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

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Abstract

We empirically examine three channels in the relation between banks' CDS trading and loan sales. The substitute channel predicts a negative relation between CDS hedging and loan sales, and the complementary channel predicts a positive relation. The credit-enhancement channel predicts a positive relation between banks' CDS selling and loan sales. Using syndicated loan share ownership data of U.S. banks over the period 2001–2013, we find that the complementary channel dominates the substitute channel, and the credit-enhancement channel plays an important role in bank loan sales.

JEL classification: G21; G28; G23; G20; G10;
Key words: CDS; Loan sales; Hedging; Substitute channel; Complementary channel; Credit-enhancement channel

1. Introduction

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, which raises the question of whether banks use CDS hedging to substitute for loan sales. Despite their growing importance and the associated controversies, relatively little is known about the relation between banks' use of CDS and loan sales. Although there are some theoretical models on the link between CDS hedging and loan sales (Duffee and Zhou 2001; Parlour and Winton 2013), empirical evidence is limited (Minton, Stulz, and Williamson 2009; Stulz 2010). One important reason for the lack of empirical studies on this important topic is that both the secondary loan market and the CDS market are over-the-counter (OTC) markets with low transparency.

Our study aims to fill this gap by examining three channels that coexist in the relation between banks' CDS trading and loan sales.[3] The first is the substitute channel, which predicts a negative relation between CDS hedging and loan sales. Specifically, if a bank buys CDS protection to hedge

[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.

[3] We define each channel as a broad category for grouping multiple forces that work in similar directions.

its loans, it would have less incentive to sell loans. The second channel is the complementary channel, which predicts a positive relation between bank CDS hedging and loan sales. Specifically, if a bank has a higher propensity to use credit-risk-mitigation tools, it can choose to use both loan sales and CDS hedging. Furthermore, the complementary channel suggests that lenders that engage in CDS hedging have higher propensities to sell all loans, regardless of whether they hold CDS positions on these obligors.

The third channel is the credit-enhancement channel, which predicts a positive relation between bank CDS selling and loan sales. Specifically, under the originate-to-distribute business model, bank loan sales can be driven by funding purposes. To facilitate loan sales, banks can sell CDS protection as credit enhancements to investors unwilling to hold credit risk (Minton, Stulz, and Williamson 2009).

Our empirical study centers on the link between banks' net CDS positions and loan sales. If the substitute channel dominates the complementary channel, we would observe a negative relation between banks' net CDS positions and loan sales for net buyers of CDS protection. Conversely, if the complementary channel plays the dominant role, this relation would be positive. Finally, if the credit-enhancement channel exists, we would observe a negative relation between banks' net CDS positions and loan sales for net sellers of CDS protection.

Because the secondary loan market is an OTC market with low transparency, data limitations pose a major challenge to empirical studies on banks' loan sales. For instance, prior studies on corporate loan sales (Drucker and Puri 2009; Gande and Saunders 2012; Kamstra, Roberts, and Shao 2014; Beyhaghi, Massoud, and Saunders 2017) rely primarily on the Loan Syndications and Trading Association (LSTA) mark-to-market pricing database, which collects only loan bid and ask prices from market makers and provides no information about transactions of loan sales.

Consequently, researchers have to assume that loan sales have occurred when the LSTA database reports a quote on a loan. This approach of identifying loan sales is imprecise. Furthermore, researchers do not know the identity of the seller, buyer, or amount involved in a loan sale. Additionally, the Thomson-Reuters Loan Pricing Corporation's (LPC) Dealscan database does not track lenders' syndicated loan share after origination.

The data used in our study overcome some of the 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. A syndicated credit facility can be either a term loan or a line of credit. Each facility has multiple lenders. These lenders are called syndicate members. The SNC data track each syndicate member's loan share after origination. A lender's loan share in a facility is the maximum amount that the lender has legally committed to the facility. In the absence of refinancing and loan amendments, a negative loan share change is caused by loan sales, and a positive loan share change is caused by loan purchases. Consequently, the SNC data allow us to track syndicated loan share sales in the secondary market.

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 the borrower-side or the lender-side effects. Additionally, a researcher may either be unaware of or lack access to all relevant variables.

To overcome these problems, we employ an identification strategy to disentangle the effects of borrower-side and lender-side factors, and to minimize the omitted-variables bias. This

identification strategy, which allows us to focus on the effects of lender-side factors without worrying about borrower-side factors, leverages one prominent feature of syndicated lending: Each syndicated facility has multiple lenders, and each lender participates in multiple facilities. To control for all borrower-side and macroeconomic factors, we compare loan sales by different lenders to the same facility in the same year.

Overall, we find a positive and significant relation between banks' net CDS positions and loan sales for CDS net buyers. This positive relation, which suggests that banks engaging in CDS hedging also sell more loans, is consistent with the hypothesis that the complementary channel dominates the substitute channel. In addition, for lenders that are net sellers of CDS protection, we find a negative relation between their net CDS positions and loan sales. This negative relation is consistent with the credit-enhancement channel. Furthermore, we show that these findings are robust to analyses that control for refinancing and loan amendments, facility types, and credit quality.

Our empirical findings have important implications in the debate on the role of financial innovations in the financial system. Proponents of financial innovations advocate their risk diversification potential, and opponents question whether financial innovations contribute to financial instability. Although this debate is likely to continue in the foreseeable future, it is important to note that financial innovations can be used for different purposes. Consequently, market structure, economic conditions, and regulatory environment can affect how banks use these financial innovations. By shedding light on different channels in the relation between banks' use of CDS and loan sales over a relatively long period, our study provides empirical evidence that is essential in the debate over the risks and benefits of financial innovations.

The rest of this paper proceeds as follows. Section 2 reviews the related literature. Section 3

describes the data and key variables. Section 4 describes the empirical design. Section 5 presents the empirical results on the relation between banks' net CDS positions and loan sales. Section 6 concludes.

2. Related literature

To the best of our knowledge, the current study is the first to empirically examine the relation between U.S. banks' use of CDS and loan sales using data that track individual banks' lending exposures to individual firms. Because of the lack of information on the sellers and buyers involved in loan sales, prior empirical studies on loan sales predominantly focus on whether obligor and loan characteristics affect the existence and liquidity of the secondary loan market (Drucker and Puri 2009), as well as the implications of the secondary loan market on borrowers (Gande and Saunders 2012; Kamstra, Roberts, and Shao 2014). Within the empirical literature of bank loan sales, our research is closely related to the work of Irani and Meisenzahl (2017), which uses the SNC data to study the link between bank loan sales and their exposure to disruptions in wholesale funding market during the financial crisis period. Unlike their study, we focus on the relation between banks' use of CDS and loan sales over a relatively long period (2001–2013).

In the empirical literature on banks' use of credit derivatives, our study complements two previous studies that examine whether banks' use of credit derivatives affect the pricing of syndicated corporate loans (Norden, Silva Buston, and Wagner 2014) and credit supply (Hirtle 2009). Specifically, Norden, Silva Buston, and Wagner (2014) find that the pricings of syndicated loans are negatively related to lead arrangers' gross positions in credit derivatives but not their net positions. They argue that this finding suggests banks' use of credit derivatives affects loan pricing through the risk-management channel. On the other hand, Hirtle (2009) finds only limited evidence that CDS hedging increases credit supply. Our study also complements a pioneering study by

Minton, Stulz, and Williamson (2009), which uses bank-level aggregate loan data to examine the use of credit derivatives by large US banks from 1999 to 2005. Independent of our work, and with a different thrust, Beyhaghi, Massoud, and Saunders (2017) examine the joint choice and trade-off of CDS and loan sales as tools of hedging a loan's credit risk. Their study, which covers the period from 2003 to 2007, assumes that a loan sale occurs when the loan facility has an LTSA record, and uses positive changes in CDS spreads as proxies for CDS hedging by banks.

Additionally, our study is broadly related to the literature that examines the CDS market and its implications. One strand of this literature examines the link between the CDS market and other markets. For instance, Das, Kalimipalli, and Nayak (2014) examine the effects of CDS trading on the liquidity of the secondary market for corporate bonds, and Hilscher, Pollet, and Wilson (2015) examine the link between the CDS market and equity market. A second strand of this literature examines the effects of CDS trading on CDS reference entities' borrowing costs (Ashcraft and Santos 2009), leverage ratios and debt maturities (Saretto and Tookes 2013), and credit risk (Subrahmanyam, Tang, and Wang 2014). Other strands of this literature examine the hedging and speculation motives of CDS trading (Oehmke and Zawadowski 2017), CDS-bond basis trades (Choi and Shachar 2014), the impacts of the daily aggregate order imbalance on CDS spreads (Shachar 2012), the relationship between concentrated capital losses of CDS sellers and changes in CDS spreads (Siriwardane 2015), the liquidity premium in CDS transactions (Gehde-Trapp, Gündüz, and Nasev 2015), and CDS trading and credit supply of German banks (Gündüz et al. 2015). Our study complements these studies by investigating the underlying channels in the relation between U.S. banks' CDS trading and loan sales.

3. Data and summary statistics

The primary sample used in this study is an annual panel of lender-facility pairs over the period

of 2001–2013. This data sample is constructed by linking the SNC data with the U.S. bank holding companies (BHC) data (FR Y-9C), Compustat, Center for Research in Security Prices (CRSP), and Markit CDS.

The SNC program tracks syndicated credit facilities shared by three or more unaffiliated supervised institutions. It includes any facility with originating facility commitment of $20 million or more. For a group of facilities, if the aggregate commitment is $20 million or more, then each facility of this group is included in the SNC data.

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 facility commitment and outstanding balance (i.e., utilized amount) of each facility in each year. It also includes information about facility type, facility purpose, origination date, maturity date, agent bank, and internal risk ratings assigned by the agent bank. 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 loan share and utilized amount in each facility in each year.

The U.S. BHC data contain U.S. bank holding companies and U.S. branches of foreign banks that file FR Y-9C forms. To simplify exposition, unless explicitly stated, U.S. branches of foreign banks are also referred to as U.S. BHCs in the remainder of this paper. Lenders in the SNC data include U.S. banks, foreign banks, U.S. non-bank entities, and foreign non-bank entities. To match the SNC data with the BHC data, we restrict our sample to lenders that are U.S. BHCs. For lenders that are subsidiaries of BHCs, we aggregate them to the BHC level. The SNC database includes the Replication Server System Database ID (RSSD_ID) for the BHC of each lender. The RSSD_ID is the primary identifier for the BHC database. Therefore, we use the RSSD_ID field to link the SNC data with the BHC data.

We match obligors between the SNC data and the CRSP/Compustat merged database by obligor name. As a result, the sample is restricted to obligors that are U.S. public firms. This matching process consists of two stages. In the first stage, we match SNC obligors and Compustat firms using exact and fuzzy name-match algorithms. That second stage is a lengthy process in which we manually review each matched obligor to ensure it is a correct match. Overall, this matching process yields 2,931 matched obligors. The Markit CDS data is linked with Compustat using a combination of CUSIP and name matching.

3.1. Definitions of key variables

A syndicated credit facility can be either a term loan or a line of credit. Each facility has multiple lenders. These lenders are called syndicate members. One of these syndicate members is the lead bank, or lead arranger. The lead bank serves as an agent (i.e., agent bank) for the lending syndicate. The lead bank's responsibilities include establishing relationship with the borrowers, conducting due diligence on the borrower, preparing the credit agreement, obtaining funding commitments from syndicated members. As the agent bank, the lead bank is also responsible for monitoring the borrowers and other administrative duties (Sufi 2007; Ivashina 2009; Duchin and Sosyura 2014).[4]

Importantly, the SNC data track the facility size of each facility and each lender's loan share in each facility over time. The facility size, also known as facility commitment, is the maximum amount that the obligor can borrow from a facility according to the credit agreement. Each syndicate member commits to a share of the facility commitment. A lender's loan share in a facility

[4] Borrowers can also hire multiple lead banks for different roles; one of these lead banks serves as the agent bank.

is the maximum amount that the lender has legally committed to the facility (Sufi 2007; Ivashina 2009; Irani and Meisenzahl 2017). The loan share is also called share commitment or lending exposure in this study.

