013

This table reports the estimation results on the relationship between CDS trading and loan sales, by comparing exposure cuts on different facilities by the same lender in the same year. We include the lender-time fixed effects, which are lender fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved lender-level factors (time-invariant and time-varying), and macroeconomic factors. Consequently, lender-side and macroeconomic variables are excluded from regressions. The sample period is from 2001 to 2013. Variables are defined in Table I. The dependent variable is *exposure cut*, which is the difference in lender-facility exposure between the end of year *t-1* and the end of year *t* for each lender-facility pair (expressed in millions of U.S. dollars). The explanatory variables are observed at the end of year *t-1*. We construct two variables using the Markit CDS data. The first variable is *CDS traded firm*, a dummy variable created to control for time-invariant unobservable differences between CDS-referenced and non-CDS-referenced firms. The *CDS traded firm* dummy equals one for a firm in all years if any of the firm's debts was referenced in the CDS market at any time during the sample period of 2001–2013. The second variable is *CDS active firm*, which is designed to capture of the effects of CDS trading. The *CDS active firm* dummy equals one for a firm in a given year if any of the firm's debts was referenced in the CDS market during that year. Regression (1) is the baseline regression. Regression (2) controls for the differences over three sub-periods: before the crisis (2001–2006), during the crisis (2007–2009), and after the crisis (2010–2013). Regression (3) controls for the differences between firms with and without investment grade ratings. Regression (4) controls for the differences between firms with and without pass internal ratings. Regression (5) controls for the differences between amended facilities and facilities that have not been amended. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

Table IV—Continued

	(1)	(2)	(3)	(4)	(5)
CDS traded firm	-0.572***	-0.478***	-0.338**	-0.290*	-0.287*
	[0.158]	[0.157]	[0.163]	[0.163]	[0.163]
CDS active firm	1.721***	3.123***	4.037***	3.399***	1.859***
	[0.399]	[0.484]	[0.505]	[0.486]	[0.539]
Credit line	-2.850***	-2.678***	-2.743***	-2.758***	-2.657***
	[0.170]	[0.168]	[0.168]	[0.168]	[0.175]
CDS active firm*Credit line	-1.636***	-2.096***	-1.206***	-1.265***	-0.561
	[0.408]	[0.417]	[0.437]	[0.436]	[0.453]
CDS active firm*Crisis		-1.557***	-1.671***	-1.893***	-1.918***
		[0.357]	[0.356]	[0.358]	[0.358]
CDS active firm*Post crisis		-1.622***	-1.741***	-1.696***	-1.718***
		[0.317]	[0.317]	[0.315]	[0.315]
Investment-grade firm			-0.871***	-0.841***	-0.851***
			[0.167]	[0.166]	[0.166]
CDS active firm*Investment-grade firm			-2.086***	-1.465***	-1.187***
			[0.351]	[0.333]	[0.333]
High-risk internal rating				1.744***	1.736***
				[0.312]	[0.312]
CDS active firm*High-risk internal rating				3.966***	3.938***
				[0.849]	[0.843]
Amended facility					0.271**
					[0.132]
CDS active firm*Amended facility					2.189***
					[0.333]
Agent lender	-1.052***	-1.042***	-1.048***	-1.047***	-1.046***
	[0.210]	[0.210]	[0.209]	[0.209]	[0.209]
Lender-facility exposure	0.073***	0.074***	0.075***	0.076***	0.075***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Lender-borrower exposure	0.012***	0.012***	0.012***	0.012***	0.012***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Facility all-in-draw spread	0.799***	0.822***	0.509***	0.455***	0.427***
	[0.089]	[0.089]	[0.090]	[0.089]	[0.090]
Firm stock return	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Firm distance-to-default	-0.079***	-0.078***	-0.057***	-0.052***	-0.050***
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Firm size	0.000	0.000	0.001	0.001	0.000
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Firm earning-to-asset ratio	-0.135***	-0.134***	-0.125***	-0.099***	-0.094***
	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]
Firm leverage	0.019***	0.019***	0.018***	0.015***	0.013***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Firm current ratio	0.000	0.001	-0.000	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Firm tangibility	-0.011***	-0.011***	-0.013***	-0.013***	-0.014***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Firm Altman's Z	0.001**	0.001**	0.001*	0.001*	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Firm Tobin's Q	-0.003***	-0.004***	-0.004***	-0.003***	-0.003***

