Banks' Use of Credit Derivatives and the Pricing of Loans: What Is the Channel and Does It Persist Under Adverse Economic Conditions?*

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Abstract

This paper studies whether active use of credit derivatives by banks has an impact on the loan spreads they charge to their corporate borrowers, and if so, through which channel(s) this occurs. We find that a bank's *gross* position in credit derivatives is associated with significantly lower loan spreads, while the bank's *net* position is not related to loan spreads. We argue that this is consistent with banks passing on risk management benefits to their corporate borrowers, but not with other channels through which credit derivatives may affect loan pricing. We also find that the risk management benefits extend to borrowers unlikely to be traded in the credit derivative markets (although to a smaller extent). The evidence further suggests that risk management remains effective throughout the crisis of 2007-2009 since i) the benefit of borrowing at lower spreads from credit-derivative active banks does not fall during the crisis, ii) active banks have persistently lower loan charge-offs, iii) active banks cut lending by less than other banks during the crisis. Taken together the evidence indicates significant risk management benefits from financial innovations that persist under adverse conditions – that is, when they matter most.

Key words: Financial innovations, credit derivatives, syndicated loans, loan pricing, financial crisis

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"*Credit derivatives [have] contributed to the stability of the banking system by allowing banks . . . to measure and manage their credit risks more effectively. . . .*"

Alan Greenspan, 2005

"*The boom in subprime mortgage lending was only a part of a much broader credit boom characterized by ... the creation of complex and opaque financial instruments that proved fragile under stress.*"

Ben Bernanke, 2008

1 Introduction

Financial innovations are at the centre of an intense debate on how to shape the future global financial system. The dominant view prior to the crisis of 2007-2009 was that financial innovations are beneficial for the financial system. The experience of the crisis has led to an – at least partial – reassessment of this view. Some policy makers have even adopted the opinion that the use of financial innovations needs to be restricted or prohibited. There is also an emerging concern that financial innovations, while beneficial under normal economic conditions, may amplify shocks in times of crises. Whether this is the case is likely to depend on how these innovations will be used in the financial system. If, for example, the innovations are employed by financial institutions to improve risk measurement and risk control, they may serve to insulate them against negative shocks. However, the use of financial innovations may also encourage risk-taking at institutions and make institutions dependent on their continued availability. This may result in greater vulnerability in times of stress. Despite the importance of this issue, there is relatively little evidence on the channels through which financial innovations affect financial institutions and how this impacts institutions in adverse circumstances.

This paper examines whether, and through which channel, the active use of *credit derivatives* influences bank behavior in the lending market, and how this channel is affected by the crisis of 2007-2009. Credit derivatives are probably the most significant financial innovation of the recent decade and banks are major players in credit derivative markets. Unlike traditional debt instruments (such as bonds and loans), it is relatively easy to hedge or source credit risk (on a single borrower or a pool of borrowers) using credit derivatives. The most prominent instrument is the credit default swap (CDS). A CDS is a contract under which a protection buyer makes periodic payments to a protection seller in exchange for protection against the default of a reference entity. The market for credit derivatives has grown dramatically during the last decade. The outstanding amount at the peak of the market in 2007 was estimated at $60 trillion by the ISDA. Notional amounts remained very high after the onset of the crisis but following the failure of Lehman Brothers declined to $41 trillion at the end of 2008 and to $31 trillion in June 2010. However, in contrast to other credit markets the CDS market did not break down during the crisis.

Studies that examined banks' use of financial innovations show that under normal economic conditions these instruments facilitate credit extension and result in more favorable lending conditions for borrowers. In particular, there is evidence that loan sales (Cebenoyan and Strahan (2004)), Collateralized Debt Obligations (Franke and Krahnen (2005)) and Collateralized Loan Obligations (Goderis et al. (2006)) lead to an increase in lending at banks. Lower borrowing costs are observed for loans intended for subsequent sale (Guener (2006)) or securitization (Nadauld and Weisbach (2010)). Hirtle (2009) finds that there is a positive link between a bank's net position in credit derivatives and loan spreads. In contrast, Ashcraft and Santos (2009) document that firms face higher loan spreads after they start being traded in the CDS market. They argue that this effect is driven by reduced incentives for banks to monitor firms.

In this paper we consider credit derivative use at U.S. banks and their impact on the pricing of syndicated loans – as well as on the characteristics of lending at these banks in general. Our analysis is based on loan-level information from the LPC DealScan database and bank-level information from the Call Reports. We consider four different channels through which credit derivative use affects loan pricing. Briefly, these derivatives may provide benefits that can be passed on to borrowers if banks use them to hedge credit risk, to reduce economic or regulatory capital, or to manage credit risk. Credit derivatives can also increase borrower risk (and result in higher spreads) if the transfer of risk leads to incentive problems at banks. We derive hypotheses about these channels that allow us identifying them in the data. The key prediction turns out to be that risk management does not require a bank to take a net position in credit derivatives For example, banks can reduce concentrated exposures by buying protection but at the same time source credit risks on underrepresented (or absent) exposures by selling protection. All other channels operate through banks purchasing protection only.

Our principal result is that, after controlling for lender, loan and bank characteristics, banks' gross positions in credit derivatives are negatively and significantly related to the (loan) spread they charge to the average corporate borrower. By contrast, net positions do not display any association with loan spreads. This result provides support for the risk management channel but is inconsistent with the other channels through which credit derivatives may affect loan pricing. The effect is very robust; in particular it survives when we control for the use of other derivatives and take into account various endogeneity concerns. The effect is larger for borrowers that are more likely to be actively traded in credit derivatives markets – as to expected. The largest effect obtains for firms that are rated investment-grade: the estimates imply that a one-standard deviation increase in the banks' gross credit derivative position lowers their loan spread by 17% (44 bps). We also find that the risk management benefits extend to firms that are unlikely to be traded in the credit derivative market: their spread falls by 4% (10 bps).[1] Significant risk management benefits are thus passed on to the entire portfolio of borrowers and not only the borrowers that can be easily traded. This suggests that risk management reduces a bank's overall (marginal) cost of risk-taking. It may also reflect pseudo-hedging – the practice at banks to hedge non-traded exposures using correlated traded exposures.

We also analyze loan pricing during the crisis of 2007-2009. If banks use credit derivatives to properly manage risks, we would expect their pricing advantage relative to other banks not be eroded during the crisis. We find that loan spreads increased for all banks during the crisis consistent with the fact that the crisis was driven by systemic factors that cannot be diversified using credit derivatives. However, consistent with effective risk management we find that banks active in credit derivatives still charge spreads that are lower than at other banks – in fact, the spread difference is very similar to the one before the crisis. We further investigate the effects of credit derivative use on the characteristics of lending at the bank level. Active risk management suggests that banks are less likely to face constraints under adverse conditions (Froot, Scharfstein and Stein (1993)). Consistent with this argument we find that active banks cut lending back by significantly less than other banks. Active banks also do not seem be more aggressive as their pre-crisis lending levels are comparable to other banks. There is thus no evidence for increased risk-taking. Furthermore, we expect banks that actively manage their credit risks to have lower loan risks and not to suffer more from the financial crisis than other banks. Accordingly, we find that banks with a larger gross credit derivative position have lower charge-offs than other banks and that this difference is not eroded (even partially) during the crisis. This finding parallels our loan pricing results.[2]

Taken together the analysis provides consistent and robust evidence that banks use

[1] The implied annual savings per loan are in excess of $142.000.