Both facility commitment and loan share are legally binding. The facility commitment changes only when the credit agreement changes (e.g., refinancing or loan amendments). According to Sufi (2007), unanimity among all syndicate members is required for credit agreement changes that affect facility commitment, interest, or maturity. The loan share changes only in the event of loan sales, refinancing, or amendments.

It is important to note that facility size is different from facility balance, and loan share is different from used loan share. Specifically, the facility balance is the current outstanding balance of a facility. In other words, it is the used portion of the facility commitment. Likewise, the used loan share is a lender's current outstanding balance to a facility. Because principal and interest payments affect only the used loan share, they do not lead to negative change in loan share.

For a lender-facility pair in a given year, we compare the lender's loan share in the current year and in the next year. We define a binary variable, *loan sale*, which equals one if the loan share is reduced from a non-zero value in the current year to zero in the next year.[5] It is important to note that both term loans and lines of credit can be sold in the secondary market. For instance, Drucker and Puri (2009) report that 34% of loans traded are lines of credit in their study, which uses the LSTA data.

[5] This definition of loan sale is consistent with Irani and Meisenzahl (2017). In addition to the loan sale dummy, we also define the partial loan sale dummy, which equals one if the reduction in loan share exceeds a threshold. We have defined partial loan sale using $1 million and $5 million as the thresholds. The results based on definitions of partial loan sale are qualitatively similar to the results based on loan sale, and are not reported for brevity.

Additionally, for a lender-facility pair, *loan share change* is the change in loan share from the current year to the next year. When calculating the *loan sale* dummy and *loan share change* for a lender-facility pair, we make sure that the facility and the lender exist in both the current year and the next year. Otherwise, the values of these variables are set to missing. Observations with missing values are excluded from analyses for conservative reasons.

As also pointed out by Irani and Meisenzahl (2017), when facilities in the SNC data are refinanced or amended, their facility identifiers do not change. To leverage this advantage, we define the *amended* dummy, which equals one if the facility commitment, maturity date, or origination date changes between the previous year and the current year. As a result, the *amended* dummy identifies both refinancing and loan amendments in our data.

A bank's net notional value of CDS protection equals the notional value of its bought CDS protection minus the notional value of its sold CDS protection. A bank is a *CDS net buyer* if the net notional value of CDS protection is positive. Conversely, a bank is a *CDS net seller* if the net notional value of CDS protection is negative. We define a variable, *bank net CDS ratio,* which equals a bank's net notional value of CDS protection divided by its total assets. This definition is consistent with Norden, Silva Buston, and Wagner (2014). [6]

[6] In 1997, U.S. banks started to report the notional values of bought and sold credit derivatives. Since 2006, these data are further divided into four subcategories: CDS, total return swaps, credit options, and other credit derivatives. Overall, CDS is the dominant category, and the shares of the other three categories are minimal. For instance, in September 2007, JPMorgan's total notional amount of bought credit derivatives is about $3.82 trillion, which consists of $3.8 trillion of CDS and $0.02 trillion of all three other categories. For this reason and for data consistency over the entire period of 2001–2013, we use the notional values of all credit derivatives as the proxy for the notional values of CDS.

3.2. Other variables

We include a set of control variables at lender, lender-facility, facility, and borrower levels in empirical analyses. The definitions of these variables are in Appendix A. The selection of lender-side control variables is largely based on the six key components that regulators use to assess an institution's financial condition and operations: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk. Consequently, we include most commonly used variables in the existing literature (Hirtle 2009; Li 2013; Berger et al. 2014; Boyson, Helwege, and Jindra 2014; Duchin and Sosyura 2014; Norden, Silva Buston, and Wagner 2014; Irani and Meisenzahl 2017).

Norden, Silva Buston, and Wagner (2014) find that banks' gross positions in credit derivatives are significantly negatively related to the pricing of syndicated loans. Therefore, we also include *bank gross CDS ratio* as a control variable. This variable is the sum of notional values of bought and sold CDS protection divided by the bank's total assets. The *CDS dealer* dummy equals one if the bank is one of the 10 largest CDS dealers in the US (i.e., seven largest U.S. banks and three U.S. branches of foreign banks) that file form FR Y-9C. The *bank merger* dummy equals one if the bank has acquired other banks between the current year and the next year. The data on bank mergers and acquisitions are from the website of the Federal Reserve Bank of Chicago.

We also control for banks' participation in the government capital and liquidity support programs during the recent financial crisis. These programs are the Troubled Asset Relief Program (TARP), and the Federal Reserve's Discount Window (DW) and Term Auction Facility (TAF) programs. Appendix B provides background information on DW, TAF, and TARP. We construct three variables to measure the government capital and liquidity support to a bank: *TARP funding ratio*, *DW funding ratio*, and *TAF funding ratio*. The definitions of these variables are in Appendix A. Appendix C describes the construction of these variables.

Among borrower-side control variables, the *investment grade* dummy indicates whether a firm has an investment-grade credit rating (i.e., a long-term S&P rating above BBB-). 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. Other ratings are broadly referred to as "criticized" ratings that indicate elevated levels of default risk. The *criticized rating* dummy equals one if a facility has a criticized internal risk rating.

We construct two variables to measure the CDS liquidity of a firm. The most basic measure is the *CDS traded* dummy, which equals one if the firm has ever been a CDS reference entity in the past five years. Next, the *CDS liquid* dummy equals one for a firm in a given year if the CDS quote depth is above three. A firm's CDS quote depth is the average number of dealers that provide CDS quotes on the firm over the trailing 12-month period.

We borrow the *earnings disagreement* measure from Oehmke and Zawadowski (2017). This variable is the standard deviation of IBES analyst forecasts on two-year earnings per share divided by the stock price. The *distance-to-default* measure, which is based on Merton's model, is calculated following the approach of Bharath and Shumway (2008). We will skip the description of other control variables, as these variables are commonly used in the literature to control for the credit risk of an obligor.

3.3. Summary statistics

As explained in Section 3.1, the final sample of this study is restricted to lender-facility pairs in which the lenders are U.S. bank holding companies, and the obligors are U.S. public firms. The sample period is 2001–2013, including six years before the most recent financial crisis (2001–2007), two years during the crisis (2008–2009), and four years after the crisis (2010–2013). This

sample consists of 167,145 lender-facility-year observations, including 611 lenders, 2,931 borrowers, and 8,396 facilities. As of 2013, the total amount of share commitment for this sample is $844 billion. Figure 1 plots U.S. BHCs' total syndicated loan exposures by lender's CDS-using status, which shows that the syndicated loan holdings of CDS net buyers exhibit more volatility compared with other lenders.

Table 1 reports the summary statistics of selected variables for this sample. As this table shows, the average facility commitment is $715.4 million, and the average loan share is $40.2 million. The average loan share change is -$1.9 million, or -6.2% of loan share. Because this sample excludes non-bank lenders and foreign banks, the negative value of average loan share change suggests that U.S. banks are more likely to reduce rather than increasing their loan share over time.

Figure 2 shows that the average loan share of CDS net buyers is higher compared with other lenders. Table 2 compares the average loan share changes and loan sale rates between CDS net buyers and other lenders across different categories. Overall, the average loan share cut by CDS net buyers is $2.2 million, which is higher than that of other lenders ($1.6 million). In addition, the average loan sale rate is 9.0% for CDS net buyers, which is also slightly higher than that of other lenders (8.7%). Compared with other lenders, the average loan share cuts and loan sale rates of CDS net buyers tend to be higher across most categories.

Figure 3 compares the average loan share changes between CDS net buyers and other lenders. Before the crisis, loan share cuts by CDS net buyers are substantially higher than that of other lenders. After the crisis, however, the differences in loan share cuts between these two groups became smaller.

Figure 4 plots U.S. BHCs' total syndicated loan exposures along with the notional values of bought, sold, and net CDS protection. This figure shows that the notional values of bought and

sold CDS protection move largely in parallel. In addition, they are higher than the values of total syndicated loan exposures and net CDS protection by at least one order of magnitude. Finally, Figure 5 plots the movement of U.S. BHCs' total syndicated loan exposures and the notional values of net CDS protection. This figure shows that these two series moved largely in parallel until 2010, when they started to move in opposite direction.

4. Empirical design

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 loan sale can be caused by capital and liquidity pressures on a lender. It can also be caused by the credit risk of the borrower. Additionally, economic conditions can also affect loan sales. Consequently, the estimated results will be biased if one does not properly control for the borrower-side or the lender-side effects. Additionally, a lender can choose to sell all or only a portion of its loan share. It can also increase its loan share rather than reducing it. Finally, if there are multiple facilities between a lender-borrower pair, the lender can reduce its loan share to one facility and increase its loan share in another facility of the same obligor.

To overcome these challenges, our empirical analyses consist of four stages. The first stage is a control-variable approach, which estimates a logit regression of bank loan sales by including control variables at lender, lender-facility, facility, and borrower levels. Specifically, we estimate the following logit regression:

$$\begin{aligned} Logit(Loan\ sale)_{i,j,t+1} &= (Year\ fixed\ effects)_t + B_1 \bullet (Bank\ net\ CDS\ ratio)_{i,t} \\ &+ B_2 \bullet (Lender\ controls)_{i,t} + B_3 \bullet (Lender\text{ - }facility\ controls)_{i,j,t} \\ &+ B_4 \bullet (Facility\ controls)_{j,t} + B_5 \bullet (Borrower\ controls)_{k,t} + \varepsilon_{i,j,t+1}, \end{aligned} \tag{1}$$

where i, j, k, and t index lenders, facilities, borrowers, and time. Although this control-variable

approach may not completely disentangle the borrower-side and lender-side factors, it provides reasonable benchmarks for further analyses.

In the second stage, we employ an identification strategy that allows us to focus on the effects of lender-side factors without worrying about borrower-side factors. To control for all borrower-side and macroeconomic factors, we compare loan sales by different lenders to the same facility in the same year. Consequently, the estimation method is OLS regression with facility*year fixed effects:

$$\begin{aligned} Loan\ sale_{i,j,t+1} &= (Facility*Year\ fixed\ effects)_{j,t} + B_1 \bullet (Bank\ net\ CDS\ ratio)_{i,t} \\ &+ B_2 \bullet (Lender\ controls)_{i,t} + B_3 \bullet (Lender\text{ - }facility\ controls)_{i,j,t} + \varepsilon_{i,j,t+1}, \end{aligned} \tag{2}$$

where *i*, *j*, *k*, and *t* index lenders, facilities, borrowers, and time. Specifically, there is a dummy variable for each facility in each year. Because the *facility*year* fixed effects completely absorb the borrower-side and macroeconomic factors, we can focus on the relation between lender-side factors and loan sales.

The *loan sale* dummy captures a lender's sale of its entire loan share. It considers neither the possibility of partial loan share sale nor the possibility of loan share purchase. To address these possibilities, we estimate a regression of loan share change in the third stage. Specifically, the regression design can be summarized by the following equation:

$$\begin{aligned} Loan\ share\ change_{i,j,t+1} &= (Facility*Year\ fixed\ effects)_{j,t} + B_1 \bullet (Bank\ net\ CDS\ ratio)_{i,t} \\ &+ B_2 \bullet (Lender\ controls)_{i,t} + B_3 \bullet (Lender\text{ - }facility\ controls)_{i,j,t} + \varepsilon_{i,j,t+1}, \end{aligned} \tag{3}$$

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

Finally, to address the possibility that a lender cuts its loan share in one facility but increases its loan share in another facility of the same obligor, we estimate a regression of loan share change at the lender-borrower level:

$$\begin{aligned} Loan\ share\ change_{i,k,t+1} &= (Borrower * Year\ fixed\ effects)_{k,t} + B_1 \bullet (Bank\ net\ CDS\ ratio)_{i,t} \\ &+ B_2 \bullet (Lender\ controls)_{i,t} + B_3 \bullet (Lender - borrower\ controls)_{i,k,t} + e_{i,k,t+1}, \end{aligned} \tag{4}$$

where *i*, *k*, and *t* index lenders, borrowers, and time. The regression sample is constructed by aggregating the annual panel of lender-facility pairs to an annual panel of lender-borrower pairs. Specifically, for a lender-borrower pair, the loan share is the sum of the lender's loan shares to all syndicated facilities of the borrower.

