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Abstract

This paper examines the relationship between the new markets for credit default swaps (CDS) and the pricing of syndicated loans to U.S. corporates. We find that changes in CDS spreads have a significantly positive coefficient and explain about 25% of subsequent monthly changes in aggregate loan spreads during 2000-2005. Moreover, when compared to traditional loan pricing factors, they turn out to be the dominant determinant of loan spreads. In particular, they explain loan rates much better than same rated bonds. This suggests that, even though CDS and bond markets may equally price market credit risk, a substantial part of CDS prices additionally contains loan-specific information. We also find that, over time, new information from CDS markets is incorporated into loans faster, but information from other markets is not. We argue that this indicates that the markets for CDS influence banks' loan pricing behavior and thus have an impact on actual financing decisions in the economy.

JEL classification: G10; G21

Keywords: Syndicated Lending; Loan Rates; Credit Derivatives; Credit Markets; Credit Spreads

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1. Introduction

Credit derivatives, famously dubbed by Alan Greenspan as the most significant financial innovation of the recent decade, are instruments which provide protection on credit exposures. While in the past credit risk was essentially untradeable, these instruments now provide banks with various methods for hedging and transferring credit risks. In their most common form, the credit default swap (CDS), they insure against the default of a credit in return for a periodic payment to the seller of protection. This payment, the price of a CDS, provides a direct measure of the compensation required by the market for taking on credit risk. [1]

In this paper we examine empirically how the prices of CDS relate to the pricing of new loans by banks. One would expect the prices in both markets to be linked to the extent that both are driven by credit risk. However, there are many important differences between loans and CDS. Loans are often collateralized and subject to covenants, and thus have their own risk characteristics. Their pricing may, moreover, be based on relationship arguments and reflect current conditions in the banking sector, rather than market prices. CDS, by contrast, are secondary market instruments whose prices may be driven by risk and liquidity premia. CDS also have specific institutional characteristics, such as the definition of the event that triggers the insurance. These, and other differences, speak against a robust relationship between both markets.

There are also reasons for a special link between CDS and loan markets. Credit derivatives now allow banks to hedge an increasing number of credit exposures. Although reliable data is difficult to come by, especially large banks seem to make use of this opportunity. For example, Deutsche Bank announced in 2003 that it plans to hedge all loans with a duration of more than 180 days with credit derivatives (Walter, 2003). Since the prices

[1] Credit derivatives are rapidly developing into liquid and widely used instruments. Only introduced a decade ago, their notional outstanding amount has reached $ 20,200bn in 2006 and is predicted to grow to $ 35,000bn in 2008 (British Bankers' Association, 2006).

on CDS represent the costs of hedging, they should have a bearing upon banks' pricing of loans. And even when banks are not able to hedge a loan, credit derivatives may still affect its price. Banks have started to calculate pseudo-prices for exposures on which credit derivatives are not traded. These prices now provide loan officers with an accurate benchmark for the pricing of loans (e.g. Kealhofer, 2002, and The Banker, 2003). They are also increasingly used as internal transfer prices between the bank's loan department and its credit portfolio management unit and thus become a yardstick for loan officers (e.g., Beitel et. al. 2006).

Both markets may further be linked because banks trade actively in CDS markets. Recent evidence has suggested that this causes private information about lending to be revealed in the CDS market (Acharya and Johnson, 2005). Public lending-specific information may become priced as well into CDS, through banks' hedging of loan risk. For example, a higher demand for loans which drives up loan prices may also raise prices in the CDS market by increasing banks' demand for hedging.

We provide evidence on the relationship between loan and CDS markets by relating the (interest rate) spreads on new syndicated loans to U.S. corporates to the spreads observed in CDS markets. We consider the period from 2000 onwards (even though credit derivatives have been traded since 1996) since only then CDS had become widely used and their pricing reliable. We focus in our analysis on aggregate data, which allows to examine loan pricing at regular intervals (monthly in our data).[2] Moreover, since loans as primary markets are presumably more sluggish than secondary markets, we look for a lagged relationship between loans and CDS.

We find that there is a close relationship between both markets. Monthly changes in CDS spreads are very significant in explaining loan spread changes of the subsequent month. The coefficient is near one, suggesting that a one basis point change in the CDS spread translates

[2] At the firm level, new loan extensions and thus potential changes in loan rates occur only infrequently and irregularly.

into a one basis point change in the loan spread. Overall, CDS spreads can explain about 25% of the total variation in loan spread changes.[3] When controlling for a variety of traditional loan pricing factors, such as the implied volatility in equity markets and macroeconomic conditions, the CDS spread remains strongly significant and emerges as the by far most important determinant of loan prices.

