CDS and Credit:

Testing the Small Bang Theory of the Financial Universe with Micro Data

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Abstract

Does hedging motivate CDS trading and does that affect the availability of credit? To answer these questions we couple comprehensive bank-firm level CDS trading data from the Depository Trust and Clearing Corporation with the German credit register containing bilateral bank-firm credit exposures. We find that following the Small Bang in the European CDS market, extant credit relationships with riskier firms increase banks' CDS trading and hedging of these firms. Holding more CDS contracts of safer firms leads banks to supply relatively more credit to them. Only if banks were properly hedged before the Small Bang they take more risk.

Keywords: Credit default swaps, credit exposure, hedging, bank lending, Depository Trust and Clearing Corporation (DTCC).

JEL Codes: G21.

1. Introduction

Credit default swaps (CDS) are insurance-type contracts that offer their buyers protection against default by a debtor.[1] The default risk of the outstanding bank-firm exposures should determine the extent to which financiers buy this protection to hedge their credit risk. At the same time the ease of hedging could in principle affect their new lending.[2] To convincingly identify any causal effect in this regard however remains an empirical challenge that has not been fully tackled so far.

In this paper we therefore provide comprehensive empirical evidence linking outstanding bank-firm credit exposures to hedging with CDS and subsequent granting of new credit, both also at the bank-firm level. To identify this link we exploit the effects of the so-called "Small Bang" which brought contract and convention changes that facilitate a higher degree of standardization in the CDS market in 2009.[3] The Small Bang improved liquidity (Fulop and Lescourret (2016)) and spurred more trading of CDS (we will show later). We investigate how outstanding bank-firm exposures help

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[1] See Stulz (2010), Augustin, Subrahmanyam, Tang and Wang (2014) and Augustin, Subrahmanyam, Tang and Wang (2016) for a review. A large empirical literature explains CDS spreads and trading volume; e.g., Ericsson, Jacobs and Oviedo (2009), Gârleanu, Pedersen and Poteshman (2009), Zhang, Zhou and Zhu (2009), Tang and Yan (2010), Bongaerts, De Jong and Driessen (2011), Galil, Shapir, Amiram and Ben-Zion (2014), Gehde-Trapp, Gündüz and Nasev (2015), and Kiesel, Kolaric and Schiereck (2016).

[2] CDS allow financiers that buy this protection to hedge their credit risk; therefore, these financiers should increase the supply of credit to the underlying firms. CDS have important ex ante commitment benefits. In Bolton and Oehmke (2011) for example CDS raise the debtor's pledgeable income and help reduce the incidence of strategic default by strengthening creditors' bargaining power. In Arping (2014) CDS improve the credibility of foreclosure threats, which can have positive implications for borrower incentives and credit availability ex ante. See also Shan, Tang and Winton (2015).

[3] The Small Bang entailed contract changes related to restructuring, alongside separate convention changes to the European corporate CDS market and Western European Sovereign CDS trades (Markit (2009)). The Small Bang was considered to be a natural extension of the Big Bang, which entailed global contract and convention changes in North American contracts, and which came into effect on April 8, 2009. The impact of the Big Bang has recently been studied by Danis (2016) and Haas and Reynolds (2015). They assess the illiquidity spillovers between CDS and equity markets and the restructuring of distressed firms, respectively. While as a market-wide event the Big Bang may have been partly triggered by the Lehman collapse and its fallout, the later ensuing Small Bang is clearly mostly exogenous to each individual bank-firm pair in Germany that we study.

explain this extra trading and if and how this exogenously induced extra trading by individual banks of CDS contracts on specific firms altered the provision of credit by these banks to these firms.

Coupling unique and comprehensive bank-firm CDS trading data with a credit register containing all relevant bank-firm credit exposures we can investigate hedging activity with CDS, before, during and after the Small Bang. We are particularly interested in whether the default risk and outstanding amount of bank-firm exposures before the Small Bang determines changes in CDS hedging on those firms by banks and whether changes in bank-firm CDS positions then led to changes in bank-firm credit exposures. Using an identification strategy that is applied in this literature for the first time,[4] our results show that after the Small Bang larger credit exposures to riskier firms held by banks led to increases in protection-purchasing on these firms by these banks. Banks that increased their holdings of CDS then also re-allocated their credit granting, maintaining lending to safer firms despite a concurrent lending contraction (that started in Germany in 2009). On the other hand, they extended relatively more credit to riskier firms if their main intention was hedging their credit exposure with CDS before the Small Bang. These effects are not only statistically significant but also economically relevant.

In sum, banks exploit this financial innovation to better manage risk: The higher their outstanding credit exposure to riskier firms before the Small Bang, the more the banks hedge by buying CDS on those firms after the Small Bang. However, the banks do not

[4] Our identification strategy presumes that the Small Bang first and foremost affected CDS trading. While a concurrent recovery from the financial crises during 2009 may have stimulated banks to trade more CDS, we are mainly interested in the changes in individual bank-firm level CDS trading within fairly short event windows and we will control for bank and firm fixed effects (such that any changes in demand or supply pertaining to each individual bank and firm within the short event windows we study are accounted for). In addition, notional amounts for single-name CDS actually declined from $33 trillion during the financial crisis to about $13 trillion in 2013. So it is not the case that 2009 witnessed a boom in trading due to a crisis recovery.

seem to simply "abuse" the innovation to take on more risk. After the Small Bang banks buy more protection and allocate relatively more credit to safer firms; it is only if the banks were properly hedged before the Small Bang that they take on more risk.

We are not the first to investigate the CDS – credit nexus, but − as far as we are aware − we are the first to couple bank-firm CDS trading information to bank-firm level credit exposures to uniquely identify the effect of bank-firm exposures on CDS trading and on the supply of new credit.[5] Most of the previous studies use CDS trading data which are aggregated at reference firm level, so these studies look at the effect of CDS either from the bank side or from the firm side. At the bank level, Norden, Silva Buston and Wagner (2014), for example, show that banks with larger gross positions in credit derivatives charge significantly lower corporate loan spreads, while banks′ net positions are not consistently related to loan pricing. Shan, Tang and Yan (2014) on the other hand find that banks become more aggressive in risk taking after they begin using credit derivatives. Loans issued to CDS-referenced borrowers are larger and have higher yield spreads if the lead banks in the syndicate are active in CDS trading.

At the firm level, Ashcraft and Santos (2009), for example, fail to find evidence that the general onset of CDS trading in the financial system lowers the cost of debt financing for the average borrower in their sample; yet, they uncover economically significant adverse effects on risky and informationally opaque firms. Saretto and Tookes (2013) find that firms with traded CDS contracts on their debt are able to maintain higher leverage ratios and longer debt maturities. They find this to be especially true during periods in which credit constraints become binding, a finding which is consistent in timing with the ability to hedge, helping to alleviate frictions on

[5] A somewhat related literature investigates the impact of loan securitization on bank lending (e.g., Loutskina and Strahan (2009); Kara, Marqués-Ibáñez and Ongena (2016); Loutskina (2011)).

the supply side of credit markets. Subrahmanyam, Tang and Wang (2014) for example use CDS trading data to demonstrate that the credit risk of reference firms, reflected in rating downgrades and bankruptcies, increases significantly upon the inception of CDS trading at the firm level (a finding that seems robust after controlling for the endogeneity of CDS trading). Additionally, distressed firms are more likely to file for bankruptcy if they are linked to CDS trading.

Finally, at the bank-firm level, Hasan and Wu (2015) examine the relationship between bank CDS use and loan sales involving large syndicated credit facilities. They find that banks' usage of CDS hedging is correlated with − and therefore seems to complement − loan sales (see also Hasan and Wu (2015)).

Overall, the literature finds that CDS usage intensifies risk-taking by banks (e.g., Saretto and Tookes (2013), Subrahmanyam, Tang and Wang (2014) or Shan, Tang and Yan (2014)). Though most insightful in highlighting some of the potential consequences of CDS trading at the bank, firm or bank-firm level, none of these papers examines how bank-firm level credit exposures influence banks` trading of the CDS on the respective borrowing firms (i.e., as we do, at the bank-firm level) and/or measures how exogenously caused changes in bank-firm level CDS trading affect bank-firm level credit. This is the main contribution of our paper. As our estimates imply that following the Small Bang more hedging through CDS and subsequent safer lending took place, we provide first-hand evidence on the benefits of financial innovation for risk mitigation.

The remainder of the paper is organized as follows. In Section II, we briefly review the contours of the CDS market and the Small Bang. In Section III, we describe the data and the methodology. We present the main estimation results explaining the degree of concentration in Section IV, followed by a series of robustness tests. Section V concludes.

2. "Big Bang" and "Small Bang" on the CDS Market

"*On March 11, 2009 major European dealers made a commitment to European regulators to begin clearing index and single name CDS trades through a European central clearing party by July 31, 2009*" (Markit (2009)). Under this so-called "Small Bang", the contract and convention changes were not explicitly required for central clearing of CDS trades (any more than the changes were required under the equivalent "Big Bang" that took place in the U.S. on April 8, 2009), but they quickly became a market standard for both cleared and non-cleared trades. Although central counterparty clearing of single-name CDS has first been mandated only in 2016 by the European Commission, the Small Bang event fundamentally changed the rules of the game through these new trading protocols in Europe already in 2009.[6]

The changes to promote greater standardization of contracts were expected to improve the ability of central clearing parties to conduct daily hedging operations and reduce systematic counterparty risk, as well as benefit trade compression and processing. Among several convention changes that enabled further standardization, European corporates started to trade with fixed coupons plus an upfront fee in the market. This, in effect, has facilitated a higher flexibility to dealers for their bilateral

[6] The European Commission has only recently mandated the implementation of central clearing obligation for certain single-name CDS that are denominated in Euro covering some European corporates, as a supplement to the European Market Infrastructure Regulation ('EMIR', Regulation (EU) No. 648/2012). This Delegated Regulation (EU) 2016/592 refers to mandatory central clearing of single-name CDS for the first time, after the G-20 Pittsburgh Summit commitment in 2009 to improve transparency and mitigate risks in OTC markets. Any mandate on central clearing of single-name CDS has not been regulated to date in the US through the Dodd-Frank Act.

assignment and termination negotiations throughout the maturity. Second, the introduction of an *event determination committee* created a central decision maker to indicate whether or not a credit event took place, to prevent differing conclusions regarding the same event from arising, and again facilitating a higher standardization. Third, a hardwired auction mechanism was expected to support a binding settlement price when such a credit event occurred. Hence, the Small Bang may have improved liquidity in the CDS market as documented by Fulop and Lescourret (2016), for instance, who also find that the effect is larger for more illiquid firms.