5. Results

5.1. Logit regressions of bank loan sales

Table 3 presents the logit regression results of bank loan sales. This table consists of two regressions on two subsamples created based on lender's CDS-using status. Specifically, Regression (1) is based on the subsample of CDS net buyers, and regression (2) is based on the subsample of CDS net sellers. A lender is a CDS net buyer if *bank net CDS ratio* is positive, and is a CDS net seller if *bank net CDS ratio* is negative. All regressions include year fixed effects and a comprehensive list of control variables at lender, lender-facility, facility, and borrower levels.

For comparability with linear models, Table 3 reports the average marginal effects (AME). The marginal effect of a regressor measures the change in the dependent variable when the regressor changes by one unit. For linear regression models, the marginal effect equals the coefficient of the corresponding regressor. This is no longer the case for nonlinear regressions. In the logit regression of loan sales, the probability of loan sale is

$$P(\text{loan sale}|x)=\Lambda(x'\beta)=\exp(x'\beta)/\left(1+\exp(x'\beta)\right). \tag{5}$$

The marginal effect measures the change in the probability of loan sale when a regressor changes by one unit:

$$ME_i = \frac{\partial P}{\partial x_i} = \Lambda(\mathrm{x}'\beta)(1-\Lambda(\mathrm{x}'\beta))\beta_i. \quad (6)$$

As Equation (6) shows, the marginal effect is no longer a constant, and changes when any regressor changes. Consequently, the AME is the average marginal effect over the estimation sample.

In all regressions of this paper, binary variables have the values of zero and one, while continuous variables are expressed as real numbers (i.e., 1 means 100%, and 0.01 means 1%). For this reason, the AME measures the effects on the dependent variable when a binary regressor changes from zero to one, or when a continuous regressor changes by 100%.

First, we observe a positive and statistically significant relation between bank net CDS positions and loan sales for CDS net buyers. For instance, the AME value of *bank net CDS ratio* is 0.133 in regression (1), which suggests that a 1% increase in *bank net CDS ratio* is associated with an increase of 0.133% in the probability of loan sale for CDS net buyers. This positive relation is consistent with the hypothesis that the complementary channel dominates the substitute channel. In other words, when banks want to reduce their credit risk exposures, they use all available risk mitigation tools: selling loans and buying CDS. Since the standard deviation of *bank net CDS ratio* is 4.9%, it implies that a one standard-deviation increase in *bank net CDS ratio* increases the probability of loan sales by about 0.65% for CDS net buyers.

Next, we observe a negative and statistically significant relation between bank net CDS positions and loan sales for CDS net sellers. Specifically, the AME value of *bank net CDS ratio* is -0.913 in regression (2), which suggests that a 1% decrease in *bank net CDS ratio* is associated with an increase of 0.913% in the probability of loan sale for CDS net sellers. Therefore, a one standard-deviation decrease in *bank net CDS ratio* increases the probability of loan sales by about 4.5%. The negative relation between bank's net CDS positions and loan sales for CDS net sellers is consistent with the credit-enhancement channel. In other words, banks sell CDS protection as

credit enhancements to facilitate loan sales to investors unwilling to hold credit risk.

In addition, the link between *bank gross CDS ratio* and loan sales is very weak. Specifically, the AME of *bank gross CDS ratio* is close to zero and insignificant in regression (1), which suggests that this variable has little effect on loan sales for CDS net buyers. In addition, although this value is negative and statistically significant in regression (2), its magnitude is very small.

Furthermore, regressions (1) and (2) suggest that there are significant differences in the motivation of loan sales between CDS net buyers and CDS net sellers. First, we find that loan sales probability is negatively related to *bank capital ratio* for CDS net buyers, which is consistent with the view that banks sell loans because of capital pressures (Pennacchi 1988; Allen and Carletti 2006). On the other hand, this relation is positive for CDS net sellers. Second, we find loan sales probability is positively related to *bank wholesale funding ratio,* and is negatively related *bank liquid asset ratio* for CDS net buyers. This finding is consistent with the liquidity risk management motive of loan sales (Irani and Meisenzahl 2017). For CDS net sellers, however, we find that loan sales probability is negatively related to *bank wholesale funding ratio* and is positively related *bank liquid asset ratio.* Furthermore, the relation between loan sales probability and *bank NPA ratio* is positive for CDS net buyers, but is negative for CDS net sellers.

We use two variables to measure the lender-facility relationship: *agent bank* and *loan share*. Compared with other lenders, the loan sale probability is lower for agent banks. In addition, loan sale probability is negatively related to a lender's *loan share*. Among facility-level control variables, the loan sale probability is higher for amended and refinanced facilities, and for facilities with criticized ratings. These results are consistent with the risk-management motive of loan sales: banks are likely to sell more loans on firms with relatively high risk. In addition, CDS net buyers are less likely to sell loan shares in credit line facilities. This result is consistent with Drucker and

Puri (2009), who find that credit lines account for only 34% of the loan sales in their study. This relation does not hold for CDS net sellers. Among borrower-level control variables, loan sale probability is lower for investment-grade obligors. Finally, loan sale probability is positively related to *earnings disagreement* and *firm size*.

5.2. Regressions of bank loan sales with facility*year fixed effects

To control for all borrower-side and macroeconomic factors, this section compares loan sales by different lenders to the same facility in the same year. Specifically, the estimation method is OLS regression with facility*year fixed effects. Because the facility*year fixed effects absorb all borrower-side and macroeconomic factors, these variables are excluded from the regressions.

Table 4 reports the regression results. This table consists of five regressions. In addition to the facility*year fixed effects, all regressions include a set of control variables at lender and lender-facility levels. Furthermore, each subsequent regression adds additional variables: bank gross CDS ratio (regression (2)), CDS net seller*bank net CDS ratio (regression (3)), the interaction terms between bank net CDS ratio and several explanatory variables (regression (4)), and controls for TARP, DW, and TAF programs (regression (5)).

Across all regressions, we observe a positive and statistically significant relation between bank's net CDS positions and loan sales for CDS net buyers, which is consistent with the hypothesis that the complementary channel dominates the substitute channel. For instance, the coefficient of *bank net CDS ratio* is 0.516 in regression (5), which suggests that a 1% increase in *bank net CDS ratio* is associated with an increase of 0.516% in the probability of loan sale for CDS net buyers. In addition, we observe a negative and statistically significant relation between bank's net CDS positions and loan sales for CDS net sellers, which is consistent with the credit-enhancement channel. Taking regression (5) as an example, the sum of the coefficient of *CDS net*

*seller*bank net CDS* ratio and the coefficient of *bank net CDS* ratio is (-2.479+0.516) = -1.963, which suggests that a 1% decrease in *bank net CDS ratio* is associated with an increase of 1.963% in the probability of loan sale for CDS net sellers. Moreover, the coefficient of *bank gross CDS ratio* is small or insignificant across all regressions. These results are qualitatively consistent with those of Table 3.

We also find that the U.S. government's capital and liquidity support programs had modest effects in reducing loan sales during the recent financial crisis. In regression (5), the coefficients of TARP, DW, and TAF funding ratios are all negative and statistically significant. The coefficient value of *TARP funding ratio* is around -3.4, which suggests that a 1% increase in *TARP funding ratio* is associated with a decrease of 3.4% in the probability of loan sale. The average *TARP funding ratio* among TARP banks is 1.5%. Therefore, a 1% increase in the average *TARP funding ratio* implies that the U.S. Treasury had to increase the amount of TARP fund by two-thirds. The coefficient value of *DW funding ratio* is around -1.3, which implies that a 1% increase in *DW funding ratio* is associated with a decrease of 1.3% in the probability of loan sales. The average *DW funding ratio* is 0.6% among DW banks in the sample. Therefore, a 1% increase in the average *DW funding ratio* would imply that the Fed had to increase the DW funding by 167%. Finally, the coefficient value for *TAF funding ratio* is about -0.14, which implies that a 1% increase in *TAF funding ratio* is associated with a decrease of 0.14% in the probability of loan sales. Because the average *TAF funding ratio* among TAF banks is 4.7%, increasing the average *TAF funding ratio* by 1% would imply that the Fed had to increase the TAF funding by 21%. Overall, these results suggest that these capital and liquidity programs played a modest role in reducing loan sales during the crisis.

5.3. Lender's CDS-using status and loan sales: Subsample analysis

This section reports further analysis on the role of lender's CDS-using status in loan sales. Table 5 consists of five regressions on five subsamples: CDS users (regression (1)), CDS net buyers (regression (2)), CDS net sellers (regression (3)), non-CDS dealers (regression (4)), and CDS dealers (regression (5)).

Consistent with Tables 3 and 4, we observe a positive and statistically significant relation between bank's net CDS positions and loan sales for CDS net buyers and a negative and statistically significant relation between bank's net CDS positions and loan sales for CDS net sellers. These results are consistent with the hypothesis of the complementary channel dominating the substitute channel, and the existence of the credit-enhancement channel.

Furthermore, as shown in the regressions results on the subsamples of non-CDS dealers (regression (4)) and CDS dealers (regression (5)), the complementary channel and the credit-enhancement channel are stronger among non-CDS dealers. This finding is consistent with common sense. CDS dealers trade CDS mainly for market-making purposes. Consequently, a majority share of their CDS trading activities may be unrelated to their lending exposures, which explains the weak relation between loan sales and net CDS positions for CDS dealers.

5.4. Substitute channel versus complementary channel: further tests

The substitute channel predicts a negative relation between banks' net CDS positions and loan sales for CDS net buyers, but the complementary channel predicts a positive relation between these variables. The results from previous sections have shown a positive, modest, and robust relation between bank net CDS ratio and loan sales for CDS net buyers. This subsection performs further tests by examining whether the availability of CDS contracts on an obligor affects bank loan sales.

Specifically, lenders cannot use CDS contracts to hedge the credit risk of a loan if the obligor

of the loan is not a CDS reference entity. Consequently, the substitute channel is absent for obligors that are not CDS reference entities. Therefore, we can use obligors that are not CDS reference entities as the control group when testing the existence of the substitute channel. For instance, we can create subsamples based on whether an obligor is a CDS reference entity. Because the effect of the substitute channel offsets the effect of the complementary channel, if a lender's tendency to sell loans is similar for all obligors, we would observe a weaker relation between *bank net CDS ratio* and *loan sales* for the subsample of obligors that are CDS reference entities.

Table 6 reports the regressions on subsamples created based whether an obligor is a CDS reference entity, and whether the CDS market for an obligor is liquid. Specifically, regression (1) is based on the subsample of obligors that are not CDS reference entities, and regression (2) is based on the subsample of obligors that are CDS reference entities. In addition, regression (3) is based on the subsample of obligors with liquid CDS markets.

Overall, the coefficient of *bank net CDS ratio* is positive and statistically significant for CDS net buyers in all three regressions. In particular, this coefficient has the largest value in regression (1), which is based on the subsample of obligors free of the substitute channel. The slightly smaller values of this coefficient in regressions (2) and (3) appear to be signs for the existence of the substitute channel.

We next examine the interaction between obligors' CDS liquidity and bank net CDS ratio. In Table 7, regression (1) includes the interaction term between the *CDS traded* dummy and *bank net CDS ratio*, and regression (2) includes the interaction term between the *CDS liquid* dummy and *bank net CDS ratio*. If the substitute channel were significant, the coefficient of these interaction terms would be negative and statistically significant. On the contrary, we find little evidence that supports the significance of the substitute channel, as both coefficients are positive. Overall, the

results in Table 7 provide further support for the complementary channel.

5.5. Robustness tests

To ensure that the relation between *bank net CDS ratio* and loan sales is not driven by heterogeneities associated with loan amendments, different facility types, and the credit quality of obligors, this section performs different subsample analyses. We first run regressions on two subsamples created based on whether a facility is amended between the current year and the next year. Note that the *amended* dummy captures both refinanced and amended facilities.

The results are reported in Table IA1 in the Internet Appendix. Consistent with results from previous sections, we observe a positive and statistically significant relation between *bank net CDS ratio* and *loan sales* for CDS net buyers in both subsamples. In addition, this positive relation is stronger in the subsample of facilities that are neither amended nor refinanced. Additionally, we continue to observe a negative and statistically significant relation between *bank net CDS ratio* and *loan sales* for CDS net sellers in both subsamples. Overall, we conclude that the relation between *loan sales* and *bank net CDS ratio* is not driven by loan amendments.