In particular, CDS spreads clearly dominate the natural alternative benchmark for loan pricing, the spreads on same-rated bonds. In regressions where both variables are included, the bond spread is insignificant. And when considered in isolation, it only adds little explanatory power. This is noteworthy since in accordance with previous studies we find bonds and CDS spreads changes to be highly correlated and both driven by market credit risk factors. Thus, while CDS and bonds both reflect general credit risk, CDS additionally contain a considerable amount of loan-specific information. This, perhaps surprising, finding can be explained by banks' active role in CDS markets, influencing CDS prices through their private lending information and hedging demand. Bond markets, by contrast, are dominated by institutional buy-and-hold investors and hedging credit risk through shorting bonds is difficult there. The finding can also be explained by an impact of CDS on loan pricing, arising because CDS spreads represent the costs of hedging loans, or simply because they provide the pricing benchmark.

We also address the question of how long it takes for information from the CDS market to be reflected in loan prices. We find that in order to explain average loan spreads in a month in the first half of our sample, only information generated in the CDS markets after the third week of the previous month is needed. Hence, CDS information is relatively quickly reflected in actual loan decisions. The lag even shortens over time, as in the second half of our sample CDS information from the previous month no longer explains loan changes in the current

[3] By means of comparison, firm-level studies can typically explain in total about 25% of (weekly) bond spread changes using a wide set of explanatory factors (e.g., Collin-Dufresne, Goldstein, and Martin, 2001, and Blanco, Brennan and Marsh, 2005).

month. Moreover, throughout the sample the coefficient for same month CDS information rises gradually, indicating an increasing weight on current information.

The shortening of the lag suggests that either CDS markets or the pricing of loans by banks (or both) have changed during our sample period. CDS markets have presumably become more efficient in recent years. Hence, they should incorporate new information quicker, which per se *increases* the lag of the loan market. Changes in CDS markets are thus an unlikely explanation of the shortening of the lag, suggesting that it is due to banks pricing new information faster into loans. Interestingly, we find that this seems to be limited to information from CDS prices: the relation between loan spreads and same-month non-CDS information (relative to previous month information) does not strengthen during our sample period. This suggests that banks' loan pricing behavior has changed in the presence of CDS markets.

Overall, even though there are *a priori* many reasons for why the prices on new loans and CDS may differ, we find that both are strongly linked. Our findings suggest that the relatively young credit derivatives markets have very rapidly developed an important role in the financial system by closely relating to actual financing decisions, and thus beyond being purely a ‘financial instrument’.

Recent empirical studies have addressed other aspects of credit derivatives and bank lending. Acharya and Johnson (2005) provide evidence for insider trading in the CDS market and show that it is related to the number of bank relationships of a traded reference entity. They argue that this is consistent with banks using CDS markets to exploit their informational advantage from the syndicated lending market. Our finding of the CDS market containing substantial loan-specific information is supportive of such a role of banks in CDS trading. Marsh (2006) considers the impact of the announcement of a new bank loan on a firm's public debt (as first studied by James, 1987). He presents evidence that the announcement effect is lessened when the lending bank actively trades in credit derivatives. This suggests that the uniqueness of bank loans is eroded through credit derivatives, consistent with the theory that hedging may undermine monitoring incentives (e.g., Morrison, 2005). Goderis et al (2006) study the impact of credit risk transfer through Collateralized Loan Obligations (CLOs) on the amount of bank lending. They find that subsequent to issuing their first CLO, banks increase their lending by an amount that more than offsets the actual risk shed with the CLO. This is interpreted as CLOs providing a new risk management tool for banks, allowing them to operate with riskier balance sheets. In a similar vein, Hirtle (2007) shows that U.S. banks which purchase protection using credit derivatives increase their loan supply. These two papers indicate that credit derivatives have a quantity effect for loans. Our results suggest that they also interact with the pricing of loans.

While our paper considers the time-series dimension of loan rates, the loan pricing literature has mostly focused on explaining differences in loan rates across borrowers (e.g., Strahan, 1999). Carey and Nini (2004) compare spreads on European and U.S. syndicated loans. They find, after controlling for a variety of factors, European spreads to be significantly smaller than U.S. spreads, which indicates a lack of integration of loan markets. [4] Cook and Spellman (2005) compare prices on loans and bonds of the same borrower. They match prices at the date when a new loan is originated and find that for highly rated firms, loan rates command a premium over bonds; while for lower rated firms they are discounted. An exception from the focus on the cross section is Altman, Gande and Saunders (2006) who study the relation between secondary market prices for loans and bonds. They find that loans react more strongly than bonds prior to an information sensitive event but react less in the period immediately before and after the event. This suggests a monitoring advantage of loans over bonds, even when loans are traded.