In sum, the greater standardization was expected to lead to more trading and this is indeed what happened. Figure 1 visualizes our employment of three quarter averages before the first quarter of 2009 (2009Q1), three quarter averages after the third quarter of 2009 (2009Q3), and three quarter averages between 2009Q1 and 2009Q3. These two quarters, i.e., the first and third quarters of the year 2009, closely match the two event dates, i.e., March 11, 2009, when the European dealers made the commitment to start the changes that facilitate central clearing and July 31, 2009, when the Small Bang came into effect. We refer to these periods as "Pre" (i.e., 2008Q2 to 2008Q4), "Post" (i.e., 2009Q4 to 2010Q2) and "Mid" (i.e., 2009Q1 to 2009Q3), respectively. We are aware that the date when the changes that were part of the Small Bang come into effect may be dealer specific; e.g., some dealers may choose to adhere to those new protocols earlier around April, while others had their changes later in July (and the same may be true for the resultant changes in CDS trading and hedging activities by the banks). Thus we do not confine our study to a short period around the announcement and implementation dates, but rather extend our assessment period and compare the average CDS holdings of two three-quarter periods, i.e., the difference in CDS positions between "Pre" and

"Post". In this way we are able to identify the more stable and permanent effect of the Small Bang, without being influenced by short term fluctuations of CDS trading.

As Figure 2 vividly illustrates, and as statistically shown in Panel A, Table 1, the Small Bang boosted CDS trading. When we compare the three-quarter average notional amount of CDS contracts of our sample banks before the Small Bang ("Pre") with the value after the Small Bang ("Post"), we find that the gross notional amount (the sum of buying and selling divided by two; for scaling purposes we always divide the gross amount by two) increased from 62.11 Million € to 66.95 Million €: An increase of 4.84 Million € that is statistically significant at the 1 percent level. Similarly their average net CDS position increased significantly from -0.64 Million € to 3.93 Million €.[7]

Even more important for our purposes is the observation that the average number of banks in our sample with CDS positions increased from 14 to 17, the average number of firms on which a CDS contract is traded from 172 to 187, and the average number of bank-firm pairs with CDS positions from 973 to 1,090. It turns out that bank lending overall actually contracted during the studied period; for example the average on balance sheet bank-firm credit exposures contracted from 11.63 to 8.20 Million €. Yet, CDS trading may have substantially arrested this contraction for some types of firms we will show. Indeed, this what we want to do: investigate the differential effects for each bank-firm pair instead of the average effects.

The increasing trend in average net CDS positions and bank-firm pairs is observed before the Small Bang ("Pre") as well while the gross notional amount presents a decreasing trend in the same period. This may suggest that banks may have started to purchase more credit protection than they sell during the crisis (especially after the

[7] We note here that Table 1 Panel A presents the three-quarter averages of "Pre" and "Post" periods, which also include any non-trading activity. On the other hand, Figure 2 provides a time series of the cross-sectional averages of bank-firm pairs that are active in the CDS market.

Lehman collapse in the last quarter of 2008) and continued to do so. However, gross CDS position starts to increase with the Small Bang but not earlier, which indicates clearly that the Small Bang lead to an overall increase in CDS trading, and this was not due to the crisis. After the Small Bang ("Post"), net CDS positions remain relatively stable, and the gross amount slightly decreases and stays below the levels of early 2008. This decrease in gross amount had been mostly due a market-wide activity called "portfolio compressions".[8]

3. Data and Methodology

3.1 Data Sources

We employ two data sources. A first unique dataset we access is from the Trade Information Warehouse (TIW) of the *Depository Trust and Clearing Corporation* (DTCC). This data source covers more than 95 percent of the global activity for standard single-name CDSs, making it by far the most comprehensive dataset for CDS positions and trading.[9] The DTCC position-level data provides a weekly bought and sold position for each bank on each firm with each counterparty after accounting for all new trades, assignments, terminations and amendments that have happened since the past week.[10]

[8] The Bank for International Settlements defines compression as follows: "*Compression aggregates derivatives contracts with similar risks or cash flows into fewer trades. It is a process for tearing up trades that allows economically redundant derivative trades to be terminated early without changing each participant's net position*" (Bank for International Settlements (2016)). While terminating the redundant trades, the process takes place by generating a smaller number of new trades with much smaller volumes, although they possess the same cash flows and risk profile as the initial portfolio. Portfolio compression has enabled a better risk management practice by eliminating $85.7 trillion of CDS notional through year-end 2012 (ISDA (2013)).

[9] Using firm-level aggregated positions of this dataset, Oehmke and Zawadowski (2016) for example document trading and arbitrage activity on the CDS market. See also Du, Gadgil, Gordy and Vega (2015) and Kim, Koo and Liu (2015) on the matching between dealers and customers.

[10] The coverage of the DTCC TIW dataset was stable during our observation period and less likely to be affected by the increasing tendency to use central counterparty clearing. If any trend in coverage did exist,

Different from the weekly firm-level data, which are aggregated across all trades and publicly available in DTCC's websites, we have unique access to this DTCC position-level data that contain detailed information of *all* banks and their weekly CDS trading with each individual counterparty of all extant individual firm CDS contracts. For each bank, we aggregate its CDS contracts on each individual firm across trades with different counterparties at the weekly level. For each bank, these positions of protection bought and sold on each firm uniquely capture the risk taking relationship of the bank with the respective firm that is not available on the public website of the DTCC.

For our period of investigation we match DTCC data with the German credit register *(MiMik),* which makes it possible to observe individual exposures of German banks at the borrower level. We match the weekly CDS data of German banks' CDS positions on all European reference entities with the quarterly credit register data of German banks' credit exposures on the same set of European borrowers and then take the three-quarter averages separately for the CDS and the credit register data.[11] We construct our sample in a conservative way by including all potential bank-firm pairs from the entire sample of banks and firms, whereby we account only for banks that participated at least once in the CDS market in the "Pre" period and account only for firms that actually issued CDS. We exclude those banks and firms that never show up in the credit register data set, such as investment companies.[12]

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this could not have been bank-firm specific, but rather bank or firm specific, for which we will be accounting through bank and firm fixed effects.

[11] Since we use quarterly averages of credit exposure and CDS position data we are less concerned about banks' short term credit position fluctuations, i.e., short term loans which banks may not bother to hedge against, or alternatively, the CDS contracts they transact on behalf of their clients, which will be passed on to their clients probably within a very short time.

[12] Almost all financial institutions active in the CDS market that are not matched with credit register data (*MiMiK*) are either investment companies or asset management companies that are not involved in lending.

As the fourth largest economy in the world and a bank-based system, Germany is a particularly interesting country to study the link between CDS trading and the supply of credit. The German universal banking system is structured along three pillars, i.e., commercial banks, public sector banks and credit cooperatives (Krahnen and Schmidt (2004)), and all three types of banks lend to corporates and could enter the CDS market.[13]

The Deutsche Bundesbank's credit register *(MiMiK)* is the main data source for the individual exposures of German banks to firms. Bank exposures to firms in the credit register are defined fairly broadly, e.g., they include both loans and corporate bonds.[14] Despite obtaining, withdrawing and repaying credit − possibly frequently − firms keep their individual credit amount from banks surprisingly constant over time (3/4 of all individual exposures vary less than 20 percent over time, with a median growth of -3.8 percent). This observed persistency in individual exposures makes our ensuing estimates of the impact of CDS trading on credit even more economically relevant.

The credit register contains information on large credit exposures of 1.5 Million € (formerly 3 Million Deutsche Mark) and above on each quarter end.[15] Therefore,

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[13] According to the Bundesbank Banking Statistics, by the end of 2008, there were 1,864 banks in the country of which 64 percent were credit cooperatives. However, as credit cooperatives are very small institutions, and commercial banks include the four largest institutions in the country, the picture in terms of market shares is substantially different. Commercial banks account for 36 percent of all bank assets, mortgage and special purpose banks 20 percent, whereas public sector banks also take 33 percent, and credit cooperatives together with their central institutions only 11 percent. These figures clearly indicate the importance of the public sector banks, which include the savings banks ("Sparkassen") and their central institutions ("Landesbanken").

[14] For a more detailed definition of the bank exposures see Section 19 of the Banking Act (Deutsche Bundesbank (2001)). The following items are deemed not to be bank exposures: Shares in other enterprises and securities in the trading portfolio. Details on this credit register can also be found in Schmieder (2006), and in published work by Schertler, Buch and von Westernhagen (2006), Hayden, Porath and von Westernhagen (2007) and Ongena, Tümer-Alkan and von Westernhagen (2012) for example. The Bundesbank also maintains a website with working papers based on its credit register.

[15] If the sum of the exposures to firms in a borrower unit exceeds the threshold of 1.5 Million €, the individual exposure to a firm in that borrower unit is also reported, even if it is a small exposure below this threshold. For a more detailed definition, see Section 14 of the Banking Act (Deutsche Bundesbank (2001)). If exposures of 1.5 Million € or above existed during the reporting period but are partly or fully

exposures to small and medium-sized firms might be underrepresented in this database. However, for this study this threshold is less of a concern as most if not all CDS contracts that are traded pertain to large firms with commensurately large exposures.