Next, we run regressions on two subsamples created based on facility type. Table IA2 in the Internet Appendix reports the regression results. Regression (1) is based on the subsample of term loans, and regression (2) is based on the subsample of credit lines. In both regressions, we continue to observe a positive and statistically significant relation between *bank net CDS ratio* and *loan sales* for CDS net buyers, and a negative and statistically significant relation between *bank net CDS ratio* and *loan sales* for CDS net sellers. These suggest that the relation between *bank net CDS ratio* and *loan sales* is robust to control of facility type.

Finally, we run regressions on subsamples created based on the credit quality of borrowers. Panel A of Table IA3 in the Internet Appendix reports the regression results on subsamples created

based on the public ratings of obligors. Across all regressions, loan sales is positively related to bank net CDS ratio for CDS net buyers, and is negatively related to bank net CDS ratio for CDS net sellers. In addition, the positive relation between *bank net CDS ratio* and *loan sales* for CDS net buyers is stronger for the subsample of obligors with investment-grade ratings, but is weaker for the subsample of obligors with non-investment-grade ratings.

Panel B of Table IA3 reports the regression results on subsamples created based on bank internal ratings on facilities. The results are largely consistent with Panel A of Table IA3. In addition, these results seem to suggest bank either did not or could not take advantage of their private information about a loan in their loan and CDS trading. Specifically, the positive relation between bank net CDS ratio and loan sales for CDS net buyers is statistically significant for the subsample of facilities with pass internal ratings, but is insignificant for the subsample of facilities with criticized internal ratings. Similarly, this relation is statistically significant for the subsample of facilities that experience no internal rating downgrade, but is insignificant for the subsample of facilities that experience internal rating downgrades.

5.6. Additional robustness tests: Regression of loan share changes

The analyses in previous sections are based on the *loan sale* dummy, which captures only the case when a lender sells its entire loan share. It considers neither the possibility of partial loan share sale nor the possibility of loan share purchase. To address these possibilities, regressions in Table IA4 in the Internet Appendix compares loan share change by different lenders to the same facility in the same year. The dependent variable, *loan share change*, is the change in a lender's loan share to a facility from the current year to the next year, and is expressed as percentage of the lender's loan share.

Across all regressions in Table IA4, we observe a negative and statistically significant relation

between *bank net CDS ratio* and *loan share change* for CDS net buyers. This negative relation is consistent with the positive relation between *bank net CDS ratio* and *loan sale* for CDS net buyers observed in previous sections, as a loan sale is associated with negative loan share change. In addition, we observe a positive and statistically significant relation between *bank net CDS ratio* and *loan share change* for CDS net sellers, which is also consistent with the negative relation between *bank net CDS ratio* and *loan sale* for CDS net sellers observed in previous sections.

Additionally, a lender could reduce its loan share in one facility of a firm but increase its loan share in another facility of the same firm. To control for this possibility, we run regressions at the lender-borrower level in Table IA5 in the Internet Appendix. The regression sample in Table IA5 is constructed by aggregating the annual panel of lender-facility pairs to an annual panel of lender-borrower pairs. Specifically, for a lender-borrower pair, the loan share is the sum of the lender's loan shares to all syndicated facilities of the borrower. Consistent with Table IA4, we continue to observe a negative and statistically significant relation between *bank net CDS ratio* and *loan share change* for CDS net buyers, and a positive and statistically significant relation between *bank net CDS ratio* and *loan share change* for CDS net sellers. Overall, these results are consistent with hypothesis of the complementary channel dominating the substitute channel, and the hypothesis of the credit-enhancement channel.

6. Conclusion

This study empirically examines three channels that affect the relation between banks' CDS trading and loan sales. First, banks can use CDS hedging to substitute for loan sales. Therefore, the substitute channel predicts a negative relation between banks' net CDS positions and loan sales for CDS net buyers. Next, if a bank has higher propensity to use credit risk mitigation tools, it can choose to use both loan sales and CDS hedging. Accordingly, the complementary channel predicts

a positive relation between banks' net CDS positions and loan sales for CDS net buyers. Finally, banks can sell CDS protection as credit enhancements to boost loan sales to investors unwilling to hold credit risk. Consequently, the credit-enhancement channel predicts a positive relation between bank CDS selling and loan sales for CDS net seller.

Overall, we find a positive, modest, and robust relation between bank net CDS positions and loan sales for CDS net buyers. This finding supports the hypothesis that the complementary channel dominates the substitute channel. Moreover, for lenders that are net sellers of CDS protection, we find a negative relation between banks' net CDS positions and loan sales, which lends support to the credit-enhancement channel.

It is important to note that the relation between CDS hedging and loan sales can change over time as the economic environment and regulatory environment change. It could also change across different types of investors and borrowers. Apparently, these important questions warrant further investigation, which is beyond the scope of this study.

Appendix A. Variable definitions

Table A1
Variable definitions

Variable	Definition
Facility size (facility commitment)	The *facility size*, also known as *facility commitment*, is the maximum amount that an obligor can borrow from a syndicated facility according to the credit agreement. The facility size is legally binding and changes only when the credit agreement changes (i.e., loan amendments).
Facility balance	The *facility balance* is the current outstanding balance of a facility. It is the used portion of the facility commitment.
Amended	The *amended* dummy captures both refinanced and amended facilities. It equals one if the facility commitment, maturity date, or origination date changes between the current year and the next year.
Credit line	The *credit line* dummy equals one if a facility is a credit line, and it equals zero if a facility is a term loan.
Loan share	A lender's *loan share*, also known as *share commitment* or *loan exposure*, is the maximum amount that the lender has legally committed to the facility. It is legally binding and changes only when the credit agreement changes (i.e., loan amendments) or when the lender sells part or all of its loan share to another lender (i.e., loan sales).
Used loan share	The *used loan share* is a lender's current outstanding balance to a facility. It is the used portion of the loan share.
Loan sale	The *loan sale* dummy equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year.
Loan share change	For a lender-facility pair, the loan share change is the change in loan share from the current year to the next year. In the absence of loan amendments, a negative loan share change is caused by loan sales, and a positive loan share change is caused by loan purchases.
Agent bank	For a lender-facility pair, the *agent bank* dummy equals one if the lender is the agent bank for the facility. For a lender-borrower pair, this dummy variable equals one if the lender is the agent bank in one syndicated facility of the borrower. The agent bank is the bank that originates and/or administers a syndicated facility for the syndication of participating lenders.
Bank bought CDS ratio	*Bank bought CDS ratio* equals the notional value of bought CDS protection divided by the bank's total assets.
Bank sold CDS ratio	*Bank sold CDS ratio* equals the notional value of sold CDS protection divided by the bank's total assets.
Bank net CDS ratio	*Bank net CDS ratio* equals the net notional value of CDS protection divided by the bank's total assets. The net notional

Variable	Definition
	value of CDS protection equals the notional value of bought CDS protection minus the notional value of sold CDS protection.
Bank gross CDS ratio	*Bank gross CDS ratio* equals the sum of notional values of bought and sold CDS protection divided by the bank's total assets.
Bank total assets	The total assets of a bank (expressed in billions of U.S. dollars)
Bank capital ratio	The bank's capital to assets ratio
Bank wholesale funding ratio	*Bank wholesale funding ratio* is the sum of large time deposits, foreign deposits, repo sold, other borrowed money, subordinated debt, and fed funds purchased divided by total assets.
Bank ROA	Bank's return on assets
Bank NPA ratio	Bank's non-performing assets to total assets ratio
Bank real estate loan ratio	Bank's real estate loans to total assets ratio
Bank commercial loan ratio	Bank's commercial and industrial loans to total assets ratio
Bank subordinated debt ratio	Bank's subordinated debt to total assets ratio
Bank risk-weighted assets ratio	Bank's risk-weighted assets to total assets ratio
Bank unused commitment ratio	Bank's unused commitment to total assets ratio
Bank hedging derivatives ratio	Bank's non-credit-risk derivatives held for purposes other than trading to total assets ratio
Bank liquid asset ratio	*Bank liquid asset ratio* is the sum of cash, fed funds sold, repo bought, and securities (excluding asset-backed securities (ABS) and mortgage-backed securities (MBS)) divided by total assets.
Bank securitized assets ratio	Bank's securitization balance to total assets ratio
Bank merger	The *bank merger* dummy equals one if the bank acquires other banks between the current year and the next year. The data on bank mergers and acquisitions are obtained from the website of the Federal Reserve Bank of Chicago.
CDS user	The *CDS user* dummy equals one if the gross CDS position is positive.
CDS net buyer	The *CDS net buyer* dummy equals one if the net CDS position is positive.
CDS net seller	The *CDS net seller* dummy equals one if the net CDS position is negative.
CDS dealer	The *CDS dealer* dummy equals one if the bank is one of the 10 largest CDS dealers in the U.S. (i.e., seven largest U.S. banks and three U.S. branches of foreign banks) that file form FR Y-9C.
DW active	For a bank in a given year, the *DW active* dummy equals one if the bank is actively participating in the Federal Reserve's Discount Window (DW) in that year. The DW data are

Variable	Definition
	obtained from the Federal Reserve Board.
DW funding ratio	For a bank in a given year, the *DW funding ratio* equals the duration-weighted aggregate DW fund it received in that year divided by its assets. This variable equals zero if the bank is not actively participating in DW in that year. When aggregating the DW loans of a bank, each loan is scaled by its duration in years (e.g., the scale factor is 0.25 for a 90-day loan).
TAF active	For a bank in a given year, the *TAF active* dummy equals one if the bank is actively participating in the Federal Reserve's Term Auction Facility (TAF) in that year. The TAF data are obtained from the Federal Reserve Board.
TAF funding ratio	For a bank in a given year, the *TAF funding ratio* equals the duration-weighted aggregate TAF fund it received in that year divided by its assets. This variable equals zero if the bank is not actively participating in TAF in that year.
TARP duration	For a bank that has ever participated in the Troubled Asset Relief Program (TARP) program, we obtain the start and end dates for the bank's participation in the TARP program. Next, in each year, the bank's *TARP duration* is the overlap between the period of its TARP participation and the one-year period from the current year to the next year. For instance, the duration is 1.0 if the overlap is one year, and is 0.25 if the overlap is one quarter. The TARP data are obtained from the U.S. Treasury.
TARP active	For a bank in a given year, the *TARP active* dummy equals one if the bank's TARP duration in that year is greater than zero. This dummy equals zero if the bank's TARP duration in that year is zero.
TARP funding ratio	For a bank in a given year, the *TARP funding ratio* equals the TARP fund it received multiplied by the bank's TARP duration in that year, and divided by the bank's total assets.
CDS quote depth	A firm's *CDS quote depth* is the average number of dealers that provide CDS quotes on the firm over the trailing 12-month period.
CDS traded	For a firm in a given year, the *CDS traded* dummy equals one if the firm has ever been a CDS reference entity within the past five years.
CDS liquid	For a firm in a given year, the *CDS liquid* dummy equals one if the CDS quote depth is greater than or equal to 3.
Investment grade	For a firm, this dummy equals one if the S&P long-term rating is better than or equal to BBB-.
Criticized rating	Banks rate each facility using five-grade internal risk ratings: "pass", "special mention", "substandard", "doubtful", and "loss". For a facility, the *criticized rating* dummy equals one

Variable	Definition
	if the facility does not have a "pass" rating. For a firm, the *criticized rating* dummy equals one if the firm has one or more facilities with non-pass ratings.
Public rating downgrade	This dummy equals one if the S&P long-term rating on the firm is downgraded by one or more notches, based on the 22-point scale.
Internal rating downgrade	This dummy equals one if the bank's internal rating on the firm is downgraded by one or more notches, based on the five-grade scale (pass, special mention, substandard, doubtful, and loss).
Firm total assets	The total assets of a firm (expressed in billions of U.S. dollars)
Earnings disagreement	The *earnings disagreement* equals the standard deviation of the IBES analyst forecasts on two-year earnings per share divided by the share price if the share price is above one dollar and is missing otherwise.
Firm distance-to-default	The firm's *distance-to-default*, which is based on the Black-Sholes-Merton model, is calculated following Bharath and Shumway (2008).
Firm stock return	Firm's trailing 12-month stock return
Firm profitability	Firm's earnings to total sales ratio
Firm current ratio	Firm's current assets to current liabilities ratio
Firm accounts payable	Accounts payable to total assets ratio
Firm tangibility	Property, plant and equipment to total assets ratio
Crisis	This dummy equals one if the year is between 2008 and 2009.
Post crisis	This dummy equals one if the year is 2010 or later.