[2] We also find that over the entire sample period the volatility of the average loan spreads charged by the group of active banks is almost one half less than the spread volatility of the other banks. This further speaks to risk management benefits.

credit derivatives to improve their management of credit risks.[3] There is no evidence in support of other channels through which credit derivatives may affect loan spreads. Corporate borrowers benefit from risk management through lower spreads and these benefits do not seem to be limited to the borrowers whose risks can be directly managed using the derivatives. Our results also show that the benefits extend to the crisis period – not only through more favorable lending conditions but also through a more stable supply of credit. All in all, our results contain a positive message for benefits of this type of financial innovation – even in circumstances where the markets for innovations were under great stress.

The remainder of the paper is organized as follows. Section 2 develops a set of hypotheses that allows identifying the channel through which credit derivatives might affect corporate loan spreads. Section 3 describes the data. Section 4 explains the empirical strategy and presents the results. Section 5 concludes.

2 Hypotheses

Academics and practitioners have suggested different channels through which credit derivatives (and risk transfer activities in general) can affect bank lending. In this section we briefly summarize the key channels. We also explain our approach for how to identify the channels empirically.

Credit derivatives allow banks to transfer risk exposures to third parties, either by selling loans or by hedging exposures through the purchase of protection. This may reduce banks' incentives to screen and monitor borrowers (e.g., Morrison (2005)). We refer to this as the *Incentives Channel*. Ashcraft and Santos (2009) provide evidence for this channel. Ashcraft and Santos investigate the effect of a firm being traded in the CDS market on the spread it has to pay on its loans. They argue that once a firm is traded in the CDS market, banks can hedge their exposure to this firm. This may, in turn, lower banks' incentives to monitor. The firm's borrowing cost should then increase – as it becomes riskier. Consistent with this, Ashcraft and Santos find that informationally opaque firms, who benefit the most from bank monitoring, face higher spreads after the onset of trading in the CDS market.[4]

Credit derivatives may also affect bank lending through the *Risk Management Chan-*

[3] Our results on financial innovations complement recent evidence on the link between risk management, control and performance of US bank holding companies (Ellul and Yerramilli (2010)).

[4] Marsh (2006) finds that the announcement effect of a new bank loan is weakened when a bank actively uses securitization techniques to transfer of risk – consistent with reduced bank incentives.

nel. According to this channel credit derivatives allow banks to better manage the risk in their portfolios. They can buy protection on overrepresented exposures and sell protection on credits they have little exposure to. Banks can also use credit derivatives to keep the overall risk of their portfolio close to the target level. Among others, this provides benefits as it reduces the likelihood of financing constraints becoming binding (Froot, Scharfstein and Stein (1993)). Risk management benefits may also obtain indirectly: the use of credit derivatives may induce banks to more rigorously measure their credit risks. An increased awareness of risks may make banks more efficient in their lending behavior. Empirical research provides evidence that risk management benefits enables banks to extend larger loan volumes (Franke and Krahnen (2005) and Goderis et al. (2007)) or to pass on the benefits to their borrowers through lower spreads (see Cebenoyan and Strahan (2004) for loan sales). If this channel is operative, we would expect banks that are actively trading credit derivatives to reduce the interest rate charged to borrowers. Hirtle (2009) examines this hypothesis. Controlling for bank and loan characteristics, she finds that for large borrowers the net position of credit derivatives held by banks has a negative effect on loan spreads, and argues that this finding is consistent with banks managing credit risk.

There are two additional channels through which credit derivatives may influence loan pricing. Both channels suggest a negative effect on loan spreads. According to the *Hedging Channel* banks hedge their exposures by purchasing protection in derivatives markets, which enables them to source new risks. Nadauld and Weisbach (2011) study whether this channel has an impact on loan pricing. Nadauld and Weisbach examine the spreads of loans that are subsequently securitized. They find that loans that were later included in a CLO exhibit lower spreads when they are issued. Another channel, closely related to the hedging channel, is the *Capital Relief Channel*. This channel is based on the idea that bank lending is constrained by a lack of regulatory capital. Credit derivatives can be used to alleviate this constraint by buying protection from third parties, thus releasing capital for new lending. This allows banks to grant new loans and to price loans more aggressively. Broadly consistent with this channel, Loutskina and Strahan (2006) show that securitization diminishes the impact of bank financial condition on loan supply.

While most of the studies have focused on one channel, our paper considers these channels jointly and aims to identify the key channel(s) through which credit derivatives influence corporate loan spreads. It should be noted that the channels vary with their prediction regarding the impact on loan spreads (a spread reduction is suggested by the risk management, hedging and capital relief channel; a spread increase is consistent with the incentive channel). However, the key innovation in our paper that ultimately allows us to identify the dominant channel is that we separately consider the effect of the gross and the net credit derivative position on spreads. We argue that all channels except the risk management channel require the bank to take a net-position in the credit derivative market (that is, to buy protection). Under the hedging channel risk is only reduced if the bank sheds risk net, that is, buys more protection than it sells. Similarly, under a capital relief is only provided if the bank overall reduces its risk, again requiring the bank to take a net-position. Finally, the incentive channel also requires banks to buy protection – but not to sell. The only channel that can become operative without a net position is the risk management channel. For example, diversifying the portfolio by shedding risk on overrepresented borrowers and assuming risk on underrepresented exposures can be achieved without taking a net position. Improvement of the measurement of risks requires regular use of credit derivatives but not to take a net position. We thus argue that finding an association between gross positions and loan spreads supports the risk management channel. In addition, absence of a relationship between the net-position and the spread is evidence against the presence of each of the three other channels.

Table 1 summarizes the predictions of the various channels for loan spreads, and whether the relationship comes through the net or the gross position. Note that these predictions do not allow to distinguish between the hedging and the capital relief channel – but between all other channels.[5]

3 The data

Our analysis is based on individual loan transaction data from the LPC DealScan database and bank level data from the US Call Reports. From the first database we obtain information on loan characteristics of syndicated loans, such as loan spread over LIBOR, loan maturity, loan amount, currency, loan purpose and loan type. We also obtain borrower characteristics such as industry, sales, rating and stock market listing. We only consider completed term loan transactions. The database also provides information about the lead arrangers that are involved in the syndicate. We restrict ourselves to loans with a single lead arranger as in the case of multiple lead arrangers it is difficult to attribute credit derivative use of individual banks to the syndicate group. We match the lead arranger with bank-level data from the Call Reports. From the Call

[5] If needed these two channels could be identified by using the prediction that benefits under the capital relief channel should apply to all borrowers, while under the hedging channel they should predominantly arise for borrowers that are actively traded in the credit derivative markets.