3.2 Methodology

To disentangle the relation between CDS trading and credit exposure, we follow a two-step strategy. First, we explore if there is a change in trading after the Small Bang and we investigate whether or not existing credit relationships determine the trading of CDS of these firms by the same banks, especially for riskier firms. Banks may want to use CDS to hedge their existing credit risk, and the higher the risk, the more CDS they might trade and hedge. In our sample, we focus only on banks and firms that actively participate in the CDS market in the "Pre" period. We estimate by OLS regression models of the form:

$$\begin{aligned}\Delta CDS\ Contracts_{ij} = {} & \beta_1 Bank - Firm\ Exposure\ (\text{Before})_{ij} + \\ & +\beta_2 Bank - Firm\ Exposure\ (\text{Before})_{ij} * Firm\ CDS\ Price\ (\text{Before})_j + \alpha_i + \alpha_j + \varepsilon_{ij}\end{aligned} \tag{1}$$

where $\Delta CDS\ Contracts_{ij}$ is the absolute difference in the three-quarter average levels of CDS contracts on firm *j* held by bank *i* around the Small Bang (i.e., the difference in the average of the "Post" period minus the average of the "Pre" period, or "Post" minus "Mid" and "Mid" minus "Pre", respectively).[16] Bank – Firm Exposure $(\text{Before})_{ij}$ is the amount of credit exposure bank *i* has to firm *j* before our estimation window, namely in the first quarter of 2008, and Firm CDS Price $(\text{Before})_j$ is the premium paid for a CDS

repaid, the remaining exposure is reported even if the amount is zero. We take the actual amounts of the single-borrower exposures into consideration rather than those at the holding company level.

[16] Alternatively, we employ relative changes in CDS contracts and re-estimate our model. The results are mainly unaffected.

contract on firm *j* at the end of the first quarter of 2008.[17] α_i and α_j are bank and firm fixed effects.[18] All variable names, definitions and summary statistics are presented in Panel B, Table 1. We note that the standard errors in the above specification are clustered at the bank level, and also do not suffer from serial correlation as we aggregate the observations over time (Bertrand, Duflo and Mullainathan (2004); Petersen (2009)).[19]

The average level of CDS contracts is measured both with the *gross* and *net* number and the notional amount of contracts alternatively. In this context, an increase in the gross CDS position, defined as the average of bought and sold positions, refers to a higher trading activity, whereas an increase in the net CDS position, the difference of bought and sold positions, is considered to be associated with hedging (especially when net CDS positions are only moderately exceeding the level of credit exposure). We therefore differentiate in first instance between hedging and speculation as follows: A positive value for the net number of contracts or net notional amount indicates a higher tendency to hedge by purchasing more protection than selling. A negative net number of contracts or notional amount, on the other hand, indicates a tendency to "speculate" by taking on more credit risk as the bank sells more protection than it buys. Later on we also differentiate between lower and higher levels of positive values, and we will explain this differentiation further in the next section.

[17] The variable is subsumed by the firm fixed effects that are present in most specifications. However, when firm fixed effects are not featured, this variable will be included. The same applies to equation (2) below.

[18] We do not include bank-borrower fixed effects since the model is estimated with cross-sectional data at the bank-borrower level.

[19] We opt for clustering at the bank level since the analysis focuses on banks' hedging motives and credit exposures. We also re-estimate our models with firm-level clustering. The results are qualitatively similar.

In Panel A, Table 1, we already documented the increase in the number and notional amounts of CDS contracts held by banks around the Small Bang ("Post" minus "Pre"). Our aim is to explain these changes with an existing bank-firm exposure and the riskiness of a firm before the Small Bang, whereas the control group consists of bank-firm pairs without any credit relationship. We are mainly interested in the differential effect measured by the coefficient of the interaction term in Equation 1 above; whether or not existing credit exposures to riskier firms influence banks' trading of CDS of these firms.

In a next step, we examine the final impact on extending of credit, i.e., the association between trading of credit default swaps and the availability of credit. We explain the change in the credit exposure of bank *i* to firm *j* using the changes in CDS contracts held by the same bank on the same firm in the same period. We estimate the following model:

$$\begin{aligned}\Delta Bank - Firm\ Exposure_{ij} &= \beta_1 \Delta CDS\ Contracts_{ij} + \\ &+ \beta_2 \Delta CDS\ Contracts_{ij} * Firm\ CDS\ Price\ (\text{Pre-})_j + \alpha_i + \alpha_j + \varepsilon_{ij}\end{aligned} \tag{2}$$

where ΔBank – Firm Exposure$_{ij}$ is defined as the absolute difference in the three-quarters average amount of exposure bank *i* has to the firm *j* between the indicated periods (e.g., the difference in the average of the "Post" period minus the average of the "Pre" period, "Post" minus "Mid" and "Mid" minus "Pre", respectively). ΔCDS Contracts$_{ij}$ is measured again by the change in the average levels of firm CDS contracts held by banks around the Small Bang. Firm CDS Price (Pre-)$_j$ is the premium paid for a CDS contract on the firm *j* at the end of the last week in December 2008, which is the end of the "Pre-" period. We choose a shorter lag for CDS price (than the one in the previous exercise) when explaining the change in credit exposure around the Small Bang in order to have a more accurate information for firm risk.

We continue to control for firm and bank fixed effects in the “main line” of our specifications. The inclusion of firm fixed effects is made possible by the fact that following the Small Bang not all banks that have a credit exposure to a particular firm will commence trading a CDS on this firm. Their inclusion results in a comparison of change in individual bank exposures to the *same* firm for which some banks trade its CDS, while others do not. The inclusion of bank fixed effects focuses on the behaviour of the same bank with an existing credit exposure to some firms but not others, and the effect on CDS trading. Following the same argument, we also add bank and firm fixed effects in the second step analysis.

The change in CDS trading could *per se* explain most differences in the bank’s exposures. However, we again aim to examine the heterogeneity of the effect, the influence of trading of riskier firms. Our empirical strategy is to analyze how bank-firm exposures respond to the *changes* in bank’s CDS trading (mainly driven by the Small Bang) on specific firms.

4. Results

4.1 Change in CDS Trading around the Small Bang

Table 2 displays the cross sectional regressions of the change in the number of firm CDS contracts held by banks around the Small Bang on the existing bank-firm credit exposure and the firm CDS price before our event window. That is we estimate Equation (1) introduced before. Recall that “Pre” refers to three quarters from 2008Q2 to 2008Q4, “Mid” refers to the periods from 2009Q1 to 2009Q3 (that includes the implementation of the Small Bang from March 11 to July 31, 2009), and that “Post” refers to three quarters from 2009Q4 to 2010Q2.

In the first six specifications, we use the *gross* changes in the number of CDS contracts. Gross refers to the sum of buy and sell contracts the bank has on a given firm and is a measure for trading activity.[20] We are mainly interested in the “Post” minus “Pre” changes in the variable. However we also employ “Post-Mid” and “Mid-Pre” changes in the last two specifications of the set, in order to conduct robustness checks on possible announcement and implementation effects of the Small Bang. We start with a regression including only the constant term. The positively significant coefficient for the constant captures the average incremental Small Bang effect on CDS trading within the “Post-Pre” window.[21] Then we include Bank-Firm Exposure (Before) to investigate how existing credit exposures between bank-firm pairs influence CDS trading of these firms by the banks. The coefficient is imprecisely estimated suggesting that having a lending relationship before the Small Bang may not be related to trading of CDS for that particular firm. It is plausible that existing exposures do not predict the changes in CDS positions as banks trade CDS contracts not only for hedging purposes but also for speculating. When doing so, banks might prefer increasing credit exposure by selling protection and earn profits by receiving the CDS premium. However, their ultimate

[20] Notice that our terminology for the “gross” position deviates from the DTCC TIW description on their website. We add bought and sold contracts (divided by two) in order to reach a measure for trading activity, whereas DTCC makes use of only a single side of the trade since they report only aggregate values on their website, which is not as detailed as the bank-specific activity data we use.

[21] Comparing significance levels for the estimated coefficients on the constant in specifications 1 and 7 in Tables 2 and 3 with the two group mean comparison tests of the "Post-Pre" periods in Table 1 Panel A should take into account the fact the standard errors are clustered at the bank level in the former two tables, while this is not the case in the latter one.

decision to hedge might be driven by the default risk of the prospective exposures, and that is what we explore next.[22]

In Model 3, we include Firm CDS Price (again before our event window) as a proxy for default risk, and interact it with the credit exposure. The coefficient on the Firm CDS Price equals to -1.165, however only significant at 20 percent level. The estimated coefficient on the interaction variable equals 0.049**.[23] This result implies that for one standard deviation change in Firm CDS Price, the slope of the change in CDS contracts on Bank-Firm Exposure increases by about 4.80 (=0.049*59.39*1.65) measured in the unit of contracts per one standard deviation change in Bank-Firm Exposure; recall that the average gross number of firm CDS contracts held by the bank equals 4.14.[24] In Model 4, we include bank and firm fixed effects. In this case we are explaining the change in CDS trading of the *same firm* around the Small Bang by the *same bank* that has an existing credit exposure to this firm. The coefficient on the interaction term is slightly smaller, equal to 0.038***, still economically relevant. The next two models use alternative timings for the dependent variable; "Post-Mid" and "Mid-Pre". The results are in line with the one in Model 4. The magnitudes of the coefficients are

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[22] We acknowledge that most loans are collateralized. However, liquidating collateral is potentially costly, and lenders may choose to hedge those exposures as well. We once again note that our credit exposure sample consists of both loans granted and bonds purchased by the bank.

[23] *** Significant at 1 percent, ** significant at 5 percent, and * significant at 10 percent. For convenience we will also indicate the significance levels of the estimates that are mentioned further in the text.