Appendix B. Background information on DW, TAF, and TARP

This study controls for banks' participation in the government capital and liquidity support programs during the recent financial crisis. These programs are the Troubled Asset Relief Program (TARP), and the Federal Reserve's Discount Window (DW) and Term Auction Facility (TAF) programs. The TARP data are obtained from the U.S. Treasury, and the DW and TAF data are from the Federal Reserve Board, which released these data to the public on March 31, 2011, following the Bloomberg's Freedom of Information Act (FOIA) lawsuit.

The DW, TAF, and TARP programs were largely active between 2007 and 2010. Following the start of the financial crisis in 2007, the Fed began to encourage depository institutions to borrow from the discount window. The TAF program was established in December 2007. In response to improvements in financial conditions, the Fed began to scale back DW and TAF programs in late 2009. The final TAF auction was held on March 8, 2010.

The U.S. Department of the Treasury launched the TARP program in October 2008. One major component of the TARP was the Capital Purchase Program (CPP), which was designed to stabilize the financial system by providing capital to financial institutions of all sizes throughout the nation. Starting in May 2009, TARP banks began to repay their TARP funds. Consequently, the majority of the $205 billion funds under CPP were repaid by the end of 2009. On December 19, 2014, the U.S. Treasury sold its remaining holdings of Ally Financial, essentially ending the TARP program. After the sale of the Ally stake, the Treasury only held stakes in 35 small community banks. Therefore, for a bank with a missing end date of TARP participation (for instance, some banks did not repay the TARP funds for various reasons), we specify December 31, 2014 as the end date.

Appendix C. TARP funding ratio, DW funding ratio, and TAF funding ratio

We construct three variables to measure the government capital and liquidity support to a bank during the recent financial crisis: *TARP funding ratio*, *DW funding ratio*, and *TAF funding ratio*. The durations of DW and TAF loans range from a single day to several months. For comparability across these different programs, these funding ratios are duration-weighted ratios. Specifically, if a bank is actively participating in DW in a given year, the DW funding ratio equals the duration-weighted aggregate DW funding it received in that year divided by the bank's total assets. This variable equals zero if the bank is not actively participating in DW in a given year. When aggregating the DW loans of a bank, each loan is scaled by its duration in years (e.g., the scale factor is 0.25 for a 90-day loan). The TAF funding ratio is defined in a similar manner.

For a bank that has ever participated in TARP, we obtain the start and end dates for the bank's participation in TARP. Next, in each year, the bank's TARP duration is the overlap between the period of its TARP participation and the one-year period from the current year to the next year. For instance, the duration is 1.0 if the overlap is one year, and is 0.25 if the overlap is one quarter.

For a bank in a given year, the TARP active dummy equals one if the bank's TARP duration in that year is greater than zero. This dummy equals zero if the bank's TARP duration in that year is zero. For a bank in a given year, the TARP funding ratio equals the TARP funding it received multiplied by the bank's TARP duration in that year, and divided by the bank's total assets.

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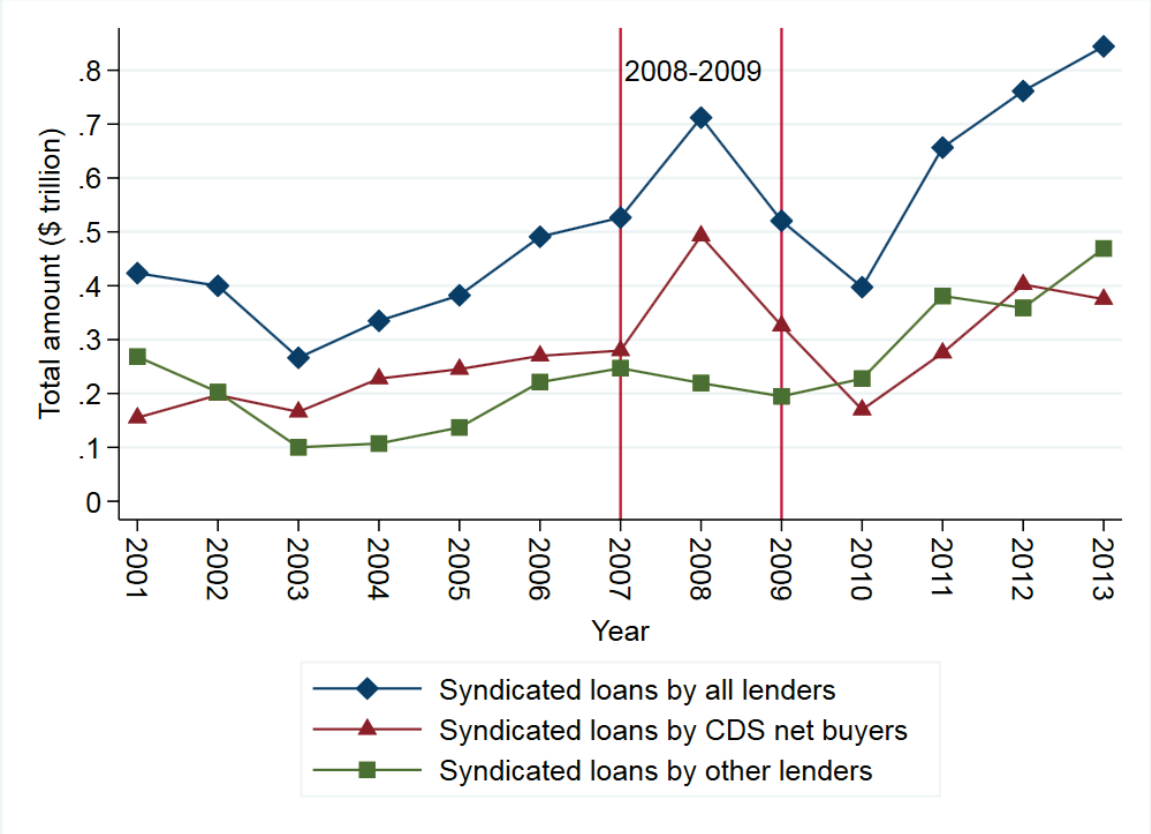

Figure 1
U.S. banks' total syndicated loan exposures by lender's CDS-using status (2001–2013)
This figure plots U.S. BHCs' total syndicated loan exposures by lender's CDS-using status. A lender's exposure to a syndicated facility, also known as loan share or share commitment, is the maximum amount that the lender has legally committed to the facility according to the credit agreement. The data sources are the SNC program, Compustat, Markit CDS data, and the U.S. BHC data (FR Y-9C). Syndicated loans include both term loans and credit lines. The SNC data track each lender's loan share in each syndicated loan facility in each year. A lender is a net protection buyer if its net notional value of CDS protection is positive.

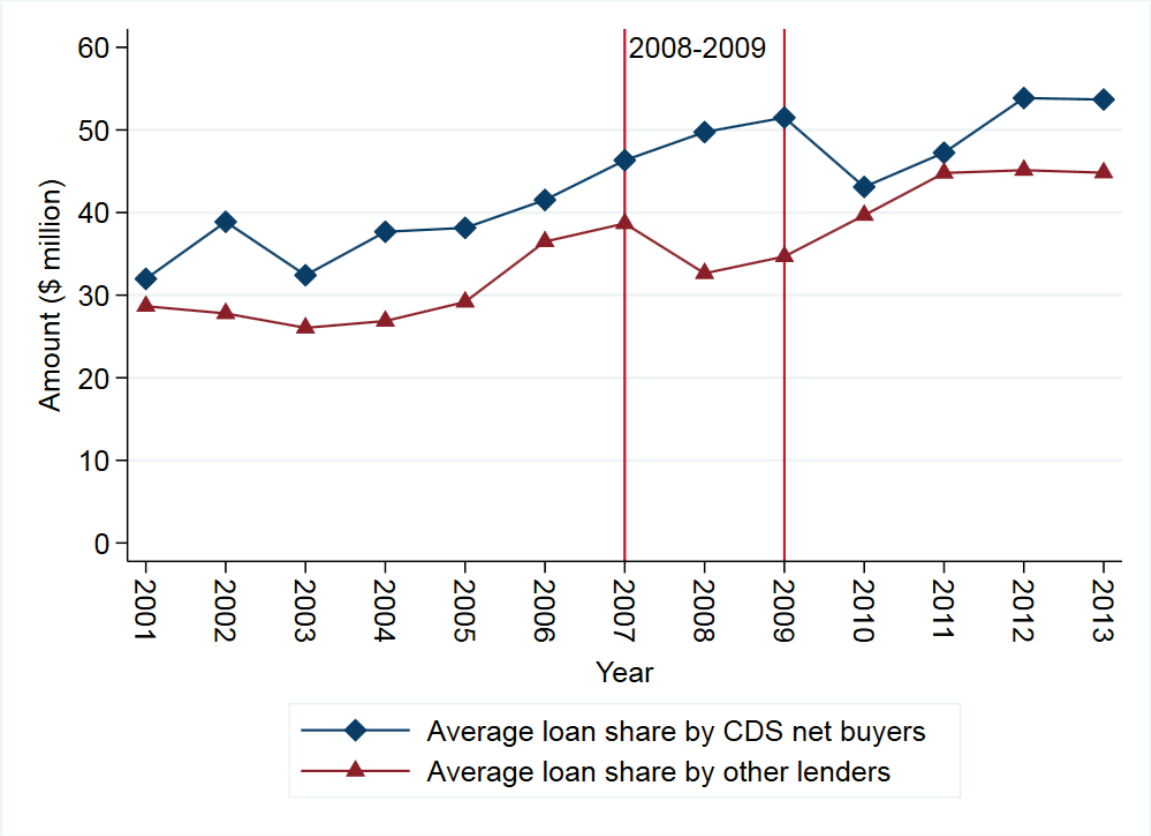

Figure 2
Average loan share by lender's CDS-using status (2001–2013)
This figure plots the average loan share of U.S. BHCs by lender's CDS-using status. A lender's loan share in a syndicated facility, also known as share commitment, is the maximum amount that the lender has legally committed to the facility according to the credit agreement. The data sources are the SNC program, Compustat, Markit CDS data, and the U.S. BHC data (FR Y-9C). Syndicated loans include both term loans and credit lines. The SNC data track each lender's loan share in each syndicated loan facility in each year. A lender is a net protection buyer if its net notional value of CDS protection is positive.