	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Lender-time fixed effects	Yes	Yes	Yes	Yes	Yes
N	65109	65109	65109	65109	65109
Adjusted R^2	0.140	0.141	0.143	0.145	0.147

Table V
CDS and Loan Sales: Comparing Exposure Cuts by Different Lenders on the Same Facility, 2001–2013

This table reports the estimation results on the relationship between CDS trading and loan sales, by comparing exposure cuts by different lenders on the same facility in the same year. We include the facility-time fixed effects, which are facility fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved facility-level factors, firm-level factors, and macroeconomic factors. Consequently, borrower-side and macroeconomic variables are excluded from the regressions. The sample period is from 2001 to 2013. Variables are defined in Table I. The dependent variable is *exposure cut*, which is the difference in lender-facility exposure between the end of year *t-1* and the end of year *t* for each lender-facility pair (expressed in millions of U.S. dollars). The explanatory variables are observed at the end of year *t-1*.

Regression (1) is the baseline regression. Regression (2) controls for differences over three sub-periods: before the crisis (2001–2006), during the crisis (2007–2009), and after the crisis (2010–2013). *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

Table V—Continued

	(1)	(2)
Bank net CDS ratio	0.326***	0.060
	[0.053]	[0.055]
Bank net CDS ratio*Credit line	-0.253***	-0.082
	[0.055]	[0.056]
Bank net CDS ratio*Crisis		0.607***
		[0.048]
Bank net CDS ratio*Post crisis		0.003
		[0.032]
Agent lender	-1.246***	-1.414***
	[0.150]	[0.151]
Lender-facility exposure	0.089***	0.090***
	[0.005]	[0.005]
Lender-borrower exposure	0.007***	0.006**
	[0.003]	[0.003]
Bank RBCR	-0.209***	-0.205***
	[0.039]	[0.039]
Bank wholesale funding ratio	-0.045***	-0.022***
	[0.006]	[0.006]
Bank securitized assets ratio	-0.482***	-0.411***
	[0.041]	[0.040]
Bank size	-0.000**	-0.001***
	[0.000]	[0.000]
Bank ROA	-1.120***	-0.989***
	[0.122]	[0.118]
Bank NIM	-0.229***	-0.167**
	[0.084]	[0.084]
Bank NPA ratio	-0.733***	-0.666***
	[0.068]	[0.067]
Bank ROA volatility	1.508***	1.423***
	[0.145]	[0.140]
Facility-time fixed effects	Yes	Yes
N	76939	76939
Adjusted R^2	0.355	0.360

Table VI
CDS and Loan Sales: Comparing Exposure Cuts on Different Firms by the Same Lender, 2010–2013

This table reports the estimation results on the relationship between CDS trading and loan sales, by comparing exposure cuts on different firms by the same lender in the same year, using a sample that links the SNC data with the DTCC data. The sample period is from 2010 to 2013. Variables are defined in Table I. The dependent variable is *exposure cut*, which is the difference in lender-borrower exposure between the end of year *t-1* and the end of year *t* for each lender-borrower pair (expressed in millions of U.S. dollars). The key explanatory variables are *net CDS buyer* and *net CDS seller*. For a lender-borrower pair in a given year, the dummy variable *net CDS buyer* equals one if the lender is a net CDS protection buyer on the borrower and zero otherwise. The dummy variable *net CDS seller* equals one if the lender is a net CDS protection seller on the borrower and zero otherwise. This table consists of 4 regressions. All regressions include the lender-time fixed effects, which are lender fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved lender-level factors (time-invariant and time-varying), and macroeconomic factors. Consequently, lender-side and macroeconomic variables are excluded from regressions. Regression (1) includes *net CDS buyer* and *net CDS seller* as the explanatory variables. Regression (2) adds *agent lender* and *lender-borrower exposure* to measure the lender-borrower relationship. Regression (3) adds *high-risk internal rating* to measure a lender's private information about a borrower. Regression (4) adds borrower-level explanatory variables. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