[24] For computing the economic relevancy of the estimated coefficients, we consider the standard deviations of the variables interacted, e.g., 59.39 million € for Bank-Firm Exposure in 2008Q1 and 165 bps/100 for Firm CDS Price in 2008Q1. In terms of total effects, banks with a previous credit exposure of 59.39 million € to a firm in 2008Q1 are expected to increase the gross number CDS contracts held of that particular firm by 2.87 contracts when the firm had a higher CDS Price by 165 basis points in 2008Q1 (= -1.165 x 1.65 + 0.049 x 59.39 x 1.65). Equivalently, banks are expected to increase their gross trading of CDS contracts of a firm with a CDS price of 165 bps in 2008Q1 by 5.27 contracts when the bank had a higher credit exposure of 59.39 million € to the firm in that quarter (= 0.008 x 59.39 + 0.049 x 59.39 x 1.65). Given that the level effects are not significantly different from zero, we choose to focus on the additional effect.

similar where the sum equals to the coefficient explaining the "Post-Pre" period. This suggests that the impact has a similar pattern in all these three periods.

The next set of specifications in Table 2 takes the changes in the net number of CDS contracts. Here, we subtract the number of CDS contracts sold from the number of contracts bought to compute the net value. We use the same approach and interact the previous credit exposure and firm CDS price in the third specification (Model 9). The coefficient equals 0.007***, referring to a change of 0.69 in the slope of the change in net number of CDS contracts on Bank-Firm Exposure per one standard deviation change in both Bank-Firm Exposure and Firm CDS Price (before) (=0.007x59.39x1.65). It is not surprising to have a smaller effect when we consider changes in the net number. However, we also note that the average change in the net number of CDS contracts in the "Post-Pre" period equals to 0.38 (see Table 1, Panel A). The positive and significant coefficient indeed reveals the hedging motives of banks that buy more credit protection than they sell for a riskier firm, to which they have an existing credit exposure.

In Table 3, we explain the change in the notional amount of firm CDS contracts held by banks around the Small Bang. The results are mainly unchanged except that we observe a strong negative effect of the past firm CDS price on the net notional amount of contracts; -0.996***. This result suggests a simple price effect rather than the influence of an increased probability of default of a firm.

The coefficient on the interaction term of the previous credit relationship and the past CDS price equals to 0.043*** in Model 9. This implies again that the long position in CDS contracts is determined by the previous credit exposure to that particular firm if the firm is considered as riskier (This refers to a total increase of 2.57 million € in the net notional amount of firm CDS contracts held by the bank with a previous credit exposure of 59.39 million € to that firm, when the CDS price increases by 165 basis points in 2008Q1 (= -0.996x1.65 + 0.043x59.39x1.65). These results provide evidence on the fact that the default risk in bank-firm exposures before the Small Bang determines the extent of banks' CDS hedging activity.

4.2 Impact on Lending around the Small Bang

In the second step of our analysis we use the changes in CDS contracts that were the dependent variables in the first step, in an attempt to explain changes in the credit exposure between the same firm-bank pair in the same period. Specifically, we estimate Equation (2) to explain the change in bank - firm exposure from mid- to post-Small Bang with the (exogenously caused) change in firm CDS contracts held by banks during the same period and the firm CDS price before the Small Bang. We use a similar approach in our estimations and the use of measures for the change in CDS trading. In Table 4, we first start with a regression including only the constant term. Throughout the rest of the table, we include gross changes in firm CDS contracts held by banks in the model. In the first set of models, we measure the change with the number of CDS contracts, whereas in the second set we include the notional amounts. The coefficient on the change in firm CDS contracts is negative and significant in two models when the model does not include any other variable. When Firm CDS Price (Pre-) (end of 2008Q4, that is right before the "Mid" period) is included, we observe a change in the sign for the coefficient on the change in CDS contracts. However the coefficient on the Firm CDS Price (Pre-) variable is negative and significant in all specifications, suggesting that an increase in firm risk is expected to decrease credit exposure to those firms. The coefficient equals to -0.162* in Model 3, implying that a one percentage point increase in the CDS price would lead to a decrease in credit exposure by 162,000

€ to that firm. The interaction term for the Change in Firm CDS Contracts Held by the Bank from Mid- to Post- and Firm CDS Price (Pre-) is negative and significant in all models ranging from -0.010*** to -0.029***. The latter estimate implies that following the Small Bang, if a bank increases its CDS trading by one buy-contract for a less risky firm, i.e., if the Firm CDS price is lower by one percentage point before the Small Bang, the increase in the three-quarter average bank-firm level credit exposure, averaged over three quarters ("Post-Mid"), equals to 29,000 €.

In Table 5, we repeat the exercise for net CDS positions, which are more informative on a bank's buying or selling activity. While an increase in the gross position is related to an overall increase in trading, the net position clearly indicates hedging incentives. Similar to the previous set-up, we first include the number of CDS contracts, and continue with the notional amount in the second part of the table. The coefficient for the Change in Firm CDS Contracts Held by the Bank from Mid- to Post- is negative in most specifications (although insignificant) implying that buying protection for a specific firm does not induce banks to lend more to that firm. Instead they reduce their credit exposure to that particular firm. Moreover, an increase in firm risk decreases credit exposure to those firms as well. We find that the interaction term for the Change in Firm CDS Contracts Held by the Bank from Mid- to Post- and Firm CDS Price (Pre-) supports the previous results: Banks that had a larger net increase in their CDS holdings of safer firms increase their credit exposure to these firms. The magnitude of the coefficient is always larger compared to the one found for gross positions. These results indeed indicate that banks do not seem to "abuse" the innovation to take on more risk.

Our identification relies on the Small Bang as an exogenous shock on CDS trading. However, we also consider the possibility that the increased trading might be driven by a confounding event, namely the recent financial crisis, which had a direct effect on lending as well. In that case, we would be capturing a spurious correlation instead of explaining the credit exposures with CDS positions by banks. Similarly, the exogeneity of the Small Bang could even be questioned if it is considered as a response to the financial crisis. However we note that while the Big Bang may have been partly triggered by the Lehman collapse, the following Small Bang is clearly mostly exogenous to each individual bank-firm pair in Germany.

The first panel in Figure 2 shows that the increased trading was not induced by the crisis, as gross Notional Amount of Firm CDS Contracts had a decreasing trend in the second half of 2008, and the amounts started to increase with the introduction of the Small Bang. However, the contemporaneous definition of both credit exposures and CDS positions by banks raises another concern of reverse causality, such as whether or not the change in credit exposures has determined the change in CDS contracts. We approach this problem first by using an instrumental variables estimation method. We instrument the change in CDS contracts and its interaction with firm CDS price (Pre-) with the following variables: the level of (net) CDS contracts held by the bank at the end of Pre- Small Bang (2008Q4) and the interaction term between the same instrument and firm CDS price (Pre-). Specifications (4) and (8) present the second stages of these estimations. The coefficient for the interaction term is negative in both estimations, but statistically significant only when using the notional amount of CDS contracts.

Table 6 includes exercises (similar to those in Tables 4 and 5) to check the robustness of our results in alternative periods, i.e., "Post-Pre" and "Mid-Pre".[25] The results are mainly unchanged with respect to the interaction term, which is negative and

[25] We present only the results for the change in the number of CDS contracts for brevity. The results including the notional amount are qualitatively similar.

statistically significant in all models. Moreover, the coefficient on the Change in Firm CDS Contracts Held by the Bank is positive in all models, suggesting that banks that hedge their positions also increase their credit exposures to the same firm. This pattern was also observed in Table 4 once the complete model was estimated.

4.3 Will the Bank Extend More Credit If Its Credit Exposure Is Properly Hedged?

In the previous section, we find that banks that hold or trade more CDS contracts of safer firms allocate relatively more credit to these firms. However, another possibility is that when firms are riskier, banks may reduce their credit exposure to such firms, while speculating on their default through the purchase of more CDS contracts than they would need to properly cover their exposures. If this were the case, our second step analysis would capture this “spurious” correlation between decreased exposure and increased net CDS position, especially for riskier firms. The key to this identification problem is to separate out the cases when banks use CDS to hedge their credit exposure rather than get over-insured while waiting for the firm to default.

To accomplish this, we introduce a new variable, which we call as the *Hedging Activity Dummy*. We first calculate the ratio of the net CDS notional amount to the credit exposure a bank has to a firm at the end of the Pre- period. This ratio can be positive or negative, and indicate the extent to which the bank’s credit exposure is secured by CDS. Therefore we define the Hedging Activity Dummy (Pre-) as equal to one if the ratio is between 0.5 to 2, when it is most likely that the bank keep the outstanding CDS position for hedging purposes, and zero in all other cases.[26] Later on we interact this dummy variable with Firm CDS price (Pre-) and Change in Firm CDS Contracts Held by the Bank from Mid- to Post-, to explain the Bank-Firm Exposure from Mid- to Post-. We would like to investigate if a bank has its credit exposure to a riskier firm properly hedged with CDS in Pre- period and if it increases its net holdings of CDS on the firm, whether then the bank will extend more credit to the firm as it gets more secured.

Table 7 presents the results. In the first set of models, we measure the CDS change with the number of CDS contracts, whereas in the second set we include the notional amounts. The coefficients of the Change in Firm CDS Contracts Held by the Bank from Mid- to Post- and Firm CDS Price (Pre-), as well as of their interaction terms, all have similar sign and size as in the previous step. However, we are more interested in the triple interaction terms, which reveal the heterogeneous effects of being properly hedged. The coefficients on the triple interaction terms are positive and significant ranging from 0.046 to 0.287. The latter estimate suggests that if a bank increases its CDS trading by only one buy-contract on a riskier firm with a CDS price higher by one percentage point and given that the bank had properly hedged its credit exposure before the Small Bang, then this bank would increase its bank-firm level credit exposure averaged over three quarters ("Post-Mid") by almost 290,000 €. This is a sizeable increase (given that the average exposure is around 10 million €) and supports our previous argumentation that if the bank is buying more CDS contracts for hedging purposes, rather than speculating on the default of the firm, the bank will grant more credit to riskier firms (despite the aggregate contraction in credit).