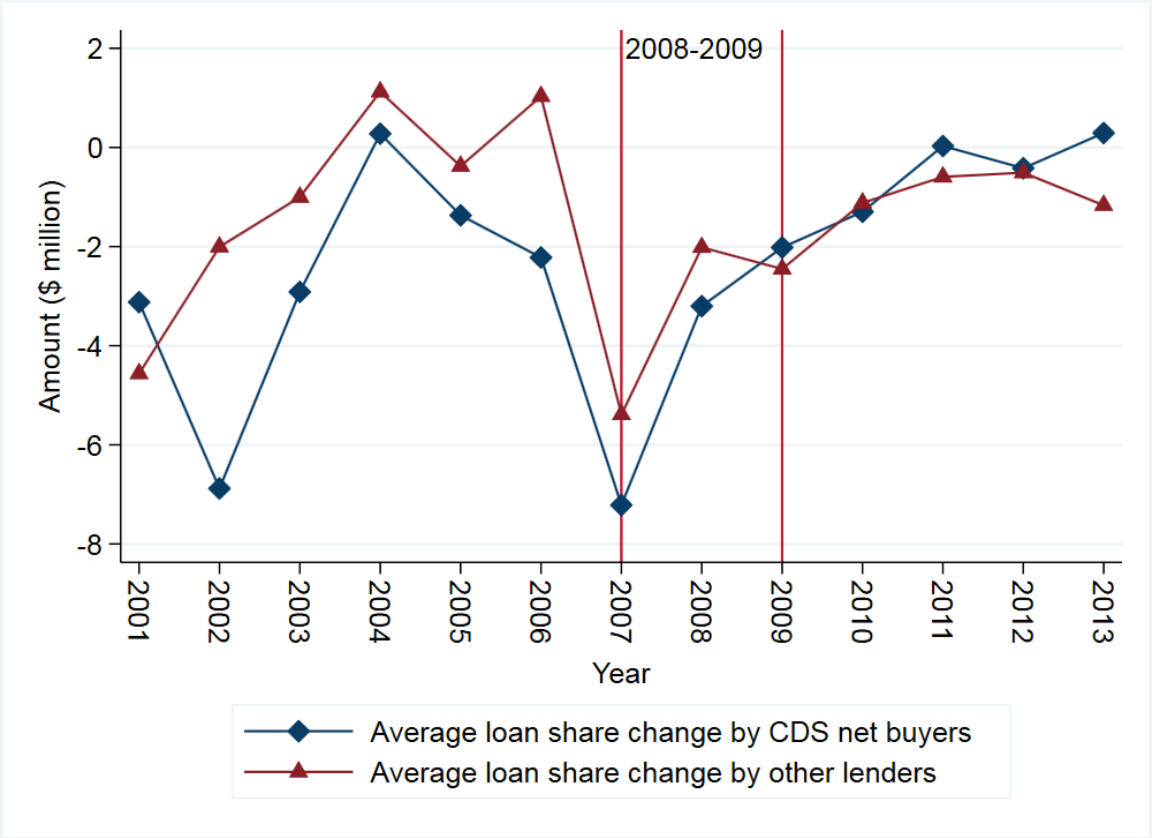

Figure 3
Average loan share change by lender's CDS-using status (2001–2013)
This figure plots the average loan share change of U.S BHCs by lender's CDS-using status. A lender's loan share in a syndicated facility, also known as share commitment, is the maximum amount that the lender has legally committed to the facility according to the credit agreement. A lender's loan share change is the difference in loan share between the current year and the previous year. The data sources are the SNC program, Compustat, Markit CDS data, and the U.S. BHC data (FR Y-9C). Syndicated loans include both term loans and credit lines. The SNC data track each lender's loan share in each syndicated loan facility in each year. A lender is a net protection buyer if its net notional value of CDS protection is positive.

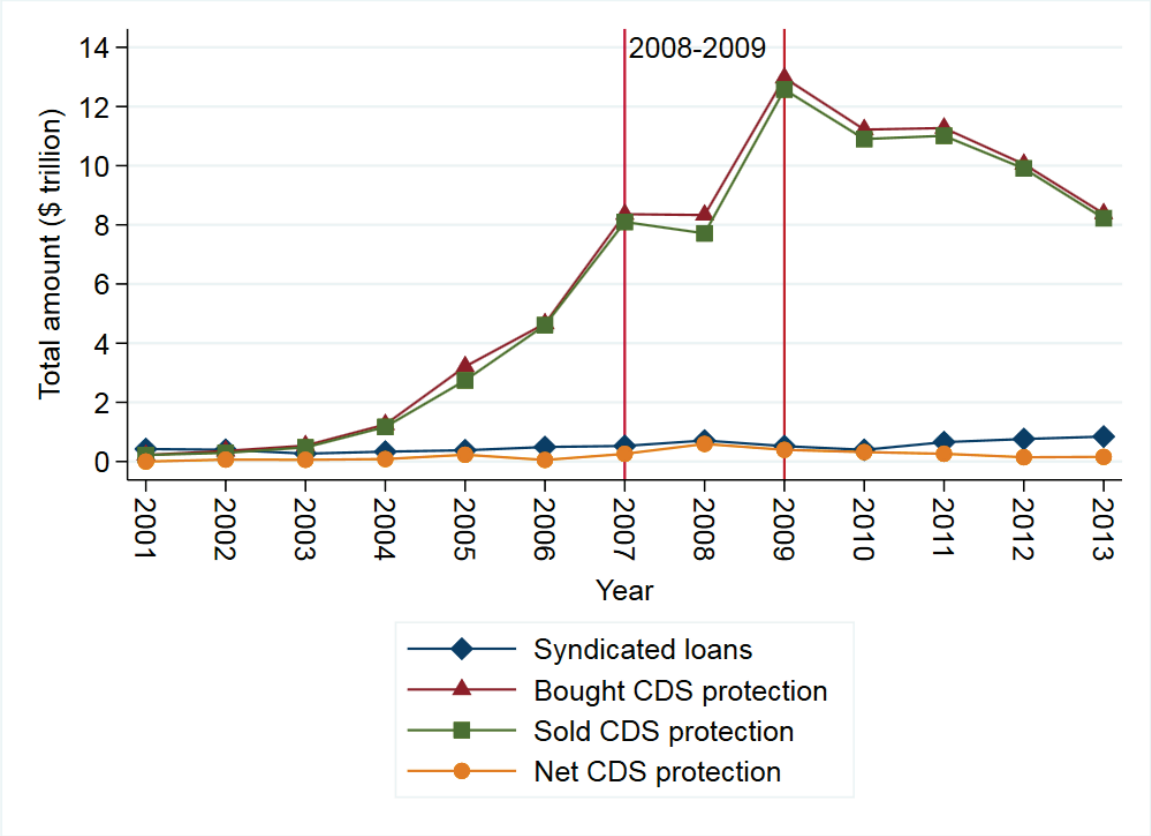

Figure 4
U.S. banks' total syndicated loan exposures and CDS positions (2001–2013)
This figure plots U.S. BHCs' total syndicated loan exposures and the notional values of bought, sold, and net CDS protection. A lender's exposure to a syndicated facility, also known as loan share or share commitment, is the maximum amount that the lender has legally committed to the facility according to the credit agreement. The data sources are the SNC program, Compustat, Markit CDS data, and the U.S BHC data (FR Y-9C). Syndicated loans include both term loans and credit lines. The SNC data track each lender's loan share in each syndicated loan facility in each year.

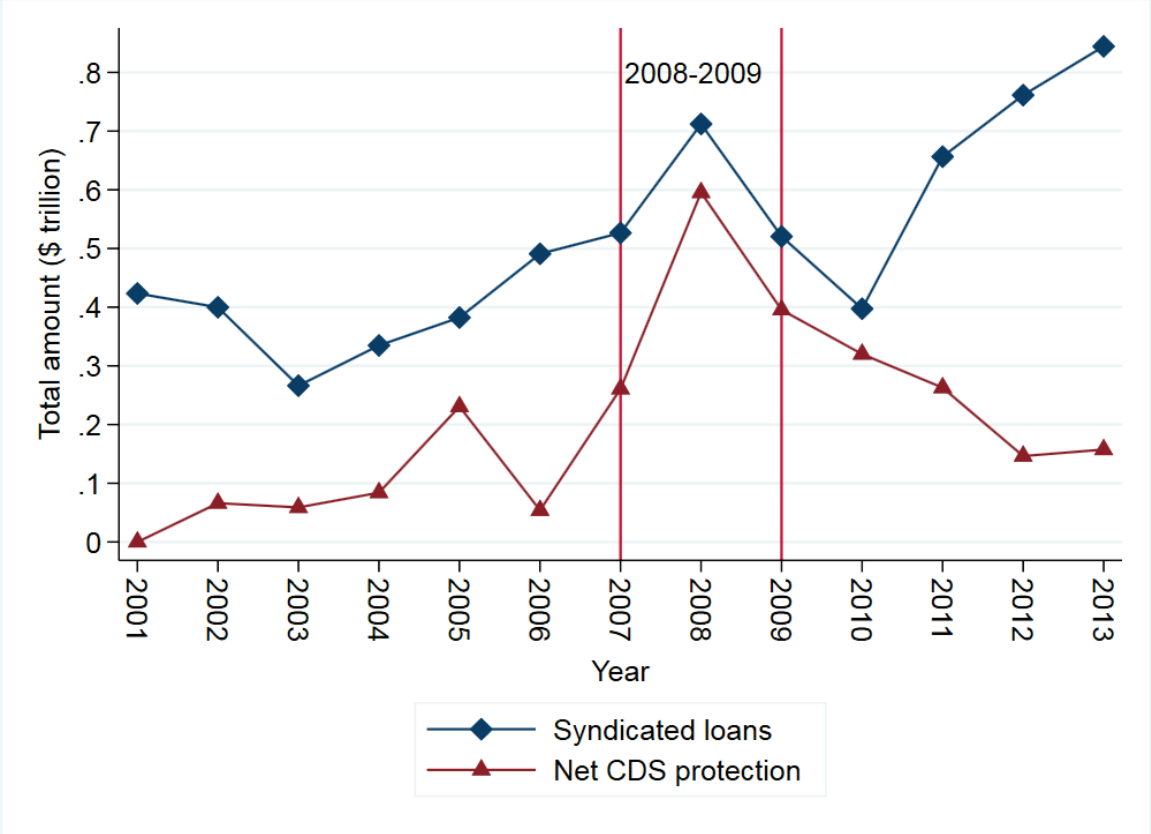

Figure 5
U.S. banks' total syndicated loan exposures and net CDS protection (2001–2013)
This figure plots U.S. BHCs' total syndicated loan exposures and the notional value of net CDS protection. A lender's exposure to a syndicated facility, also known as loan share or share commitment, is the maximum amount that the lender has legally committed to the facility according to the credit agreement. The data sources are the SNC program, Compustat, Markit CDS data, and the U.S. BHC data (FR Y-9C). Syndicated loans include both term loans and credit lines. The SNC data track each lender's loan share in each syndicated loan facility in each year.

Table 1
Summary statistics of selected variables (2001–2013)

The data sample used this study is an annual panel of lender-facility pairs that track each lender's loan share in each syndicated facility over time. The sample period is 2001–2013. The syndicated facilities include both term loans and lines of credit. The lenders in this sample are U.S. bank holding companies (and U.S. branches of foreign banks) that file FR Y-9C forms, and the obligors are U.S. public firms. The sample is constructed by linking the SNC data with the U.S. bank holding companies data (FR Y-9C), Compustat, CRSP, and Markit CDS data. Variables are defined in Table A1 in Appendix A. "N", "STD", "P5", and "P95" denote the number of observations, the standard deviation, and the 5th and 95th percentiles, respectively.