Reports we obtain quarterly bank balance sheet and income statement information. We also collect information about banks' off-balance sheet activities from these reports. From these we construct our main variables of interest: the outstanding volume of credit derivatives purchased and sold by the bank in each quarter. The sample covers the period from the first quarter of 1997 (when reporting requirements for credit derivatives started) until the fourth quarter of 2009. The final sample comprises a total of 2,638 loan observations and 77 banks.

Table 2 reports summary statistics for our sample. The average (all-in) loan spread in our sample is 258.94 basis points and varies between 30 and 455 basis points. Our main variables of interest are banks' gross and net credit derivative positions. The gross position (the outstanding sum of protection bought and sold) is on average around 39% of total assets. The net position (the difference of outstanding sold and bought protection) is only 2% of assets on average (but varies widely between banks). Figure 1a and 1b depict the evolution of the quarterly averages of the gross and net credit derivatives positions over time[6]. It can be seen that, starting from the first quarter of 1997 the gross position held by banks increases over time. The net position fluctuates between -0.1% and 4% of assets. We can also see that starting from the end of 2005 banks increased their net purchase of protection, presumably in anticipation of a higher share of problem loans.

Figure 2 compares the loan spreads charged by banks that are active in credit derivatives markets with the ones of banks that are not. For this figure we consider a bank being "active" from the moment on it either purchases or sells protection for the first time. We can see that throughout the sample period active banks tend to charge lower spreads than passive banks.[7] The mean difference in the spread of active and passive banks is 23.77 bps and this difference is significant (t-statistic of 3.79). We also note that during the sample period there does not seem to be any trend in the spread differences among the group of banks. This is first evidence for credit derivatives use being associated with a persistently lower loan spread. In addition, the figure suggests that the spreads of the active banks are more stable over time compared to their passive counterparts, consistent with risk management effects.

[6] These figures exclude the Bank of America, which bought very large amounts of protection in 2005 and 2007.

[7] In the figure for some quarters averages for passive banks are missing since there were no loans originated by these banks.

4 Empirical method and results

4.1 The empirical strategy

We estimate a loan-spread model that controls for loan, borrower and bank characteristics. We proxy banks' credit derivative use with the gross and net positions of credit derivatives scaled by (total) assets. A significant negative relationship between the gross position and the loan spread supports the risk management channel. A negative significant coefficient on the net position would provide evidence for the hedging or capital relief channel, while a positive relationship would be consistent with credit derivatives leading to incentive problems. The various channels also lead us to expect that the impact of credit derivative use may depend on the borrower type and whether banks operate under adverse circumstances. In a second step we hence also study whether the loan-spread impact differs among borrowers and whether it changes during the crisis of 2007-2009.

In order to investigate whether credit derivative use has an effect on loans spreads we estimate the following model at the loan-level:

$$\begin{aligned} spread_{b,f,l,t} &= \alpha + \beta_1 bank_b + \beta_2 year_t + \beta_3 grossCD_{b,t} + \beta_4 netCD_{b,t} + \sum_{i=1}^{K} \phi_i F_{i,f,t} \\ &\quad + \sum_{i=1}^{K} \gamma_i L_{i,b,f,l,t} + \sum_{i=1}^{K} \delta_i B_{i,b,t} + \epsilon_{b,f,l,t}, \end{aligned} \quad (1)$$

where b denotes the bank, f the borrower (firm), l the loan and t time. In (1) *spread* is the loan spread, *bank* is a set of bank dummies and *year* is a set of time dummies. The term *grossCD* denotes the sum of credit protection sold and purchased by a bank and *netCD* is the difference between credit protection purchased and credit protection sold. The terms F_i denote borrower characteristics. These include dummies indicating the industry group of the borrower and the logarithm of the sales in US dollars. We expect firms with more sales to have lower spreads since large firms are more likely to have built a reputation and are less likely to suffer from problems of informational asymmetries. We also include dummies indicating whether the commercial paper of the borrower is rated (*rating*) and whether the borrower is listed on the stock market (*ticker*). We expect a negative association between the dummies for rating and stock market listing on one side, and the loan spread on the other side. This is because rated and public firms are likely to face lower informational asymmetries. Further we control for a set of dummies that indicate the S&P senior debt rating of the borrower (using BBB as the omitted category). Within the set of ratings, we expect higher rated firms to be charged lower spreads.

The terms L_i refer to loan characteristics. Following Harjoto (2006), these controls include two dummy variables that indicate whether the database denotes a loan as *secured* and whether it denotes a loan as *unsecured* (the omitted category are loans for which securitization information is missing). It is not clear what sign to expect for these dummies. Safe borrowers may use collateral to signal their type to the lender (Besanko and Thakor (1987) and Chan and Kanatas (1985)). If this is the case, secured loans should be associated with lower spreads. However, there is evidence suggesting that lenders require collateral for riskier borrowers, which would lead to higher spreads (Berger and Udell (1990) and Berger, Frame and Ioannidou (2011)). We also include among the controls the logarithm of the loan amount in US dollars ($log(amount)$). Again, the loan amount coefficient can be positive or negative. Larger and safer firms usually demand larger loans, hence we should expect lower spreads for such loans. However, larger loans have also a higher probability of default and may in addition result in overexposures in banks' credit portfolios, suggesting higher spreads. The next set of variables contains dummies for the loan maturity: *shortmaturity* for term loans with maturity of less than two years, *intermediatematurity* for term loans with maturity between two and five years, and *longmaturity* for term loans with a maturity exceeding five years. The expected sign on these dummies is ambiguous as well. There is some evidence of longer maturity loans being associated with higher spreads (Dennis, Nandy and Sharpe, (2000)) but other studies show that short maturity loans exhibit higher spreads (Strahan, (1999)). We further include a set of loan purpose dummies (*corporatepurposes*, *acquisitions*, *backupline*, and *debtrepayment*). Finally, we consider dummies for the tranche type. $TERM$ indicates terms loans without a tranche structure and $TERMA$, $TERMB$, $TERMC+$ indicate whether a loan is designated to tranche A, B, C or higher, respectively.

The terms B_i stand for bank characteristics. We include as a proxy for bank size the logarithm of assets. We expect this coefficient to be negative given that larger banks are expected to have a lower cost of funds due to better access to debt markets. We also include a measure of a bank's liquidity equal to cash plus securities over assets ($liquid\ Assets/TA$). We expect this coefficient to be negative as well, reflecting that liquid banks find it cheaper to fund loans. Further we include as additional controls the return on assets (ROA), the amount of charge-offs over assets ($chargeoff/TA$), subordinated debt over assets ($subdebt/TA$) and equity over assets ($equity/TA$).

4.2 Credit derivative use and loan spreads

Table 3 reports the results of regressions that relate loan spreads to banks' credit derivative positions. All regressions include borrower controls, loan controls and dummies for industry, loan purpose and year. Standard errors are clustered at the bank level. Regression 1 includes next to the gross and the net positions the bank controls. The coefficient of the gross position takes a negative value (-9.36) and is significant at the 1%-level. The coefficient of the net position is not significant. This result provides support for the risk management channel but not for the other channels. The magnitude of the effect for the gross position indicates economic significance. It implies that a one standard-deviation increase in the ratio of the gross position over (total) assets decreases loan spreads by about 9 basis points. Given a mean spread of 259 bps this implies spreads fall on average by 4%. The implied annual savings for borrowers are about $142.000 per loan as the average loan size is $158 mln in our sample. This is a considerable impact – in particular since this is the impact on the *average* borrower in the syndicated loan market (many of these borrowers will not be actively traded in the credit derivatives market).