[26] To assess the importance of this somewhat *ad hoc* threshold, we use hedge ratios both with a broader range (between 0.25 and 4) and with a narrower range (between 0.66 and 1.33). Our results are fully robust to these alternative definitions of the *Hedging Activity Dummy*.

4.4 CDS and Credit Exposures: Which Series "Leads"?

In the second step analysis, we have approached the concern of the exogeneity of the changes in CDS trading with an instrumental variables' estimation. In this section, we would like to formally test whether the changes in CDS contracts are leading the changes in credit exposure. We employ a panel VAR model (employing Abrigo and Love (2016)), which is a panel version of a VAR model estimated with the bank-firm level fixed effects. In the model, each variable is explained by its own lags and the lags of the other endogenous variable, where we treat both CDS and bank-firm exposure as endogenous. Before estimating the model with GMM estimators, we first take the quarter-end CDS contracts level and match it with the quarterly credit exposure data. We restrict the sample to the period between 2008Q1 and 2010Q2.

Table A1 displays the estimated results. Since we have two endogenous variables, each model includes two equations, and different sets of equations differ by the CDS contract variable being used. For example, Model 1 uses the number of gross CDS contracts held by a bank as one of the endogenous variables. We keep two lags of both endogenous variables, and also include three exogenous variables: Firm CDS price (t-1) is the quarter-end CDS price of the firm in the previous quarter; VIX is the quarter-end Chicago Board Options Exchange (CBOE) Volatility Index; and Euribor-OIS spread (3-month) is the spread between the rate at which European banks lend to each other (Euribor) and the overnight 'risk free' swap rate among the same banks of 3-month period. Both VIX and Euribor-OIS spread (3-month) can be seen as proxies for the macroeconomic factors, i.e., market-wide "fear" and liquidity, which can influence the easiness of borrowing.

For each dependent variable, we are particularly interested in the coefficients of the other endogenous variable and its lags. For example in the first equation of Model 3 where the number of net CDS contracts is being explained, both the first and the second lags of the credit exposure do not obtain significant coefficients, however in the second equation where the dependent variable is the credit exposure, the second lag of the Firm CDS contracts held by the bank can precisely predict the credit exposure the bank has to the firm. Further evidence is found in the last two rows where the results of a Granger causality test are presented. For almost all the models, CDS Granger-causes the change in credit exposure, but not the other way round. The results of the test for the opposite direction are not significant at the 10 percent level. That is, the bank may adjust their CDS positions two quarters before they do so for their credit exposure, possibly because the Small Bang has a first order effect as an exogenous shock on the trading of CDS or because cutting of credit exposure is a long-term decision, which requires more discretion.

4.5 Placebo Tests

Usage of an exogenous event to identify the effect on CDS trading might raise questions on whether the results are sensitive to the selection of the event window (we note that any confounding events during the selected window coming from the demand or supply side have already been accounted for by the inclusion of bank and firm fixed effects; any other heterogeneous event, e.g., the effect on different CDS traded firms dealing with the same bank, will be explained by our explanatory variables). In this section, we therefore replicate our previous exercises outside the Small Bang event window, namely between 2010Q2 and 2012Q2, to assess if the identified effect would also be present then. We replace the original three periods with three symmetric periods after the small bang, namely "Pre" with the quarters from 2010Q2 to 2010Q4, "Mid" with the quarters from 2011Q1 to 2011Q3 and "Post" with the quarters from 2011Q4 to 2012Q2. The change in the indicated variable refers to the difference between the indicated periods (averaged across the three quarters in the period).

Tables A2 and A3 in the Appendix present the re-estimation of Equation 1 for those newly selected periods after the Small Bang, indicated with their exact period and the equivalent "Placebo" timing below. The predetermined values for the existing bank-firm exposure and the CDS price are measured in the "Post" period, 2010Q1. The results indicate that there is no evidence for a relationship between existing credit exposures to riskier firms and increases in CDS on these firms held by these banks after the event window.

The second exercise presented in Tables A4 and A5 is the re-estimation of Equation 2 explaining the re-allocation of credit with the change in CDS positions. We can no longer argue about the direction of causality here as the change in firm CDS contracts may not be exogeneously determined after the event window of the Small Bang. In Table A4, we find a positive coefficient for the interaction term for the change in firm CDS contracts held by bank from 2010Q2 to 2011Q4 and the CDS price in 2010Q4, implying a positive relationship between the change in bank-firm exposure and CDS trading in riskier firms. However, this finding is only documented for gross changes in CDS contracts. In Table A5, the interaction terms are insignificant in all specifications.

5. Conclusion

We investigate the link between outstanding bank-firm credit exposures, hedging with CDS, and granting of new credit. To identify this link we exploit the effects of the so-called “Small Bang” which brought contract and convention changes and facilitated a higher degree of standardization in the CDS market in 2009.

This is the first paper to couple unique and comprehensive bank-firm CDS trading data with a credit register containing all relevant bank-firm credit exposures. We study how following the Small Bang changes in trading of CDS on specific firms by individual banks is determined by an existing credit exposure to a firm with higher default risk, and how exogenously caused changes in bank-firm level CDS trading affected the provision of credit by these banks to these firms. We find that the riskier the firm and the higher the existing credit exposure, the higher will be the long position in credit default swaps of that particular firm. Moreover, an increase in CDS position leads to a relatively higher allocation of credit to safer firms during the Small Bang. However, if protection purchasing before the Small Bang was for hedging purposes, banks increase their credit exposure to riskier firms.

Because our estimates imply that following the Small Bang more hedging through CDS and subsequent safer lending took place, and that only banks properly hedged before they may take more risk, we provide first-hand evidence on the benefits of financial innovation for risk mitigation. Hence policies that foster financial innovation and spur the usage of credit default swaps are not necessarily associated with more moral hazardous bank risk-taking, but rather with more risk mitigation.

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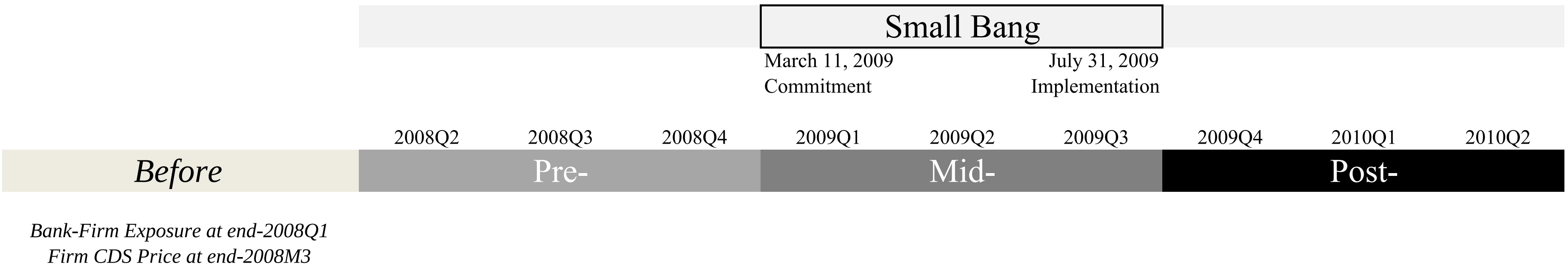
Figure 1
Time line of Small Bang in European CDS market



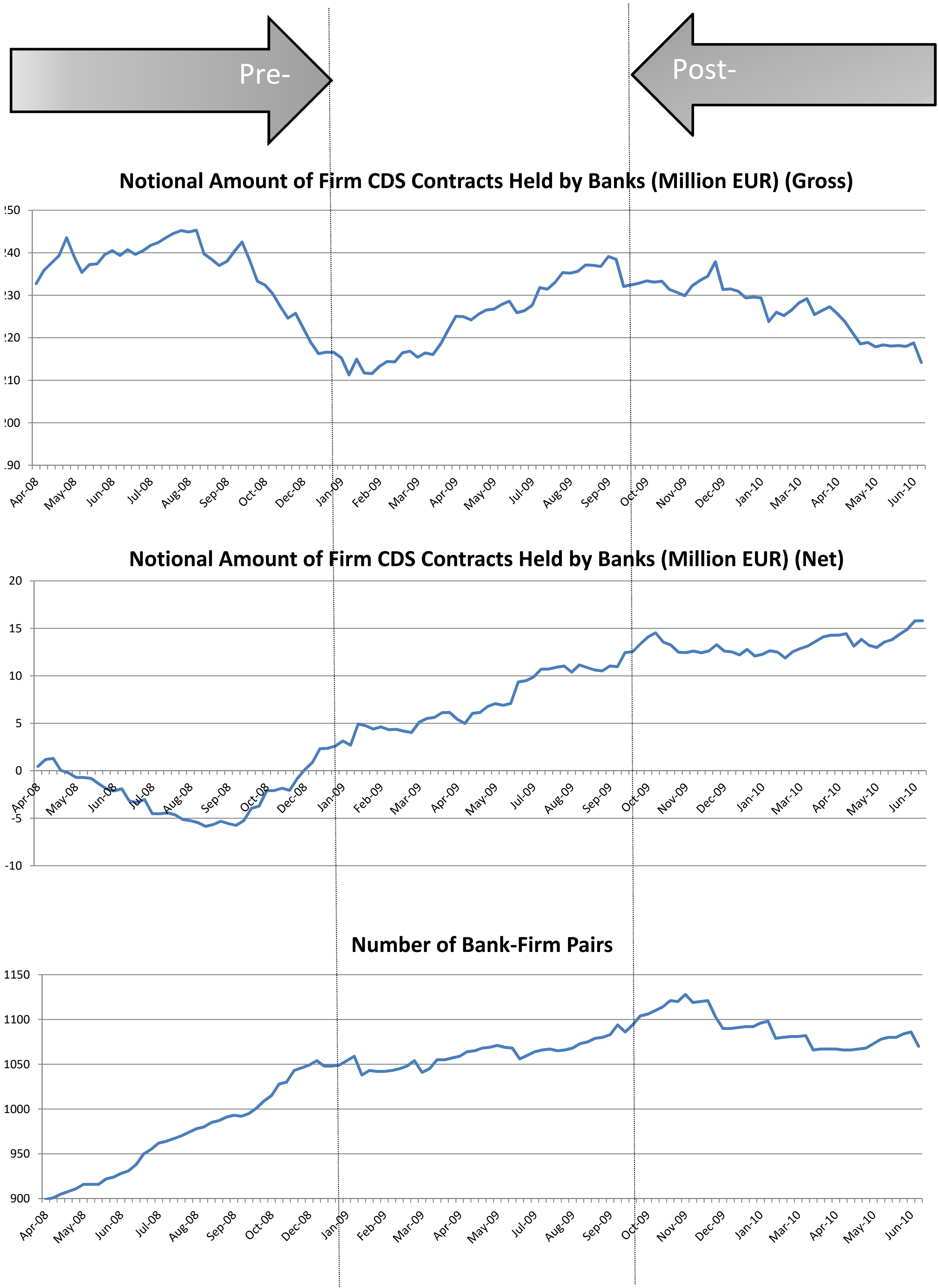


Figure 2
CDS trading before and after the Small Bang in Europe.