Table VI—Continued

	(1)	(2)	(3)	(4)
Net CDS buyer	38.089***	11.099***	11.238***	9.327***
	[2.460]	[2.607]	[2.606]	[2.463]
Net CDS seller	31.896***	9.564***	9.665***	7.845***
	[2.685]	[2.479]	[2.476]	[2.428]
Agent lender		0.705	0.648	1.200
		[1.175]	[1.175]	[1.191]
Lender-borrower exposure		0.265***	0.266***	0.251***
		[0.020]	[0.020]	[0.022]
High-risk internal rating			10.954***	10.788***
			[1.851]	[1.841]
Firm stock return				-0.001
				[0.010]
Firm distance-to-default				0.537***
				[0.170]
Firm size				0.101**
				[0.042]
Firm earning-to-asset ratio				-0.289
				[0.224]
Firm leverage				0.071*
				[0.039]
Firm current ratio				-0.008
				[0.005]
Firm tangibility				-0.020
				[0.016]
Firm Altman's Z				-0.006
				[0.004]
Firm Tobin's Q				-0.002
				[0.010]
Lender-time fixed effects	Yes	Yes	Yes	Yes
N	12518	12518	12518	12518
Adjusted R^2	0.064	0.342	0.344	0.347

Table VII
CDS and Loan Sales: Comparing Exposure Cuts on Different Firms by the Same Lender, Subsample Analyses, 2010–2013

This table reports the estimation results on the relationship between CDS trading and loan sales, by comparing exposure cuts on different firms by the same lender in the same year, using a subsample of lender-borrower pairs in which the lender holds CDS positions on the borrower. The sample period is from 2010 to 2013. Variables are defined in Table I. The dependent variable is *exposure cut*, which is the difference in lender-borrower exposure between the end of year *t-1* and the end of year *t* for each lender-borrower pair (expressed in millions of U.S. dollars). The key explanatory variables are *net CDS protection* and *sold CDS protection* (expressed in millions of U.S. dollars). This table consists of 4 regressions. All regressions include the lender-time fixed effects, which are lender fixed effects interacted with time fixed effects, to control for the combined effects of observed and unobserved lender-level factors (time-invariant and time-varying), and macroeconomic factors. Consequently, lender-side and macroeconomic variables are excluded from regressions. Regression (1) includes *net CDS protection* and *sold CDS protection* as the explanatory variables. Regression (2) adds *agent lender* and *lender-borrower exposure* to measure the lender-borrower relationship. Regression (3) adds *high-risk internal rating* to measure a lender's private information about a borrower. Regression (4) adds borrower-level explanatory variables. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. "N" denotes number of observations.

Table VII—Continued

	(1)	(2)	(3)	(4)
Net CDS protection	0.126***	0.048*	0.048*	0.044*
	[0.030]	[0.025]	[0.025]	[0.025]
Sold CDS protection	0.045***	0.024***	0.024***	0.024***
	[0.010]	[0.009]	[0.009]	[0.009]
Agent lender		3.224	3.452	5.424
		[3.448]	[3.443]	[3.438]
Lender-borrower exposure		0.259***	0.261***	0.231***
		[0.026]	[0.026]	[0.027]
High-risk internal rating			25.023***	22.916***
			[6.857]	[6.521]
Firm stock return				-0.036
				[0.041]
Firm distance-to-default				2.712***
				[0.627]
Firm size				0.189***
				[0.067]
Firm earning-to-asset ratio				-0.380
				[0.833]
Firm leverage				0.266*
				[0.148]
Firm current ratio				-0.021
				[0.021]
Firm tangibility				-0.021
				[0.054]
Firm Altman's Z				0.014
				[0.015]
Firm Tobin's Q				-0.079*
				[0.041]
CDS spread change (5-year)				-3.762***
				[0.788]
Lender-time fixed effects	Yes	Yes	Yes	Yes
N	2816	2816	2816	2794
Adjusted R^2	0.045	0.354	0.357	0.373

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