Among the borrower controls, we can see that larger firms are charged lower spreads. The same is found for rated firms and firms which have a stock exchange listing. Various rating category dummies turn out to be significant as well (the insignificance of the other rating dummies is due to the fact that for these ratings there are only few observations). Among the significant rating categories, loan spreads are found to decline with the firm's S&P rating – as expected. Turning to the loan controls, we find that there is a negative and significant association between loan amount and loan spreads. This may reflect the tendency for large loans to be given to larger, established, firms. Secured loans have significantly higher, and unsecured loans have significantly lower, spreads. This is explained by banks more likely requiring collateral for lending to risky firms. Among the maturity variables, the long-term maturity dummy enters with a negative sign and is weakly significant (at the 10% level). Finally, all the loan tranche indicators are positive and significant. Since the omitted category is loans without a tranche structure, this indicates that tranched loans are more risky and consequently command higher spreads. From the bank controls only the charge-offs are significant. They enter with a positive sign. This result likely reflects that banks that have many problem loans in their book incur higher costs and pass these costs on to their borrowers.

Regression 2 includes bank fixed effects instead of bank controls. The coefficient on the gross position increases in absolute value to -10.93. The net position remains insignificant. The other coefficients in the model are mostly unchanged. We take this model to be our baseline model. There is the concern that the insignificance of the net position is driven by a potential multicollinearity between net and gross positions. However, the correlation among these variables is not very high (0.22). To be sure, regression 3 reports results where the gross position is excluded. The net position remains insignificant. The impact of the net position may conceivably also be depend on whether the net is positive or negative. We thus modify the baseline model by including separate terms for positive and negative net-positions (unreported). These terms are each insignificant and the gross position remains significant.

Some of the previous results suggest that loan characteristics might be jointly determined with the loan spreads. In regression 4 we follow the literature by estimating a model that excludes the loan controls. The coefficient of the gross position now increases in absolute value to -14.58. This surely reflects that some of the loan controls are correlated with credit derivative use at banks. However, the coefficient on the gross position remains significant and the one on the net position stays insignificant. The key result is thus robust to the exclusion of potentially endogenous loan controls.

A key concern at this stage is that banks also have means for risk management other than through credit derivatives. Use of these means is conceivably correlated with credit derivative use. The gross credit derivative position may hence also proxy for general sophistication in bank risk management. In this case, our estimated effects cannot (exclusively) be attributed to credit derivatives. To address this issue, regression 5 controls for the stock of other derivatives used for hedging (these derivatives include interest rate, foreign exchange, equity, and commodity derivatives). The coefficient on the gross position is essentially unchanged and the other derivatives turn out insignificant. We have also estimated a version of regression 5 where instead of including the sum of all other derivatives we include each derivative separately. The results for our variables of interest are essentially unchanged (not reported here). This result suggests that the risk management benefits indeed come through credit derivatives. Among the other derivatives all are insignificant except the commodity derivatives (which are significant at the 10% level).

Another important issue is the potential endogeneity of the gross credit derivative position. A bank that pursues a risky strategy may simultaneously underprice in the syndicated lending market and write protection in the CDS market. Alternatively, a bank that faces good lending opportunities may have low lending rates and hedge the additional amount of loans using credit derivatives. However, this type of endogeneity affects the net position of credit derivatives. It is more difficult to conceive how endogeneity may affect gross positions. Endogeneity problems are also limited in our setting since we control for bank fixed effects and time effect. Nonetheless, we also employ an IV-estimation to account for remaining endogeneity. Our instruments for the gross position are other derivatives held for trading purposes.[8] Banks typically start hedging activities in derivatives following trading in derivatives. We thus expect derivatives for trading to be a good explanatory variable for credit derivatives (Minton, Stulz and Williamson (2009), find that use of credit derivatives is highly correlated with the trade of other derivatives). At the same time, we do not expect trading of derivatives to have a direct independent effect on the lending business of banks. Trading is typically done in response to short-term profit opportunities and it is difficult to conceive how this should affect a bank's lending strategy. In addition in most banks trading activities and lending activities are carried out in separate organizational entities that do not communicate. Regression 6 reports results from an IV-regression where the gross credit derivative position is instrumented with the various other derivatives held for trading (interest rate, foreign exchange, equity and commodity derivatives). The F-test of 613.08 in the first stage of the IV regression indicates that trading derivatives are good instruments as they are highly related with credit derivatives. The J-test has a p-value of 0.35. This indicates absence of endogeneity for the instruments, confirming that non-credit derivatives trading activities are not related to loan pricing. The coefficient of the gross position is still significant (now only at the 5% level). The size of the coefficient decreases in absolute size, but only very slightly (to -9.817). A specific type of endogeneity may arise from a contemporaneous dependence of gross positions on demand or supply side considerations. In regression 7 we thus include the one-year lagged gross position – instead of the contemporaneous one. The coefficient now increases in absolute size (to -12.17) and is significant at the 1% level. We conclude that our results do not seem to be driven by endogeneity of credit derivative gross positions.

We have also carried out various other robustness checks (not reported here), such as allowing for group-specific trends for active and passive banks, clustering at the firm level and scaling variables by loans instead of assets, without any noteworthy change in our variables of interest.

In sum, the evidence in this section suggests a stable and negative association between banks' gross credit derivative positions and loan spreads. The effect is robust to controlling for various forms of biases that may arise in the context. No association between net positions and loan spreads can be found. The results thus lend support for

[8] The Call Reports distinguish derivatives held for trading for all derivatives except credit derivatives.

the hypothesis that banks use credit derivatives to manage risks more effectively and pass on gains to borrowers. By contrast, there is no support for other channels through which credit derivative may affect loan spreads.

4.3 Loan spreads by borrower type

The baseline analysis shows that borrowers at banks active in credit derivatives benefit from lower loan spreads. In this section we analyze whether this effect is uniform across borrowers, or whether specific types of borrowers benefit more. Since the universe of liquid credit derivatives mainly consists of large, investment-grade rated corporate borrowers, our expectation is that risk management gains are the largest for these firms.

For this we add interaction terms between gross positions and borrower types to the baseline model. Table 4 reports the results. Regression 1 shows the results of a specification that looks at whether the credit derivative effect is different for large firms. The dummy variable *Large* indicates whether a firm belongs to the 25% largest percentile of our sample in terms of sales. The interaction term of this variable with the gross amount in credit derivatives captures the difference in the effect of risk management for these firms. The coefficient of the interaction term is negative and significant, indicating that the largest firms benefit more from risk management at banks.

Next, we analyze whether the effect differs between rated and unrated firms. Rated firms are more likely to have liquid credit derivatives given the greater availability of credit risk information for these firms. Regression 2 includes an interaction term of the rating variable with the gross position. As expected – the interaction term is negative and significant. The risk management benefit is thus larger for rated firms. We also note that the size of the coefficient is large in absolute terms (-19.73). Hence, rated firms seem to be a main beneficiary from bank credit derivative use.