The figure presents the Notional Amount of Firm CDS Contracts Held by Banks both in gross and net values and the number of bank-firm pairs involved in CDS trading before and after the Small Bang. "Pre" refers to the period before January 1, 2009 and “Post” refers to the period after September 30, 2009.

Table 1
Panel A
Summary statistics- Pre and Post

	Pre	Post	Post - Pre	P-value
CDS trading				
Number of Firm CDS Contracts Held by the Bank (Gross)	17.93	22.07	4.14***	0.00
Number of Firm CDS Contracts Held by the Bank (Net)	-0.09	0.28	0.38***	0.00
Notional Amount of Firm CDS Contracts Held by the Bank (Million EUR) (Gross)	62.11	66.95	4.84***	0.00
Notional Amount of Firm CDS Contracts Held by the Bank (Million EUR) (Net)	-0.64	3.93	4.57***	0.00
Average Number of Banks with CDS Contracts	14	17	3	
Average Number of Firms with CDS Contracts	172	187	15	
Average Number of Bank-Firm Pairs with CDS Contracts	973	1,090	117	
Credit exposure				
Average Bank-Firm Credit Exposure (Million EUR)	11.63	8.20	-3.43***	0.00

Notes. The table reports the summary statistics of CDS contracts and bank-firm credit exposures in "Pre"and "Post"periods and the two group mean comparison test between these periods. The Average Number of Bank-Firm Pairs with CDS Contracts is the number of active bank-firm pairs where the bank hold CDS contracts of the firm in the respective period. In the ensuing regressions we will backfill all the potential bank-firm combinations (see text for details).

Table 1
Panel B
Variable names, definitions and summary statistics

Variable Name	Definition	Unit	Type	Periods	Mean	Standard Deviation	Min	Max
Change in the Number of Firm CDS Contracts Held by the Bank	The difference in the number of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period)	-	Gross	Post - Pre	4.14	30.47	-379.15	885.62
				Post - Mid	2.72	15.55	-62.33	386.41
				Mid - Pre	1.41	20.73	-369.03	523.05
			Net	Post - Pre	0.38	4.72	-63.64	65.90
				Post - Mid	0.14	3.20	-40.56	42.82
				Mid - Pre	0.24	3.42	-42.56	59.00
Change in the Notional Amount of Firm CDS Contracts Held by the Bank	The difference in the notional amount of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period)	Million EUR	Gross	Post - Pre	4.84	102.50	-1,482.69	2,870.96
				Post - Mid	2.40	48.46	-425.45	1,429.77
				Mid - Pre	2.44	71.35	-1,161.36	1,849.41
			Net	Post - Pre	4.57	32.33	-555.62	548.93
				Post - Mid	1.84	22.66	-330.64	326.14
				Mid - Pre	2.74	23.21	-257.69	413.76
Change in Bank-Firm Exposure	The difference in the amount of credit exposure the bank has to the firm between the indicated periods (averaged across the three quarters in the period)	Million EUR	-	Post - Pre	-3.43	47.64	-2,038.56	901.58
				Post - Mid	-2.80	27.02	-703.17	348.08
				Mid - Pre	-0.63	50.75	-2,038.56	1,604.75
Bank - Firm Exposure (Before)	The amount of credit exposure the bank has to the firm in 2008Q1	Million EUR			9.92	59.39	0.00	1,353.01
Firm CDS Price (Before)	The premium paid for a CDS contract on the firm at the end of 2008Q1	Percent			1.75	1.65	0.03	10.75
Firm CDS Price (Pre-)	The premium paid for a CDS contract on the firm at the end of 2008Q4	Percent			4.84	6.42	0.32	43.42
Hedging Activity Dummy (Pre-)	A dummy equal to one if the ratio of net notional amount of CDS on a firm held by a bank to the credit exposure the bank has to the firm is between 0.5 and 2 at the end of 2008Q4, and zero in all other cases.	0/1			0.01	0.11	0	1

Notes. The table reports the variable names, definitions and summary statistics of all dependent and independent variables. The number of observations is 3,693. Max and Min of Bank - Firm Exposure (Before) are the average of the three highest and lowest exposures.

Table 2
The change in the number of firm CDS contracts held by banks around the Small Bang

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: Change in the Number of Firm CDS Contracts Held by the Bank	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Net*	*Net*	*Net*	*Net*	*Net*	*Net*
Period	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*
Bank - Firm Exposure (Before)		0.061	0.008	0.015	0.007	0.008		0.007	-0.001	-0.001	0.000	-0.001
		(0.045)	(0.023)	(0.025)	(0.014)	(0.012)		(0.005)	(0.003)	(0.002)	(0.002)	(0.002)
Firm CDS Price (Before)			-1.165						-0.153*			
			(0.882)						(0.076)			
Bank - Firm Exposure (Before) * Firm CDS Price (Before)			0.049**	0.038***	0.018***	0.020***			0.007***	0.007***	0.005***	0.003**
			(0.018)	(0.012)	(0.006)	(0.007)			(0.002)	(0.003)	(0.001)	(0.001)
Constant	4.136**	3.529**	5.859*				0.376*	0.304*	0.616**			
	(1.944)	(1.631)	(3.048)				(0.181)	(0.165)	(0.276)			
Bank Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
R-Squared	0.000	0.014	0.033	0.198	0.344	0.136	0.000	0.008	0.020	0.102	0.076	0.095
Number of Observations	3,693	3,693	2,998	2,998	2,998	2,998	3,693	3,693	2,998	2,998	2,998	2,998

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in the Number of Firm CDS Contracts Held by the Bank which is the difference in the number of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). Bank - Firm Exposure (Before) is the amount of credit exposure the bank has to the firm in 2008Q1. The Firm CDS Price (Before) is the premium paid for a CDS contract on the firm at the end of 2008Q1. Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 3

The change in the notional amount of firm CDS contracts held by banks around the Small Bang

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: Change in the Notional Amount of Firm CDS Contracts Held by the Bank	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Net*	*Net*	*Net*	*Net*	*Net*	*Net*
Period	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*
Bank - Firm Exposure (Before)		0.165	0.044	0.049	0.033	0.016		0.050	0.003	0.001	-0.004	0.005
		(0.147)	(0.096)	(0.098)	(0.071)	(0.032)		(0.033)	(0.026)	(0.023)	(0.007)	(0.018)
Firm CDS Price (Before)			-3.035						-0.996***			
			(2.198)						(0.323)			
Bank - Firm Exposure (Before) * Firm CDS Price (Before)			0.114**	0.116**	0.067***	0.049**			0.043***	0.031***	0.033***	-0.002
			(0.047)	(0.041)	(0.022)	(0.021)			(0.010)	(0.010)	(0.007)	(0.010)
Constant	4.840	3.201	7.725*				4.571***	4.070**	6.551***			
	(3.563)	(4.329)	(4.415)				(1.502)	(1.445)	(2.235)			
Bank Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
R-Squared	0.000	0.009	0.138	0.198	0.125	0.152	0.000	0.009	0.018	0.106	0.096	0.097
Number of Observations	3,693	3,693	2,998	2,998	2,998	2,998	3,693	3,693	2,998	2,998	2,998	2,998

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in the Notional Amount of Firm CDS Contracts Held by the Bank which is the difference in the notional amount of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). Bank - Firm Exposure (Before) is the amount of credit exposure the bank has to the firm in 2008Q1. The Firm CDS Price (Before) is the premium paid for a CDS contract on the firm at the end of 2008Q1. Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 4
The change in bank - firm exposure from mid- to post-Small Bang explained by gross CDS contracts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable: *Change in Bank-Firm Exposure from Mid- to Post-Small Bang*							
Independent Variable: Change in Firm CDS Contracts Held by the Bank from Mid- to Post-	-	***Number***	***Number***	***Number***	***Notional Amount***	***Notional Amount***	***Notional Amount***
	-	***Gross***	***Gross***	***Gross***	***Gross***	***Gross***	***Gross***
Change in Firm CDS Contracts Held by the Bank from Mid- to Post-		-0.134***	0.055	0.036	-0.043***	0.033*	0.033
		(0.031)	(0.038)	(0.036)	(0.012)	(0.018)	(0.021)
Firm CDS Price (Pre-)			-0.162*			-0.228**	
			(0.088)			(0.087)	
Change in Firm CDS Contracts Held by the Bank from Mid- to Post- * Firm CDS Price (Pre-)			-0.029***	-0.025***		-0.011***	-0.010***
			(0.008)	(0.007)		(0.001)	(0.001)
Constant	-2.796***	-2.796***	-2.112**		-2.693***	-1.997**	
	(0.808)	(0.000)	(0.772)		(0.811)	(0.732)	
Bank Fixed Effects	No	No	No	Yes	No	No	Yes
Firm Fixed Effects	No	No	No	Yes	No	No	Yes
R-Squared	0.000	0.006	0.022	0.175	0.006	0.026	0.181
Number of Observations	3,693	3,693	3,002	3,002	3,693	3,002	3,002