	N	Mean	Median	STD	P5	P95
Facility commitment ($ millions)	167,145	$715.4	$425.0	$834.6	$65.0	$2,268.6
Facility balance ($ millions)	167,145	$196.5	$45.0	$451.9	$0.0	$850.0
Loan share ($ millions)	167,145	$40.2	$25.0	$43.8	$3.2	$125.0
Used loan share ($ millions)	167,145	$9.4	$2.7	$20.3	$0.0	$38.2
Loan share change ($ millions)	167,145	$-1.9	$0.0	$14.3	$-25.0	$13.9
Loan share change (%)	165,135	-6.2%	0.0%	42.8%	-100.0%	51.4%
Bank bought CDS ratio	122,704	32.0%	1.6%	58.0%	0.0%	168.2%
Bank sold CDS ratio	122,704	30.5%	0.9%	56.5%	0.0%	168.7%
Bank net CDS ratio	122,704	1.5%	0.2%	4.9%	-2.6%	8.3%
Bank gross CDS ratio	122,704	62.5%	2.7%	114.3%	0.1%	336.9%
Bank capital ratio	167,145	10.0%	9.6%	3.5%	4.8%	16.3%
Bank wholesale funding ratio	167,145	32.1%	32.4%	14.4%	7.5%	49.5%
Bank total assets ($ billions)	167,145	$495.6	$157.1	$677.7	$3.5	$2,136.6
Bank ROA	167,145	0.7%	0.9%	0.9%	-0.9%	1.8%
Bank NPA ratio	167,145	1.3%	0.9%	1.1%	0.1%	3.8%
Bank real estate loan ratio	167,145	46.1%	49.2%	17.9%	8.8%	70.8%
Bank commercial loan ratio	167,145	23.7%	21.6%	11.2%	8.8%	48.4%
Bank subordinated debt ratio	167,145	2.3%	2.3%	1.5%	0.0%	4.8%
Bank risk-weighted assets ratio	167,145	73.1%	75.1%	18.6%	41.0%	101.2%
Bank unused commitment ratio	167,145	30.2%	35.4%	11.2%	5.8%	39.4%
Bank hedging derivatives ratio	167,145	1.8%	0.4%	3.1%	0.0%	9.0%
Bank liquid assets ratio	167,145	26.1%	19.7%	19.5%	5.2%	70.5%
Bank securitized assets ratio	167,145	1.0%	0.7%	1.0%	0.0%	2.1%
TARP funding ratio	20,620	1.5%	1.1%	0.9%	0.4%	2.8%
DW funding ratio	14,714	0.6%	0.0%	2.2%	0.0%	1.9%
TAF funding ratio	23,861	4.7%	0.9%	14.2%	0.0%	10.3%
CDS quote depth	167,145	2.4	0.0	3.5	0.0	9.7
Average CDS premium	71,520	2.1%	0.9%	5.1%	0.2%	6.1%
CDS premium change	64,904	0.1%	-0.0%	2.4%	-2.5%	2.9%
Firm total assets ($ billions)	167,145	$20.8	$4.5	$59.9	$0.5	$77.1
Earnings disagreement	145,853	0.9%	0.3%	1.7%	0.1%	3.4%
Firm distance-to-default	166,363	7.4	6.6	5.5	0.5	16.5
Firm stock return	167,145	12.7%	10.4%	41.9%	-53.9%	83.6%
Firm profitability	167,145	19.0%	15.5%	15.2%	0.0%	49.7%
Firm current ratio	167,145	152.8%	127.5%	83.6%	65.0%	323.6%
Firm accounts payable	167,145	8.0%	5.1%	9.2%	0.5%	25.5%
Firm tangibility	167,145	29.6%	21.5%	25.9%	0.0%	79.5%

Table 2
Average loan share change and loan sale rate: CDS net buyers versus other lenders (2001–2013)

This table compares average loan share change and loan sale rate between CDS net buyers and other lenders across different categories. The estimation sample is an annual panel of lender-facility pairs over 2001–2013. All variables are defined in Appendix A. A lender is a CDS net buyer if its net notional amount of CDS protection is positive. The variable, *loan share change,* is the change in a lender's loan share to a facility from the current year to the next year. The *loan sale* dummy equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The *amended* dummy equals one if the facility size, maturity date, or origination date changes between the current year and the next year.

	Average loan share change ($ million)		Loan sale rate (%)	
	CDS net buyers	Other lenders	CDS net buyers	Other lenders
All	$-2.2	$-1.6	9.0%	8.7%
Amended				
No	$-2.1	$-1.5	7.6%	6.3%
Yes	$-2.4	$-1.8	11.4%	12.1%
Credit line				
No	$-3.7	$-2.7	13.0%	11.7%
Yes	$-2.0	$-1.4	8.3%	8.1%
Agent bank				
No	$-2.4	$-1.7	9.9%	9.1%
Yes	$-1.3	$-0.7	3.9%	2.6%
Investment grade				
No	$-1.9	$-1.4	10.2%	10.0%
Yes	$-2.6	$-1.9	7.7%	7.0%
Criticized rating				
No	$-2.0	$-1.4	8.6%	8.1%
Yes	$-5.7	$-5.5	15.7%	20.4%
CDS traded				
No	$-1.5	$-1.2	9.4%	8.9%
Yes	$-3.1	$-2.2	8.7%	8.3%
CDS liquid				
No	$-1.6	$-1.3	9.1%	8.9%
Yes	$-3.6	$-2.4	8.9%	8.0%

Table 3
Logit regressions of bank loan sales (2001–2013)

This table reports the logit regressions of bank loan sales. The estimation sample is an annual panel of lender-facility pairs over 2001–2013. All variables are defined in Appendix A. The dependent variable, *loan sale*, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. This table consists of two regressions on two subsamples: CDS net buyers (regression (1)), and CDS net sellers (regression (2)). All regressions include year fixed effects and a set of control variables at lender, lender-facility, facility, and firm levels. For comparability with linear models, average marginal effects (AME) are reported. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes the number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Subsample	CDS net buyers	CDS net sellers
	AME	AME
Bank net CDS ratio	0.133***	-0.913***
	[0.021]	[0.157]
Bank gross CDS ratio	0.000	-0.039***
	[0.002]	[0.004]
Agent bank	-0.052***	-0.032***
	[0.004]	[0.006]
Log (loan share)	-0.026***	-0.021***
	[0.001]	[0.001]
Bank capital ratio	-0.418***	0.449***
	[0.061]	[0.081]
Bank wholesale funding ratio	0.116***	-0.172***
	[0.013]	[0.026]
Bank liquid asset ratio	-0.346***	0.080***
	[0.012]	[0.023]
Log (bank total assets)	0.000	0.006***
	[0.002]	[0.002]
Bank ROA	-2.647***	-0.562***
	[0.194]	[0.197]
Bank risk-weighted assets ratio	-0.124***	-0.057***
	[0.014]	[0.022]
Bank NPA ratio	1.255***	-2.177***
	[0.175]	[0.234]
Bank real estate loan ratio	-0.185***	0.015
	[0.009]	[0.014]
Bank commercial loan ratio	-0.013	0.072***
	[0.016]	[0.026]
Bank securitized assets ratio	-2.635***	2.148***
	[0.169]	[0.231]
Bank subordinated debt ratio	0.132	1.529***

	[0.123]	[0.115]
Bank unused commitment ratio	0.058***	-0.161***
	[0.015]	[0.033]
Bank hedging derivatives ratio	0.016	0.498***
	[0.045]	[0.101]
Bank merger	-0.060***	-0.045***
	[0.005]	[0.008]
Amended	0.030***	0.043***
	[0.002]	[0.002]
Credit line	-0.017***	0.006**
	[0.003]	[0.003]
Criticized rating	0.030***	0.022***
	[0.005]	[0.005]
Investment grade	-0.007***	-0.006**
	[0.003]	[0.003]
Log (firm total assets)	0.006***	0.006***
	[0.001]	[0.001]
Earnings disagreement	0.335***	0.216***
	[0.059]	[0.063]
Firm distance-to-default	-0.000	-0.000
	[0.000]	[0.000]
Firm stock return	0.009***	-0.006*
	[0.003]	[0.003]
Firm profitability	0.006	0.010
	[0.007]	[0.008]
Firm current ratio	0.003***	-0.000
	[0.001]	[0.001]
Firm accounts payable	0.005	-0.038***
	[0.010]	[0.013]
Firm tangibility	-0.006	-0.004
	[0.004]	[0.004]
Year fixed effects	Yes	Yes
N	69,707	36,617
Pseudo R^2	0.239	0.278
Log likelihood	-15521.3	-5767.5
AUC statistic	0.827	0.825

Table 4
Regressions of bank loan sales with facility*year fixed effects (2001–2013)

Regressions in this table compare loan sales by different lenders to the same facility in the same year. The estimation sample is an annual panel of lender-facility pairs over 2001–2013. All variables are defined in Appendix A. The dependent variable, *loan sale*, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. The estimation method is OLS with *facility*year* fixed effects. Specifically, there is a dummy variable for each facility in each year. This conservative identification strategy works because each facility has multiple lenders in the same year. This *facility*year* fixed effects control for borrower-side factors (i.e., firm-level and facility-level variables) and macroeconomic factors. Consequently, these variables are excluded from regressions. This table consists of five regressions. In addition to the *facility*year* fixed effects, all regressions include a set of control variables at lender and lender-facility levels. Furthermore, each subsequent regression adds additional variables: *bank gross CDS ratio* (regression (2)), *CDS net seller*bank net CDS ratio* (regression (3)), the interaction terms between *bank net CDS ratio* and several explanatory variables (regression (4)), and controls for TARP, DW, and TAF programs (regression (5)). Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank net CDS ratio	0.242***	0.242***	0.373***	0.541***	0.516***
	[0.019]	[0.020]	[0.021]	[0.072]	[0.072]
CDS net seller	-0.024***	-0.024***	-0.050***	-0.050***	-0.049***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Bank gross CDS ratio		0.000	-0.004***	-0.003***	-0.005***
		[0.001]	[0.001]	[0.001]	[0.001]
CDS net seller*bank net CDS ratio			-2.871***	-2.793***	-2.479***
			[0.130]	[0.130]	[0.128]
Agent bank*bank net CDS ratio				-0.578***	-0.558***
				[0.034]	[0.034]
Amended*bank net CDS ratio				-0.181***	-0.180***
				[0.039]	[0.039]
Credit line*bank net CDS ratio				-0.004	0.007
				[0.069]	[0.069]
TARP funding ratio					-3.399***
					[0.160]
DW funding ratio					-1.336***
					[0.138]
TAF funding ratio					-0.135***
					[0.016]
Agent bank	-0.025***	-0.025***	-0.026***	-0.015***	-0.015***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Log (loan share)	-0.030***	-0.030***	-0.031***	-0.031***	-0.032***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]

Bank capital ratio	-0.485***	-0.486***	-0.477***	-0.464***	-0.346***
	[0.030]	[0.031]	[0.031]	[0.031]	[0.034]
Bank wholesale funding ratio	0.040***	0.040***	0.030***	0.037***	0.053***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Bank liquid asset ratio	-0.231***	-0.231***	-0.252***	-0.262***	-0.267***
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Log (bank total assets)	-0.007***	-0.007***	-0.005***	-0.006***	-0.006***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Bank ROA	-4.395***	-4.395***	-4.128***	-4.105***	-4.206***
	[0.125]	[0.125]	[0.126]	[0.125]	[0.126]
Bank risk-weighted assets ratio	-0.120***	-0.120***	-0.129***	-0.139***	-0.147***
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Bank NPA ratio	1.173***	1.174***	1.322***	1.337***	1.431***
	[0.102]	[0.103]	[0.103]	[0.103]	[0.103]
Bank real estate loan ratio	-0.117***	-0.117***	-0.128***	-0.125***	-0.137***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
Bank commercial loan ratio	0.101***	0.101***	0.112***	0.113***	0.113***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Bank securitized assets ratio	-0.611***	-0.615***	-0.918***	-0.936***	-0.828***
	[0.115]	[0.118]	[0.117]	[0.117]	[0.118]
Bank subordinated debt ratio	-0.137**	-0.137**	-0.093	-0.071	0.246***
	[0.069]	[0.069]	[0.069]	[0.069]	[0.074]
Bank unused commitment ratio	0.033***	0.033***	0.015	0.018*	0.034***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Bank hedging derivatives ratio	-0.042*	-0.042*	-0.066***	-0.068***	-0.024
	[0.024]	[0.024]	[0.024]	[0.024]	[0.024]
Bank merger	-0.027***	-0.027***	-0.028***	-0.028***	-0.026***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Facility*year fixed effects	Yes	Yes	Yes	Yes	Yes
N	167,145	167,145	167,145	167,145	167,145
Adjusted R^2	0.141	0.141	0.144	0.145	0.149

Table 5
Lender's CDS-using status and loan sales: Subsample analysis (2001–2013)

This table examines the role of lender's CDS-using status in loan sales. This table consists of five regressions on five subsamples: CDS users (regression (1)), CDS net buyers (regression (2)), CDS net sellers (regression (3)), non-CDS dealers (regression (4)), and CDS dealers (regression (5)). All variables are defined in Appendix A. The dependent variable, *loan sale*, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with *facility*year* fixed effects. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Subsample	(1) CDS users	(2) CDS net buyers	(3) CDS net sellers	(4) Non-CDS dealers	(5) CDS dealers
Bank net CDS ratio	0.271***	0.350***	-4.845***	0.567***	0.189**
	[0.075]	[0.085]	[0.426]	[0.174]	[0.075]
CDS net seller	-0.068***			-0.080***	0.003
	[0.002]			[0.003]	[0.003]
Bank gross CDS ratio	-0.012***	0.005***	-0.073***	0.413***	0.012***
	[0.001]	[0.001]	[0.005]	[0.021]	[0.001]
CDS net seller*bank net CDS ratio	-2.527***			-10.466***	-0.226*
	[0.124]			[0.453]	[0.121]
Lender controls	Yes	Yes	Yes	Yes	Yes
Lender-facility controls	Yes	Yes	Yes	Yes	Yes
Facility*year fixed effects	Yes	Yes	Yes	Yes	Yes
N	122,704	80,516	41,640	102,642	64,503
Adjusted R^2	0.176	0.182	0.275	0.201	0.184