Regression 3 studies whether investment grade firms experience a different loan spread effect. We include interaction terms with dummies indicating whether the firm is a low risk entity (i.e., the S&P rating of its senior debt is A or better) or a high risk entity (i.e., the S&P rating is BBB or worse). The omitted category are unrated firms. The low risk interaction term obtains a very high coefficient in absolute values (-42.51) but is only weakly significant. The low significance most likely reflects limited rating coverage in our sample (low risk firms represent only a fraction of 0.7% in the sample while high-risk firms are 16%; the remaining 83.3% are unrated firms). The combined coefficient from the interaction term and the non-interacted gross position is -52.87. Thus, a one-standard deviation increase in gross positions at banks results in a loan spread for firms rated low-risk that is 44 bps lower (equivalent to a spread reduction of 17%).

We also study whether firms listed at the stock market benefit more from banks' use of credit derivatives. Stock market listing – after controlling for the presence of a rating – is likely to be unrelated to a firm's presence and liquidity in the credit derivative market. Consistent with this we find that the interaction term of stock market listing and the gross credit derivative position is insignificant (see regression 4).

Regressions 1-4 have considered whether firms more likely to be actively traded experience different credit derivative effects. In the respective regressions, the non-interacted gross-position coefficient stayed significant. This result suggests that also firms less likely to be actively traded benefit from enhanced risk management. In regression 5 we address this question directly. We constrain our sample to the set of firms that are unrated (and hence are very unlikely to have active credit derivatives trading). The effect on the gross position is significant and the coefficient (-10.42) is of similar magnitude as the one in the baseline model. This suggests that risk management benefits also extend to the firms for which the bank cannot directly manage risks using credit derivatives. This is consistent with risk management (balancing risks within the portfolio, keeping total risks close to the desired levels and improved measurement of risks) that reduces the banks' *overall* (marginal) cost of taking on risk. It may also partially reflect *pseudo-hedging* – the practice of banks to hedge untraded exposures using correlated traded exposures – which allows banks to reduce risks on exposures for which credit derivatives do not exist.

In sum, the evidence in this section suggests that firms generally seem to benefit from credit derivative use at banks, but firms that are more likely to be actively traded in the credit derivative market are the largest beneficiaries.

4.4 Loan spreads during the crisis of 2007-2009

It has been argued that financial innovations, while beneficial in normal times, may amplify the effects of crises. While this is likely to be the case under (for example) the incentive channel, the presence of a risk management channel suggests that benefits continue to be present under adverse circumstances. In this section we investigate whether the difference in loan pricing between active and passive banks persists during the crisis of 2007-2009. For this purpose, we re-estimate the baseline model allowing the coefficient of interest and the intercept to differ after the onset of the financial crisis.

Table 5 presents the results. Regression 1 includes a dummy indicating the crisis period (which we take to start in the last quarter of 2007). This dummy is significant and its coefficient indicates that loans spreads increase during the crisis period by 42.28 bps. Regression 2 includes the interaction term between the gross position of credit derivatives and the crisis dummy. The non-interacted gross position term stays significant and obtains a coefficient of -12.29. The interacted gross position term is insignificant. This result suggests that the benefits of credit derivative use remain unchanged after the onset of the financial crisis.

A concern with regression 2 is that banks may have changed their credit derivative activities in response to the crisis. The crisis interaction term in regression 2 relates to the contemporaneous gross position. It thus does not directly measure benefits from risk management prior to the crisis. In regression 3 we look at how loan spreads change for banks depending on their credit derivative activity prior to the crisis. We thus include an interaction term of the crisis dummy with banks' gross position in the third quarter of 2007. We find that the interaction term remains negative and insignificant. The persistence of the loan spread benefit is thus not driven by banks' responses to the crisis but by prior engagement in credit derivative markets.

We finally consider whether net positions in credit derivative markets lead to different loan spreads in the crisis. We thus include the net position and the net position interacted with the crisis dummy. The interaction term is insignificant. We also note that our prior results are unchanged as the non-interacted net term remains insignificant as well.

In conclusion, the evidence suggests that even though loan spreads generally increased after the onset of the financial crisis, the benefits of borrowing from banks' engaging in risk management via credit derivatives persist during the crisis.

4.5 Credit derivative use and bank lending

The evidence from the loan-level regressions supports the hypothesis that banks use credit derivatives for risk management purposes. In this section we look at banks' lending characteristics in general. If banks successfully manage their risks, we would expect banks active in credit derivative markets to experience lower losses on loans. In addition, we would expect these banks to be less likely to be constrained when credit risks in the economy worsen and also exhibit a more stable lending behavior.[9]

[9] Figure 2 already suggested that the loan pricing behavior of active banks is more stable than the one of passive banks (the standard deviation of the quarterly spreads of the active banks is nearly 50% less than the one of the passive banks).

Specifically, we relate in this section lending characteristics at the bank level to banks' use of credit derivatives. First, we study whether charge-offs on commercial and industrial loans are related to credit derivative use and whether this effect changes during the crisis. Second, we compare the lending volume of active and passive banks before and during the crisis. For this analysis we use yearly bank level data from the Call Reports. We include in our sample observations for the years 2006 to 2010. We estimate two models:

$$\begin{aligned} Netchargeoffs/TA_{b,t} &= \alpha + \beta_1 Crisis_t + \beta_2 GrossCD_{b,t} + \beta_3 Crisis_t * GrossCD_{b,t} \\ &\quad + \sum_{i=1}^{K} \phi_i B_{i,b,t} + \epsilon_{b,t} \end{aligned} \tag{2}$$

$$\begin{aligned} CommercialLoans/TA_{b,t} &= \alpha + \beta_1 Crisis_t + \beta_2 GrossCD_{b,t} + \beta_3 Crisis_t * GrossCD_{b,t} \\ &\quad + \sum_{i=1}^{K} \phi_i B_{i,b,t} + \epsilon_{b,t} \end{aligned} \tag{3}$$

In the first model, the dependent variable is the sum of net charge-offs (charge-offs minus recoveries) of commercial and industrial loans minus the net gains of credit derivatives scaled by assets. We include the gains on credit derivatives in order to capture potential risk management benefits: if a bank effectively manages its risk, charge-offs (recoveries) of loans should be off-set by gains (losses) in credit derivatives holdings. The terms B_i stand for other bank characteristics. These include: subordinated debt, equity, liquid assets, total loans and commercial loans (scaled by assets). We also include the logarithm of assets and the ROA. If credit derivative use extends risk management benefits, we should see that banks with larger gross amounts of credit derivatives face a lower level of net charge-offs in a given period. We hence expect the coefficient on the gross amount of credit derivatives to be negative in the first model. The crisis regressions have shown that (although spreads increased across the board) the loan spread differential between active and passive banks persisted during the crisis. This result suggests that banks with active risk management did not encounter larger losses than other banks. Accordingly, we expect the interaction term of the gross position and the crisis dummy in the model to be insignificant or even negative.