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in Bank-Firm Exposure from Mid- to Post-Small Bang which is the difference in the amount of credit exposure the bank has to the firm from mid- to post- (averaged across the three quarters in the period). The Change in Firm CDS Contracts Held by the Bank which is the difference in the number or notional amount of CDS contracts on each individual firm held by each individual bank from mid- to post- (averaged across the three quarters in the period). The Firm CDS Price (Pre-) is the premium paid for a CDS contract in the pre- period (averaged across the three quarters in the period). Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 5

The change in bank - firm exposure from mid- to post-Small Bang explained by net CDS contracts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: *Change in Bank-Firm Exposure from Mid- to Post-Small Bang*								
Independent Variable: Change in Firm CDS Contracts Held by the Bank from Mid- to Post-	***Number***	***Number***	***Number***	***Number***	***Notional Amount***	***Notional Amount***	***Notional Amount***	***Notional Amount***
	Net	***Net***	***Net***	***Net***	***Net***	***Net***	***Net***	***Net***
Change in Firm CDS Contracts Held by the Bank from Mid- to Post-	-0.692	-0.393	-0.339	-2.169	-0.119	-0.014	0.016	-0.059
	(0.565)	(0.540)	(0.431)	(2.374)	(0.071)	(0.051)	(0.050)	(0.102)
Firm CDS Price (Pre-)		-0.285***				-0.317***		
		(0.089)				(0.100)		
Change in Firm CDS Contracts Held by the Bank from Mid- to Post- * Firm CDS Price (Pre-)		-0.050***	-0.051***	-0.047		-0.025***	-0.025***	-0.020**
		(0.009)	(0.010)	(0.066)		(0.006)	(0.004)	(0.009)
Constant	-2.698***	-1.743**			-2.578***	-1.496*		
	(0.777)	(0.723)			(0.770)	(0.732)		
Instruments (Level of Firm CDS (Net) Held by the Bank at End of Pre-Small Bang)	No	No	No	Yes	No	No	No	Yes
Bank Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Firm Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
R-Squared	0.007	0.013	0.170	0.122	0.010	0.029	0.181	0.179
Number of Observations	3,693	3,002	3,002	3,002	3,693	3,002	3,002	3,002

Notes. The table reports estimates from ordinary least squares regressions and IV regressions. The dependent variable is the Change in Bank-Firm Exposure from Mid- to Post-Small Bang which is the difference in the amount of credit exposure the bank has to the firm from mid- to post- (averaged across the three quarters in the period). The Change in Firm CDS Contracts Held by the Bank which is the difference in the number or notional amount of CDS contracts on each individual firm held by each individual bank from mid- to post- (averaged across the three quarters in the period). The Firm CDS Price (Pre-) is the premium paid for a CDS contract in the pre- period (averaged across the three quarters in the period). Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects or instrument is included. "No" indicates that the set of fixed effects or instrument is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 6
The change in bank - firm exposure from pre- to post- and from pre- to mid- the Small Bang

	(1)	(2)	(3)	(4)
Dependent Variable: *Change in Bank-Firm Exposure*				
Timing on Dependent and on CDS Contracts Variables	*Post - Pre*	*Post - Pre*	*Mid - Pre*	*Mid - Pre*
Independent Variable: Change in the Number of CDS Contracts Held by the Bank	***Gross***	***Net***	***Gross***	***Net***
Change in the Number of Firm CDS Contracts Held by the Bank	0.055***	0.148	0.062***	0.529*
	(0.016)	(0.137)	(0.015)	(0.280)
Change in the Number of Firm CDS Contracts Held by the Bank * Firm CDS Price (Pre-)	-0.029***	-0.119***	-0.015***	-0.143***
	(0.004)	(0.011)	(0.002)	(0.016)
Bank Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
R-Squared	0.110	0.091	0.075	0.075
Number of Observations	3,002	3,002	3,002	3,002

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in Bank-Firm Exposure between the indicated periods which is the difference in the amount of credit exposure the bank has to the firm between the indicated periods (averaged across the three quarters in the period). The Change in the Number of Firm CDS Contracts Held by the Bank which is the difference in the number of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). The Firm CDS Price (Pre-) is the premium paid for a CDS contract in the pre- period (averaged across the three quarters in the period). Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 7

The change in bank - firm exposure from mid- to post-Small Bang explained by net CDS contracts and hedging activity

	(1)	(2)	(3)	(4)
Dependent Variable: *Change in Bank-Firm Exposure from Mid- to Post-Small Bang*				
Independent Variable: Change in Firm CDS Contracts Held by the Bank from Mid- to Post-	***Number***	***Number***	***Notional Amount***	***Notional Amount***
	Net	***Net***	***Net***	***Net***
Change in Firm CDS Contracts Held by the Bank from Mid- to Post-	-0.378	-0.314	-0.021	0.016
	(0.555)	(0.434)	(0.057)	(0.052)
Firm CDS Price (Pre-)	-0.293***		-0.322***	
	(0.094)		(0.106)	
Change in Firm CDS Contracts Held by the Bank from Mid- to Post- * Firm CDS Price (Pre-)	-0.054***	-0.055***	-0.025***	-0.026***
	(0.010)	(0.009)	(0.007)	(0.004)
Hedging Activity Dummy (Pre-)	-16.364**	-13.676**	-16.649*	-14.946**
	(7.310)	(5.597)	(8.444)	(6.705)
Change in Firm CDS Contracts Held by the Bank from Mid- to Post- * Hedging Activity Dummy (Pre-)	-1.541	-1.738***	-0.011	-0.179
	(0.998)	(0.603)	(0.112)	(0.110)
Firm CDS Price (Pre-) * Hedging Activity Dummy (Pre-)	0.379	0.729	0.652	0.984
	(0.627)	(0.506)	(0.825)	(0.614)
Change in Firm CDS Contracts Held by the Bank from Mid- to Post- * Firm CDS Price (Pre-) * Hedging Activity Dummy (Pre-)	0.287**	0.267***	0.046***	0.048***
	(0.106)	(0.074)	(0.016)	(0.014)
Constant	-1.515**		-1.241	
	(0.703)		(0.730)	
Bank Fixed Effects	No	Yes	No	Yes
Firm Fixed Effects	No	Yes	No	Yes
R-Squared	0.018	0.173	0.035	0.184
Number of Observations	3,002	3,002	3,002	3,002

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in Bank-Firm Exposure from Mid- to Post-Small Bang which is the difference in the amount of credit exposure the bank has to the firm from mid- to post- (averaged across the three quarters in the period). The Change in Firm CDS Contracts Held by the Bank is the difference in the number or notional amount of CDS contracts on each individual firm held by each individual bank from mid- to post- (averaged across the three quarters in the period). Hedging Activity Dummy (Pre-) is a dummy which equals to one if the ratio of net notional amount of CDS contracts held by a bank on a firm in the pre- period (end of pre- period) to the same period bank-firm level credit exposure is between 0.5 and 2, and zero in other cases. The Firm CDS Price (Pre-) is the premium paid for a CDS contract in the pre- period (end of pre- period). Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A1
Panel VAR model of firm CDS contract held by bank and bank-firm credit exposure

	(1)		(2)		(3)		(4)	
Dependent Variable:	*CDS*	*Exposure*	*CDS*	*Exposure*	*CDS*	*Exposure*	*CDS*	*Exposure*
Firm CDS Contracts held by bank of independent variable and dependent variable:	*Number Gross*		*Notional Amount Gross*		*Number Net*		*Notional Amount Net*	
Firm CDS Contracts Held by the Bank (t-1)	-0.269	0.070	1.057***	0.017	0.819***	-0.436	0.864***	-0.015
	(1.858)	(0.459)	(0.296)	(0.029)	(0.062)	(0.314)	(0.030)	(0.041)
Firm CDS Contracts Held by the Bank (t-2)	-0.176***	-0.068***	-0.113**	-0.020***	0.037**	-0.416**	0.022	-0.037
	(0.031)	(0.011)	(0.048)	(0.004)	(0.016)	(0.188)	(0.054)	(0.029)
Bank-Firm Exposure (t-1)	-0.074	0.813***	0.005	0.812***	-0.001	0.805***	0.004	0.809***
	(0.063)	(0.059)	(0.051)	(0.052)	(0.002)	(0.049)	(0.008)	(0.050)
Bank-Firm Exposure (t-2)	-0.011	0.026	-0.018	0.026	-0.001	0.028	-0.014	0.029
	(0.012)	(0.038)	(0.023)	(0.038)	(0.001)	(0.037)	(0.012)	(0.038)
Firm CDS Price (t-1)	-0.159	-0.014	0.614*	-0.013	-0.015	-0.013	0.087	-0.032
	(0.393)	(0.124)	(0.327)	(0.068)	(0.025)	(0.072)	(0.135)	(0.070)
VIX	1.906	1.361	-5.040*	1.355***	0.053	1.508***	-0.600	1.464***
	(3.269)	(0.942)	(2.639)	(0.390)	(0.098)	(0.390)	(0.522)	(0.388)
Euribor-OIS spread (3 month)	-38.805	-21.134	87.109*	-21.108***	-1.060	-23.968***	9.634	-23.108***
	(61.493)	(18.107)	(45.575)	(6.356)	(1.729)	(6.311)	(8.653)	(6.184)
Number of Observations	21,611	21,611	21,611	21,611	21,611	21,611	21,611	21,611
p-value of Granger causality test: Exposure causes CDS	0.266		0.544		0.406		0.487	
p-value of Granger causality test: CDS causes Exposure	0.000		0.000		0.049		0.430	