Table 6
The effects of obligors' CDS liquidity on bank loan sales: Subsample analysis (2001–2013)

This table reports regressions on three subsamples created based on the CDS liquidity of obligors: Non-CDS obligors, CDS-traded obligors, and CDS-liquid obligors. All variables are defined in Appendix A. The dependent variable, *loan sale*, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with *facility*year* fixed effects. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Subsample	(1) Non-CDS Obligors	(2) CDS-traded obligors	(3) CDS-liquid obligors
Bank net CDS ratio	0.592***	0.398***	0.491***
	[0.100]	[0.105]	[0.134]
CDS net seller	-0.044***	-0.055***	-0.063***
	[0.003]	[0.003]	[0.003]
Bank gross CDS ratio	-0.001	-0.009***	-0.010***
	[0.001]	[0.001]	[0.001]
CDS net seller*bank net CDS ratio	-1.999***	-3.000***	-3.203***
	[0.174]	[0.190]	[0.219]
Lender controls	Yes	Yes	Yes
Lender-facility controls	Yes	Yes	Yes
Facility*year fixed effects	Yes	Yes	Yes
N	91,491	75,654	53,102
Adjusted R^2	0.151	0.148	0.147

Table 7
The effects of obligors' CDS liquidity on bank loan sales: Interaction analysis (2001–2013)

This table examines the interaction between the obligors' CDS liquidity and *bank net CDS ratio*. All variables are defined in Appendix A. The dependent variable, *loan sale*, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with *facility*year* fixed effects. Regression (1) examines the interaction between *CDS traded* dummy and other explanatory variables, and regression (2) examines the interaction between *CDS liquid* dummy and other explanatory variables. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Bank net CDS ratio	0.475***	0.479***
	[0.075]	[0.073]
CDS net seller	-0.049***	-0.049***
	[0.002]	[0.002]
Bank gross CDS ratio	-0.005***	-0.005***
	[0.001]	[0.001]
CDS net seller*bank net CDS ratio	-2.174***	-2.306***
	[0.156]	[0.146]
CDS traded*bank net CDS ratio	0.079**	
	[0.037]	
CDS traded*CDS net seller*bank net CDS ratio	-0.649***	
	[0.208]	
CDS liquid*bank net CDS ratio		0.106***
		[0.037]
CDS liquid*CDS net seller*bank net CDS ratio		-0.481**
		[0.223]
Lender controls	Yes	Yes
Lender-facility controls	Yes	Yes
Facility*year fixed effects	Yes	Yes
N	167,145	167,145
Adjusted R^2	0.149	0.149

Internet Appendix

Table IA1
Regressions of bank loan sales: Subsamples based on loan amendment status (2001–2013)

This table reports the regression results of bank loan sales on two subsamples created based on whether a facility is amended between the current year and the next year. Note that the amended dummy equals one for both amended and refinanced facilities. Regression (1) is based on the subsample of facilities that are amended, and regression (2) is based on the subsample of facilities that are not amended. All variables are defined in Appendix A. The dependent variable, loan sale, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, bank net CDS ratio, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with facility*year fixed effects. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Subsample	Amended facilities	Non-amended facilities
Bank net CDS ratio	0.233***	0.659***
	[0.089]	[0.110]
CDS net seller	-0.035***	-0.058***
	[0.003]	[0.002]
Bank gross CDS ratio	-0.004**	-0.006***
	[0.002]	[0.001]
CDS net seller*bank net CDS ratio	-2.189***	-2.642***
	[0.224]	[0.150]
Lender controls	Yes	Yes
Lender-facility controls	Yes	Yes
Facility*year fixed effects	Yes	Yes
N	66,098	101,047
Adjusted R^2	0.167	0.125

Table IA2
Regressions of bank loan sales: Subsamples based on facility type (2001–2013)

This table reports the regression results of bank loan sales on two subsamples created based on facility type. Regression (1) is based on the subsample of term loans, and regression (2) is based on the subsample of credit lines. All variables are defined in Appendix A. The dependent variable, loan sale, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, bank net CDS ratio, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with facility*year fixed effects. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Subsample	Term loans	Credit lines
Bank net CDS ratio	0.630***	0.528***
	[0.124]	[0.027]
CDS net seller	-0.023***	-0.054***
	[0.006]	[0.002]
Bank gross CDS ratio	-0.008**	-0.004***
	[0.003]	[0.001]
CDS net seller*bank net CDS ratio	-2.579***	-2.463***
	[0.411]	[0.133]
Lender controls	Yes	Yes
Lender-facility controls	Yes	Yes
Facility*year fixed effects	Yes	Yes
N	26,613	140,532
Adjusted R^2	0.150	0.150

Table IA3
Regressions of bank loan sales: Subsamples based on obligors' credit quality (2001–2013)

This table reports the subsample regression results based on obligors' credit quality. Panel A reports the regression results on subsamples created based on the public ratings of obligors, and Panel B reports the regression results on subsamples created based on bank internal ratings on facilities. All variables are defined in Appendix A. The dependent variable, loan sale, is a dummy variable that equals one if a lender's loan share is reduced from a non-zero value in the current year to zero in the next year. The key explanatory variable, bank net CDS ratio, is a bank's net notional value of CDS protection divided by its total assets. Similar to Table 4, the estimation method is OLS with facility*year fixed effects. Each regression includes the same set of control variables as regression (5) of Table 4. To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Subsamples based on the public ratings of obligors

Subsample	(1) Investment grade	(2) Non-investment grade	(3) No rating downgrade	(4) Rating downgrade
Bank net CDS ratio	0.775***	0.272**	0.529***	0.437**
	[0.122]	[0.111]	[0.076]	[0.210]
CDS net seller	-0.056***	-0.044***	-0.048***	-0.059***
	[0.003]	[0.004]	[0.002]	[0.007]
Bank gross CDS ratio	-0.008***	0.001	-0.005***	-0.003
	[0.001]	[0.002]	[0.001]	[0.003]
CDS net seller*bank net CDS ratio	-2.735***	-2.449***	-2.358***	-3.357***
	[0.176]	[0.265]	[0.133]	[0.427]
Lender controls	Yes	Yes	Yes	Yes
Lender-facility controls	Yes	Yes	Yes	Yes
Facility*year fixed effects	Yes	Yes	Yes	Yes
N	75,782	51,908	149,704	17,441
Adjusted R^2	0.130	0.167	0.139	0.207

Panel B: Subsamples based on banks' internal ratings on facilities

Subsample	(1) Pass ratings	(2) Criticized rating	(3) No rating downgrade	(4) Rating downgrade
Bank net CDS ratio	0.632***	-0.152	0.546***	0.589
	[0.077]	[0.231]	[0.074]	[0.379]
CDS net seller	-0.050***	-0.037***	-0.047***	-0.090***
	[0.002]	[0.013]	[0.002]	[0.013]
Bank gross CDS ratio	-0.006***	0.012**	-0.004***	-0.013**
	[0.001]	[0.005]	[0.001]	[0.006]
CDS net seller*bank net CDS ratio	-2.454***	-3.130***	-2.289***	-6.630***
	[0.129]	[0.799]	[0.128]	[0.787]
Lender controls	Yes	Yes	Yes	Yes
Lender-facility controls	Yes	Yes	Yes	Yes
Facility*year fixed effects	Yes	Yes	Yes	Yes
N	158,596	8,549	160,545	6,600
Adjusted R^2	0.138	0.212	0.143	0.208

Table IA4
Regressions of bank loan share change at the lender-facility level (2001–2013)

Regressions in this table compare loan share change by different lenders to the same facility in the same year. All variables are defined in Appendix A. The dependent variable, *loan share change*, is the change in a lender's loan share to a facility from the current year to the next year, and is expressed as percentage of the lender's loan share. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. The estimation method is OLS with *facility*year* fixed effects. In addition to the *facility*year* fixed effects, all regressions include a set of control variables at lender and lender-facility levels. Furthermore, each subsequent regression adds additional variables: *bank gross CDS ratio* (regression (2)), *CDS net seller*bank net CDS ratio* (regression (3)), the interaction terms between *bank net CDS ratio* and several explanatory variables (regression (4)), and controls for TARP, DW, and TAF programs (regression (5)). To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-facility level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank net CDS ratio	-0.300***	-0.272***	-0.372***	-0.668***	-0.640***
	[0.026]	[0.028]	[0.029]	[0.111]	[0.112]
CDS net seller	0.021***	0.022***	0.042***	0.042***	0.040***
	[0.002]	[0.002]	[0.003]	[0.003]	[0.003]
Bank gross CDS ratio		-0.005***	-0.002*	-0.003*	-0.001
		[0.001]	[0.001]	[0.001]	[0.001]
CDS net seller*bank net CDS ratio			2.167***	2.117***	1.710***
			[0.186]	[0.185]	[0.184]
Agent bank*bank net CDS ratio				0.509***	0.483***
				[0.054]	[0.054]
Amended*bank net CDS ratio				0.203***	0.200***
				[0.056]	[0.056]
Credit line*bank net CDS ratio				0.149	0.140
				[0.108]	[0.108]
Lender controls	Yes	Yes	Yes	Yes	Yes
Lender-facility controls	Yes	Yes	Yes	Yes	Yes
Facility*year fixed effects	Yes	Yes	Yes	Yes	Yes
N	165,135	165,135	165,135	165,135	165,135
Adjusted R^2	0.270	0.270	0.270	0.271	0.273

Table IA5
Regressions of loan share change at the lender-borrower level (2001–2013)

This table reports regression results of loan share changes at the lender-borrower level. The regression samples are constructed by aggregating the annual panel of lender-facility pairs to an annual panel of lender-borrower pairs. Specifically, for a lender-borrower pair, the loan share is the sum of the lender's loan shares to all syndicated facilities of the borrower. All variables are defined in Appendix A. The dependent variable, *loan share change*, is the change in a lender's loan share to a firm from the current year to the next year, and is expressed as percentage of the lender's loan share. The key explanatory variable, *bank net CDS ratio*, is a bank's net notional value of CDS protection divided by its total assets. The estimation method is OLS with *borrower*year* fixed effects. This table consists of five regressions. In addition to the *borrower*year* fixed effects, all regressions include a set of control variables at lender and lender-firm levels. Furthermore, each subsequent regression adds additional variables: *bank gross CDS ratio* (regression (2)), *CDS net seller*bank net CDS ratio* (regression (3)), the interaction terms between *bank net CDS ratio* and several explanatory variables (regression (4)), and controls for TARP, DW, and TAF programs (regression (5)). To avoid redundancy, this table reports only the coefficients of interest and omits the coefficients of control variables. Robust standard errors (in brackets) are clustered at the lender-borrower level. "N" denotes number of observations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Bank net CDS ratio	-0.327***	-0.292***	-0.398***	-0.502***	-0.487***
	[0.040]	[0.041]	[0.043]	[0.051]	[0.052]
CDS net seller	0.021***	0.023***	0.045***	0.045***	0.043***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Bank gross CDS ratio		-0.007***	-0.003*	-0.003*	-0.002
		[0.002]	[0.002]	[0.002]	[0.002]
CDS net seller*bank net CDS ratio			2.386***	2.359***	1.967***
			[0.277]	[0.276]	[0.275]
Agent bank*bank net CDS ratio				0.300***	0.274***
				[0.073]	[0.073]
Amended*bank net CDS ratio				0.194**	0.200**
				[0.084]	[0.084]
Lender controls	Yes	Yes	Yes	Yes	Yes
Lender-borrower controls	Yes	Yes	Yes	Yes	Yes
Borrower*year fixed effects	Yes	Yes	Yes	Yes	Yes
N	158,038	158,038	158,038	158,038	158,038
Adjusted R^2	0.247	0.247	0.248	0.248	0.249