The dependent variable in the second model are commercial loans scaled by assets. We include the same set of bank controls but exclude the dependent variable. Banks that successfully manage their risk should be less constrained under adverse conditions. They should have more stable lending and possibly be able to expand lending activities (relative to passive banks) in times of crises. We thus expect the interaction term of the gross derivative position with commercial lending to be non-negative or even positive.

Table 6 displays the results of both models. In both regressions standard errors are clustered at bank level. Regression 1 displays the results for the net charge-off regression. We see that active banks have significantly lower charge-offs as indicated by the coefficient of the gross positions. The coefficient on the crisis dummy is positive and significant – indicating that charge-offs increased during the crisis. The interaction term of the crisis dummy with the gross position is insignificant. Thus, the advantage of active banks (in terms of lower charge-offs) persists during the crisis.

Regression 2 estimates the lending volume model. We find that the coefficient for the gross position in credit derivatives is not significant in this regression, indicating that active users of credit derivatives do not extend more commercial and industrial loans than other banks. The negative sign on the crisis dummy shows that the volume of commercial and industrial loans extended by banks overall decreases during the crisis. The interaction terms of the crisis dummy and the gross position is positive and significant. Thus, banks active in credit derivatives markets increased their lending volume relative to passive banks. This is consistent with risk management stabilizing the lending activities of these banks.

Summarizing, the bank-level regressions suggest that banks active in credit derivative markets face lower charge-offs in both normal times and in times of crises. In addition, they are able to expand their lending relative to passive banks in crisis times. These findings are consistent with risk management benefits from credit derivative use.

5 Conclusions

The debate on the costs and benefits of financial innovations is still ongoing. There is no consensus about whether their impact on the financial system is broadly a positive one or not. To a significant extent this is owed to the fact that we have little knowledge about what the sources of the effects of financial innovations are. In this paper we try to learn about financial innovations and their role for the economy by studying their impact on loan pricing. We focus on credit derivatives – probably the most significant financial innovation of the recent decade. There are several potential channels through which credit derivatives may impact lending behavior and affect economic activity. We derive hypotheses that relate these channels to loan pricing and use a new empirical strategy that allows us identifying the key channel.

We estimate a pricing model for syndicated loans that controls for loan, borrower and bank characteristics. Our key result is that a bank's gross position in credit derivatives has a significantly negative and robust effect on corporate loan spreads. We argue that this indicates that banks use credit derivatives for risk management purposes and pass the arising benefits (at least partly) on to borrowers. Such benefits include a better risk-balance within the loan portfolio, an improved ability to keep risk-levels at target ratios but also banks becoming more sophisticated in the measurement and control of their credit risks. We also find that the benefits from risk management persist after the onset of the financial crisis. In addition, banks that actively manage their risks with credit derivatives exhibit lower losses and have a more stable supply of loans during the financial crisis. Taken together, our paper provides consistent evidence on significant real effects of financial innovations that are present independent of economic conditions.

References

[1] Ashcraft, A. and Santos, J. (2009) Has the CDS Market Lowered the Cost of Corporate Debt, *Journal of Monetary Economics 56, 514-523*

[2] BIS (2005) Credit Risk Transfer, *The Joint Forum Bank for International Settlements*

[3] Berger, A., Frame, S., and Ioannidou, V. (2011) Tests of Ex Ante Versus Ex Post Theories of Collateral Using Private and Public Information, *Journal of Financial Economics 100, 85-97*

[4] Berger, A. and Udell, G.(1990) Collateral, loan quality, and bank risk, *Journal of Monetary Economics 25, 21-42*

[5] Besanko, D. and Thakor, A. (1987) Collateral and Rationing: Sorting equilibria in monopolistic and competitive credit markets, *International Economic Review 28, 671-689*

[6] Blanco, R., Brennan, S., and Marsh, I. (2005) An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps, *Journal of Finance 60, 2255-2281*

[7] British Banker's Association (2006) Credit Derivatives Report

[8] Cebenoyan, A. and Strahan, P. (2004) Risk Management, Capital Structure and Lending at Banks, *Journal of Banking and Finance 28, 19-43*

[9] Chan, Y. and Kanatas, G., (1985) Asymmetric Valuations and the Role of Collateral in Loan Agreements, *Journal of Money, Credit and Banking 17, 84-95*

[10] Dennis, S. A. Nandy, D. and Sharpe, I. (2000), The determinants of contract terms in bank revolving credit agreements, *Journal of Financial and Quantitative Analysis 35, 87-110*

[11] Duffie, D. (2008) Innovations in credit risk transfer: Implications for financial stability, *BIS Working paper No. 255*

[12] Ellul, A., Yerramilli, V. (2010) Stronger Risk Controls, Lower Risk: Evidence from U.S. Bank Holding Companies, *2011 AFA Denver Meetings Paper*

[13] Franke, G. and Krahnen, J. P. (2005) Default Risk Sharing between Banks and Markets: The Contribution of Collateralized Debt Obligations, *CFS Working Paper Series No. 2005/06*

[14] Froot, K., Scharfstein, D. and Stein, J. (1993) Risk Management: Coordinating Corporate Investment and Financing Policies, *Journal of Finance 48, 1629-1658*

[15] Goderis, B., Marsh, I., Vall Castello, J. and Wagner, W.(2007) Bank behaviour with access to credit risk transfer markets, *Research Discussion Papers 4/2007, Bank of Finland*

[16] Guener, B., (2006) Loan Sales and the Cost of Corporate Borrowing, *The Review of Financial Studies 19, No. 2*

[17] Harjoto, M., Mullineaux, D.J., and Ha-Chin Yi (2006) A Comparison of Syndicated Loan Pricing at Investment and Commercial Banks, *Financial Management 35, 49*

[18] Hirtle, B., (2009) Credit Derivatives and Bank Credit Supply, *Journal of Financial Intermediation 18(2), 125-150*

[19] Loutskina, E. and Strahan, P., (2006) Securitization and the declining impact of bank finance on loan supply: Evidence from mortgage acceptance rates, *Journal of Finance 64, 861-889*

[20] Marsh, I. (2006) The Effect of Lenders' Credit Risk Transfer Activities on Borrowing Firms' Equity Returns, Working paper, Cass Business School.