Notes. This table reports estimates from panel VAR model. CDS is the number or notional amount of the CDS contracts on each individual firm held by each individual bank in the end of quarter t. Exposure is the amount of credit exposure the bank has to the firm in the end of quarter t. Both these two variables are assumed to be endogenous in the model and each variable is explained by its own lags and the lags of the other variable in the two-equation system. The Firm CDS Price (t-1) is the premium paid for a CDS contract on the firm at the end of quarter t-1. VIX is the quarter end vix index and Euribor-OIS spread (3 month) is the spread between the rate at which European banks lend to each other (Euribor) and the overnight 'risk free' swap rate among the same banks of 3 month peiod. In the end of the table we also display the p-value of the Granger causality test of the corresponding model. Table 1 contains all definitions and the summary statistics for each included variable. Figure 1 displays the timing of all periods. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A2
The change in the number of firm CDS contracts held by banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: Change in the Number of Firm CDS Contracts Held by the Bank	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Net*	*Net*	*Net*	*Net*	*Net*	*Net*
From Indicated Period to Indicated Period	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2011Q1-2011Q3 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q1-2011Q3*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2011Q1-2011Q3 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q1-2011Q3*
Placebo Period	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*
Bank - Firm Exposure (2010Q1)		-0.149	-0.214	-0.042	-0.021	-0.021		-0.042*	-0.060	-0.065	-0.039	-0.026
		(0.134)	(0.171)	(0.056)	(0.025)	(0.044)		(0.023)	(0.042)	(0.049)	(0.064)	(0.025)
Firm CDS Price (2010Q1)			3.552						0.154			
			(2.434)						(0.227)			
Bank - Firm Exposure (2010Q1) * Firm CDS Price (2010Q1)			0.020	0.031	0.022	0.009			0.006	0.015	-0.002	0.018*
			(0.068)	(0.050)	(0.026)	(0.028)			(0.018)	(0.023)	(0.021)	(0.009)
Constant	-9.926	-8.875	-19.186				-0.430	-0.137	-0.783			
	(7.933)	(6.999)	(12.234)				(1.207)	(1.234)	(1.532)			
Bank Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
R-Squared	0.000	0.004	0.010	0.336	0.172	0.388	0.000	0.004	0.005	0.076	0.068	0.133
Number of Observations	4,305	4,305	3,385	3,385	3,385	3,385	4,305	4,305	3,385	3,385	3,385	3,385

Notes. The table reports estimates from ordinary least squares regressions.The dependent variable is the Change in the Number of Firm CDS Contracts Held by the Bank which is the difference in the number of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). Bank - Firm Exposure (2010Q1) is the amount of credit exposure the bank has to the firm in 2010Q1. The Firm CDS Price (2010Q1) is the premium paid for a CDS contract on the firm at the end of 2010Q1. Table 1 contains all definitions and the summary statistics for each included variable. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A3

The change in the notional amount of firm CDS contracts held by banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: *Change in the Notional Amount of Firm CDS Contracts Held by the Bank*	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Gross*	*Net*	*Net*	*Net*	*Net*	*Net*	*Net*
From Indicated Period to Indicated Period	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2011Q1-2011Q3 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q1-2011Q3*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2011Q1-2011Q3 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q1-2011Q3*
Placebo Period	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Pre*	*Post - Mid*	*Mid - Pre*
Bank - Firm Exposure (2010Q1)		-0.044	-0.072	-0.028	-0.018	-0.009		-0.003	-0.006**	-0.002	-0.002	0.000
		(0.051)	(0.063)	(0.026)	(0.014)	(0.013)		(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
Firm CDS Price (2010Q1)			1.229						0.032			
			(0.968)						(0.070)			
Bank - Firm Exposure (2010Q1) * Firm CDS Price (2010Q1)			0.011	0.021	0.017	0.003			0.001	0.000	0.000	0.000
			(0.031)	(0.026)	(0.016)	(0.010)			(0.002)	(0.002)	(0.001)	(0.002)
Constant	-2.739	-2.427	-5.982				0.040	0.064	-0.038			
	(3.460)	(3.097)	(4.728)				(0.349)	(0.346)	(0.458)			
Bank Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
R-Squared	0.000	0.003	0.008	0.403	0.117	0.478	0.000	0.001	0.001	0.145	0.052	0.207
Number of Observations	4,305	4,305	3,385	3,385	3,385	3,385	4,305	4,305	3,385	3,385	3,385	3,385

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in the Notional Amount of Firm CDS Contracts Held by the Bank which is the difference in the notional amount of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). Bank - Firm Exposure (2010Q1) is the amount of credit exposure the bank has to the firm in 2010Q1. The Firm CDS Price (2010Q1) is the premium paid for a CDS contract on the firm at the end of 2010Q1. Table 1 contains all definitions and the summary statistics for each included variable. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A4

The change in bank - firm exposure from 2011Q1-2011Q3 to 2011Q4-2012Q2 (Placebo Mid- to Post-) explained by change in CDS contracts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Dependent Variable: *Change in Bank-Firm Exposure from 2011Q1-2011Q3 to 2011Q4-2012Q2*													
Independent Variable: ***Change in Firm CDS Contracts Held by Bank from 2011Q1-2011Q3 to 2011Q4 to 2012Q2 (Placebo Mid- to Post-)***	**-**	**Number**	**Number**	**Number**	**Number**	**Number**	**Number**	**Nominal Amount**	**Nominal Amount**	**Nominal Amount**	**Nominal Amount**	**Nominal Amount**	**Nominal Amount**
	-	**Gross**	**Gross**	**Gross**	**Net**	**Net**	**Net**	**Gross**	**Gross**	**Gross**	**Net**	**Net**	**Net**
Change in Firm CDS Contracts Held by the Bank		0.046***	0.039	0.026	-0.044	0.102	0.124	0.020*	0.012	0.011	0.024	0.055	0.051
		(0.016)	(0.076)	(0.073)	(0.104)	(0.225)	(0.231)	(0.010)	(0.021)	(0.020)	(0.046)	(0.071)	(0.067)
Firm CDS Price (2010Q4)			0.030			0.078			0.075			0.086	
			(0.112)			(0.124)			(0.119)			(0.133)	
Change in Firm CDS Contracts Held by the Bank* Firm CDS Price (2010Q4)			0.038**	0.036**		-0.078	-0.087		0.019***	0.017***		-0.019	-0.021
			(0.015)	(0.017)		(0.052)	(0.056)		(0.003)	(0.004)		(0.013)	(0.013)
Constant	-0.705**	-0.706***	-0.869**		-0.711***	-1.007**		-0.673**	-0.849**		-0.676***	-0.956**	
	(0.247)	(0.246)	(0.413)		(0.243)	(0.442)		(0.237)	(0.401)		(0.221)	(0.417)	
Bank Fixed Effects	No	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Firm Fixed Effects	No	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
R-Squared	0.000	0.004	0.010	0.119	0.000	0.001	0.112	0.005	0.013	0.120	0.002	0.004	0.114
Number of Observations	4,305	4,305	3,305	3,305	4,305	3,305	3,305	4,305	3,305	3,305	4,305	3,305	3,305

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in Bank-Firm Exposure from 2011Q1-2011Q3 to 2011Q4-2012Q2 (Placebo Mid- to Post-) which is the difference in the amount of credit exposure the bank has to the firm from 2011Q1-2011Q3 to 2011Q4-2012Q2 (placebo mid- to post-. averaged across the three quarters in the period). The Change in Firm CDS Contracts Held by the Bank which is the difference in the number or notional amount of CDS contracts on each individual firm held by each individual bank from 2011Q1-2011Q3 to 2011Q4-2012Q2 (the placebo mid- to post-, averaged across the three quarters in the period). The Firm CDS Price (2010Q4) is the premium paid for a CDS contract at the end of 2010Q4. Table 1 contains all definitions and the summary statistics for each included variable. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A5

The change in bank - firm exposure from 2010Q2-2010Q4 to 2011Q4-2012Q2 (Placebo Post - Pre) and from 2010Q2-2010Q4 to 2011Q1-2011Q3 (Placebo Mid - Pre)

	(1)	(2)	(3)	(4)
Dependent Variable: *Change in Bank-Firm Exposure*				
Timing of Dependent Variable and of CDS Contracts variables	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q4-2012Q2*	*2010Q2-2010Q4 to 2011Q1-2011Q3*	*2010Q2-2010Q4 to 2011Q1-2011Q3*
Placebo Period	*Post - Pre*	*Post - Pre*	*Mid - Pre*	*Mid - Pre*
Independent Variable: Change in the Number of CDS Contracts Held by the Bank	***Gross***	***Net***	***Gross***	***Net***
Change in the Number of Firm CDS Contracts Held by the Bank	0.028	-0.014	0.039***	-0.071
	(0.022)	(0.033)	(0.012)	(0.121)
Change in the Number of Firm CDS Contracts Held by the Bank * Firm CDS Price (2010Q4)	0.005	-0.008	-0.003	0.001
	(0.004)	(0.021)	(0.003)	(0.020)
Bank Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
R-Squared	0.164	0.156	0.163	0.155
Number of Observations	3,305	3,305	3,305	3,305

Notes. The table reports estimates from ordinary least squares regressions. The dependent variable is the Change in Bank-Firm Exposure between the indicated periods which is the difference in the amount of credit exposure the bank has to the firm between the indicated periods (averaged across the three quarters in the period). The Change in the Number of Firm CDS Contracts Held by the Bank which is the difference in the number of CDS contracts on each individual firm held by each individual bank between the indicated periods (averaged across the three quarters in the period). The Firm CDS Price (2010Q4) is the premium paid for a CDS contract at the end of 2010Q4. Table 1 contains all definitions and the summary statistics for each included variable. Coefficients are listed in the first row, robust standard errors which are clustered at bank level are reported in the row below, and the corresponding significance levels are placed adjacently. "Yes" indicates that the set of fixed effects is included. "No" indicates that the set of fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.