[21] Minton, B., Stulz, R. and Williamson, R. (2009) How Much Do Bank Use Credit Derivatives to Hedge Loans?, *Journal of Financial Services Research 35, 1-31*

[22] Morrison, A. (2005) Credit Derivatives, Disintermediation and Investment Decisions, *Journal of Business 78(2), 621-647*

[23] Nadauld, T. and Weisbach, M. (2011) Did Securitization affect the Cost of corporate Debt?, *NBER Working paper No. 16849*

[24] Norden, L. and Wagner, W. (2008) Credit derivatives and loan pricing, *Journal of Banking and Finance 32(12), 2560-2569*

[25] Norden, L. and Weber, M. (2004) Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements, *Journal of Banking and Finance 28(11), 2813-2843*

[26] Strahan, P. (1999) Borrower risk and the price and nonprice terms of bank loans, *Working paper, Banking Studies Function, Federal Reserve Bank of New York*

[27] Stulz, R. (2010) Credit Default Swaps and the Credit Crisis, *Journal of Economic Perspectives, American Economic Association 24(1), 73-92*

Tables and Figures

Table 1: Predictions of the effect of different risk transfer channels on spreads

Channel	Net CD position	Gross CD position
Incentives channel	(+)	No effect
Hedging channel	(-)	No effect
Capital relief channel	(-)	No effect
Risk management channel	No effect	(-)

Table 2: Descriptive statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Loan characteristics				
Spread	258.944	107.959	30	455
Log(amount)	18.135	1.299	13.081	21.821
Secured	0.455	0.498	0	1
Unsecured	0.054	0.226	0	1
Short Maturity	0.153	0.360	0	1
Intermediate Maturity	0.476	0.499	0	1
Long Maturity	0.369	0.482	0	1
TERM	0.518	0.499	0	1
TERM A	0.118	0.323	0	1
TERM B	0.330	0.470	0	1
TERM C	0.031	0.174	0	1
Borrower characteristics				
Log(sales)	19.233	1.720	0.693	25.710
Ticker	0.423	0.494	0	1
Rating	0.021	0.145	0	1
AAA	0.0003	0.019	0	1
AA	0.0007	0.027	0	1
A	0.007	0.088	0	1
BBB	0.047	0.211	0	1
BB	0.104	0.306	0	1
B	0.159	0.366	0	1
CCC	0.027	0.164	0	1
CC	0.001	0.033	0	1
C	0	0	0	0
Bank characteristics				
Gross CD/TA	0.394	0.808	0	3.988
Net CD/TA	0.021	0.050	-0.039	0.225
Derivatives not for trade/TA	0.295	0.329	0	1.263
Log(assets)	19.216	1.996	9.998	21.566
ROA	0.006	0.006	-0.053	0.068
Sub Debt/TA	0.339	0.147	0.0006	0.848
Liquid Assets/TA	0.196	0.112	0	0.991
Charge-offs/TA	0.002	0.003	0	0.072
Equity/TA	0.093	0.098	0.010	0.961

Table 3: Credit derivative use and loan spreads

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	Spread	Spread	Spread	Spread	Spread	Spread	Spread
Gross CD/TA	-9.362***	-10.93***		-14.58***	-10.75***	-9.817**	
	(2.523)	(2.146)		(2.032)	(2.120)	(4.576)	
Net CD/TA	38.12	13.12	-1.285	17.34	12.39	11.66	
	(44.92)	(29.19)	(28.27)	(27.65)	(29.16)	(45.09)	
Derivatives					2.602		
not for trade/TA					(9.008)		
Gross CD/TA lag							-12.17***
							(3.735)
Net CD/TA lag							-9.598
							(22.22)
Log(sales)	-4.483***	-4.356***	-4.292***	-9.974***	-4.358***	-4.350***	-3.804**
	(1.483)	(1.441)	(1.446)	(2.184)	(1.440)	(1.554)	(1.566)
AAA	-9.466	-14.78	-21.85*	-11.91	-15.37	-15.50	
	(10.32)	(11.94)	(12.03)	(10.62)	(11.61)	(16.86)	
AA	27.40	15.74	13.89	44.93	15.32	15.55	26.64
	(83.12)	(86.90)	(86.13)	(90.79)	(86.87)	(83.01)	(90.80)
A	-11.77	-9.988	-10.71	-4.787	-10.15	-10.06	-0.835
	(35.81)	(36.16)	(37.33)	(35.80)	(35.99)	(27.04)	(39.23)
BB	38.38***	39.32***	38.85***	72.41***	39.36***	39.27***	43.07***
	(7.056)	(7.133)	(7.244)	(6.275)	(7.105)	(9.635)	(9.965)
B	78.43***	79.46***	79.07***	119.1***	79.48***	79.42***	83.29***
	(8.890)	(9.061)	(8.906)	(9.073)	(9.048)	(9.646)	(11.77)
CCC	129.1***	129.4***	128.8***	170.9***	129.5***	129.4***	143.0***
	(10.48)	(10.79)	(10.92)	(9.897)	(10.69)	(14.24)	(14.34)
CC	223.3***	224.7***	226.1***	252.6***	224.0***	224.8***	226.5***
	(47.49)	(46.03)	(45.10)	(40.60)	(46.36)	(41.19)	(46.89)
NR	55.74***	56.20***	55.32***	79.96***	56.25***	56.11***	59.21***
	(6.792)	(6.874)	(6.865)	(6.410)	(6.848)	(8.957)	(10.40)
Rating	-28.83*	-28.48*	-28.94*	-29.92***	-28.37*	-28.53*	-33.64*
	(14.70)	(15.09)	(15.52)	(10.96)	(14.94)	(15.55)	(17.47)
Ticker	-9.873	-6.318	-6.814	-6.993	-6.325	-6.369	-8.695
	(7.271)	(6.919)	(6.952)	(7.435)	(6.920)	(4.210)	(6.980)
Log(amount)	-13.28***	-14.58***	-14.51***		-14.58***	-14.57***	-13.64***
	(2.406)	(2.483)	(2.467)		(2.488)	(2.188)	(3.045)

Table 3: Credit derivative use and loan spreads (cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	Spread	Spread	Spread	Spread	Spread	Spread	Spread
Secured	15.28***	14.70***	14.43***		14.73***	14.67***	10.57*
	(5.267)	(5.063)	(5.111)		(5.041)	(4.491)	(5.389)
Unsecured	-56.08***	-55.30***	-56.24***		-55.27***	-55.40***	-54.35***
	(7.696)	(8.279)	(8.385)		(8.304)	(8.135)	(9.450)
Interm. maturity	-11.61	-13.19	-13.70		-13.18	-13.24**	-12.95*
	(9.062)	(9.001)	(9.076)		(8.982)	(5.826)	(7.761)
Long maturity	-14.20*	-11.59	-11.87		-11.57	-11.62*	-11.85
	(7.968)	(7.559)	(7.608)		(7.553)	(6.453)	(9.096)
TERM A	26.58***	23.81***	24.40***		23.78***	23.87***	23.36***
	(5.657)	(4.951)	(5.092)		(4.943)	(5.710)	(5.603)
TERM B	58.38***	53.90***	54.65***		53.89***	53.98***	51.81***
	(6.144)	(6.611)	(6.602)		(6.604)	(5.331)	(7.108)
TERM C	45.98***	39.61***	41.46***		39.65***	39.80***	31.78***
	(10.10)	(9.648)	(9.452)		(9.650)	(10.15)	(10.37)
ROA	-351.2						
	(309.0)						
Subdebt/TA	1.639						
	(30.43)						
Liquid Assets/TA	-34.77						
	(24.92)						
Chargeoff/TA	1,648***						
	(464.5)						
Log(assets)	-4.135						
	(2.494)						
Equity/TA	-9.369						
	(26.14)						
F-stat IV						613.08	
J-test p-value						0.356	
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Purpose Dummies	Yes	Yes	Yes	No	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,559	2,638	2,638	2,638	2,638	2,638	2,322
R-squared	0.362	0.398	0.396	0.330	0.398	0.398	0.385

The dependent variable is the all-in loan spread in basis points. All models are estimated using OLS with clustered robust standard errors at the bank level (in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% level respectively. Model (5) uses IV estimation.

Table 4: Loan spreads by borrower type

	(1)	(2)	(3)	(4)	(5)
Variables	Spread	Spread	Spread	Spread	Spread
Gross CD/TA	-6.890***	-10.05***	-10.36***	-10.62***	-10.43***
	(1.954)	(1.902)	(2.385)	(3.689)	(1.954)
Large	-10.55				
	(8.848)				
Gross CD/TA*large	-7.397***				
	(2.343)				
Rating	-27.08*	-18.55		-28.48*	
	(14.42)	(14.37)		(15.18)	
Gross CD/TA*rating		-19.73***			
		(5.991)			
Low_risk			-46.31		
			(43.95)		
High_risk			2.174		
			(3.689)		
Gross CD/TA*high_risk			-0.117		
			(2.013)		
Gross CD/TA*low_risk			-42.51*		
			(23.11)		
Ticker	-5.586	-6.419	-10.34	-6.143	-8.532
	(7.142)	(6.959)	(6.345)	(7.355)	(6.852)
Gross CD/TA*ticker				-0.309	
				(4.100)	
Borrower Controls	Yes	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	2,638	2,638	2,638	2,638	2581
R-squared	0.400	0.399	0.363	0.398	0.353

The dependent variable is the all-in loan spread in basis points. All models are estimated using OLS with clustered robust standard errors at the bank level (in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% level respectively. Model (5) only includes non-rated firms.

Table 5: Loan spreads during the crisis of 2007-2009

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread
Crisis	42.28***	44.21***	44.45***	44.49***
	(13.70)	(14.28)	(13.52)	(14.31)
Gross CD/TA		-12.29***	-12.23***	-12.47***
		(2.007)	(1.967)	(2.185)
Gross CD/TA*crisis		0.325		-2.544
		(3.307)		(4.824)
Net CD/TA				20.83
				(26.57)
Net CD/TA*crisis				136.2
				(164.7)
Gross CD 07/TA*crisis			0.115	
			(2.530)	
Borrower Controls	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Observations	4,022	2,596	2,596	2,596
R-squared	0.417	0.389	0.389	0.389

The dependent variable is the all-in loan spread in basis points. All models are estimated using OLS with clustered robust standard errors at the bank level (in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% level respectively.

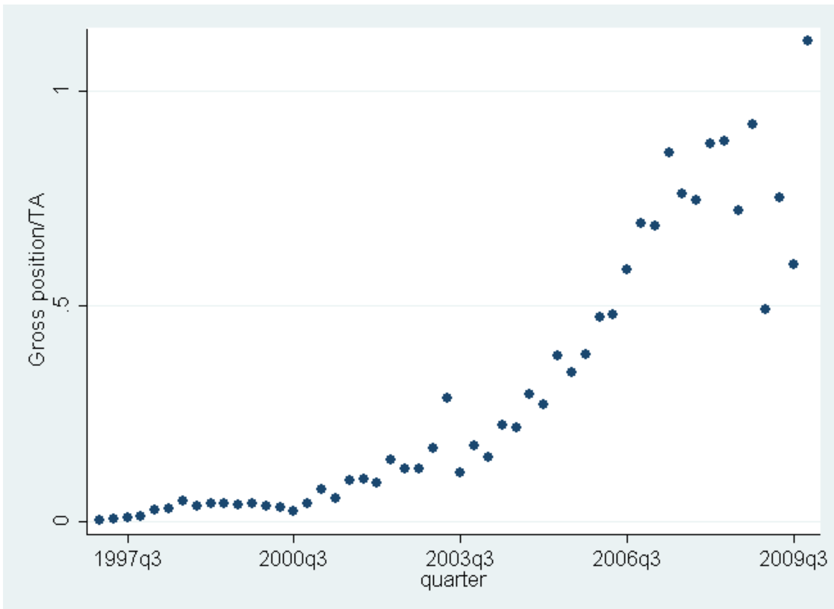
Table 6: CDS use and bank lending

	(1)	(2)
Variables	Charge-offs commercial/TA	Commercial loans/TA
Crisis	0.0003***	-0.032**
	(4.95e-05)	(0.012)
Gross CD/TA	-0.259**	-7.783
	(0.103)	(19.62)
Gross CD/TA*crisis	0.115	52.44***
	(0.115)	(20.29)
Sub debt/TA	4.23e-05	-0.057**
	(0.0001)	(0.026)
Liquid assets/TA	0.0004***	0.094***
	(0.0001)	(0.028)
Equity/TA	0.0006***	0.032
	(0.0002)	(0.036)
Log(assets)	8.88e-05***	0.008***
	(1.36e-05)	(0.001)
Total loan/TA	0.0008***	0.220***
	(0.0001)	(0.028)
Commercial loans/TA	0.003***	
	(0.0002)	
ROA	-0.034***	0.208
	(0.001)	(0.203)
Constant	-0.002***	-0.154***
	(0.0002)	(0.042)
Observations	2,243	2,243
R-squared	0.355	0.138

The dependent variable in these models are: In model (1) net charge-offs minus CDS gains scaled by total assets. In model (2) is the total volume of commercial loan extended scaled by total assets. All models are estimated using OLS with clustered robust standard errors at the bank level (in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% level respectively.

Figure 1: Gross and net credit derivative positions (scaled by total assets)

(a) Gross derivative positions



(b) Net derivative positions

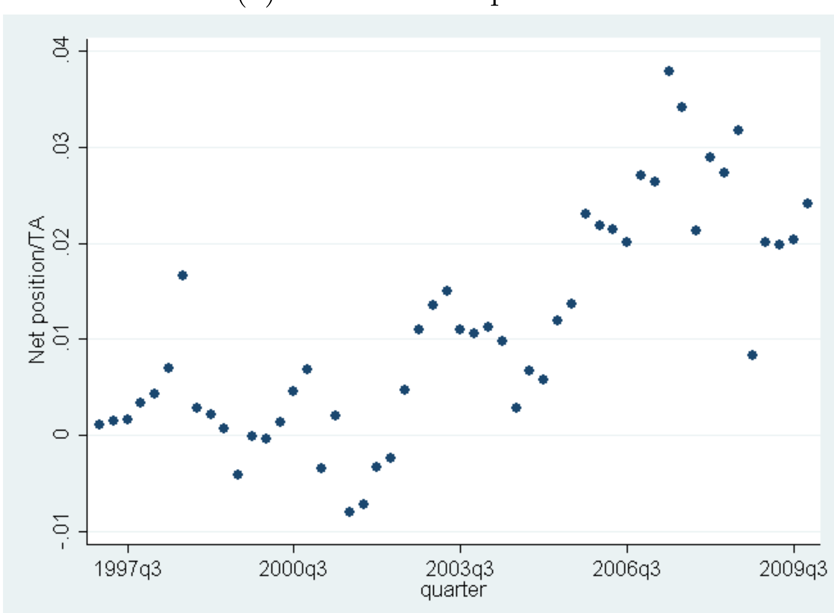


Figure 2: Spreads (all-in) of active versus other banks