[4] Interestingly, we find that U.S. loan rates are driven by global CDS markets (and not the U.S. CDS market). This suggests that, while loan markets may not be integrated across continents, loan officers at least take into account global credit conditions when pricing loans.

While our study is the first to establish a relationship between credit derivatives and pricing in primary markets, previous literature has analyzed their interaction with secondary market prices by means of time-series econometrics and in event studies (e.g., Hull, Predescu and White, 2004, Norden and Weber, 2004, Blanco, Brennan and Marsh, 2005, Houweling and Vorst, 2005, and Norden and Weber, 2006). This research is based on a higher frequency (since secondary market data is available on a daily basis) and finds that CDS markets, compared to bond and equity markets, provide a substantial part of the overall price discovery. Our results suggest that CDS markets are perhaps even more important for primary markets, as nearly all loan-specific information is generated there.

The remaining part of this paper is organized as follows. Section 2 explains the data and presents summary statistics. Section 3 contains the empirical analysis. The final section summarizes and offers conclusions.

2. Description of the data

2.1. Data sources and variables

In this study we analyze time series of aggregate loan spreads. On the firm-level, loan spreads changes occur only infrequently and irregularly, making it difficult to analyze time-series variations. Our aggregate loan spread time series comprises only new loans and thus has the advantage that it always reflects current loan market conditions. It can also be observed at a regular frequency (monthly in our study). The obvious disadvantage is that one cannot easily control for borrower-specific variables, which have been found important in earlier studies (e.g., Strahan, 1999). *A priori*, this should make it more difficult to identify a link between CDS prices and loan rates.

Despite borrower-specific differences, the prices of CDS and loans may also differ due to a variety of institutional characteristics, such as re-negotiation rights in loan contracts, the cheapest-to-delivery option in some CDS spreads, [5] and different definitions of the default event (for an excellent overview of these issues, see Cook and Spellman, 2005). These features may increase or decrease credit spreads in one market relative to those in other markets. If these differences are time varying, they may further bias our results against finding a robust relationship between CDS and loan spreads.

Our data set comprises a time series of corporate loan spreads, credit default swap spreads, corporate bond spreads and macroeconomic control variables. Loan spreads are provided by the rating agency Standard & Poor's for the period January 1998 to March 2006.[6] These spreads are monthly averages of first-lien syndicated loans to U.S. firms with a credit rating of BB/BB- and B+/B. These loan spreads are computed from newly issued loans (typically 60 to 80 deals per month) and do not reflect rates on outstanding loans. Hence, they represent loan pricing decisions of a given month. We consider these loan spreads more representative for large firms, for which syndication is the dominant form of bank financing.

Loans are priced with floating rates, i.e. they consist of a risk-free rate (usually the swap rate) plus a credit spread. Our data allows us to distinguish between straight spreads (without fees) and all-in spreads (with upfront fee, hypothetically amortized over three years). We focus on straight spreads because (i) credit spreads from the CDS and the bond market do not include fees, (ii) we found fees not to vary systematically with the straight spread levels, and (iii) the size of the fees is relatively small compared to the total spreads.

[5] CDS may specify a range of obligations which can be delivered in a default, giving the protection buyer the option to deliver the cheapest one.

[6] We have also access to average (primary) loan spreads from the Loan Pricing Corporation (LPC). We prefer to use the S&P loan spreads because they include only new loans (and not outstanding loans). We also ran regressions for *secondary* market loan spreads obtained from LPC and found that our main results continue to hold.

Our CDS market data are daily CDS spreads for more than 300 global references entities from CreditTrade[7] and one large universal bank[8] for the six-year period from January 2000 to December 2005. We only consider CDS spreads which refer to senior unsecured corporate debt and have a benchmark maturity of five years. Note that constant maturity CDS spreads are quoted on a daily basis, reflecting the market's most recent assessment of credit risk. Like loans spreads, CDS are quoted above floating rates such as LIBOR or EURIBOR. From these spreads we calculate different types of equally weighted monthly CDS spread indices. For example, we differentiate by regions (global, US, Europe), by rating grades (AAA, AA, ... , BBB), and by frequency. For the latter we use both averages of a month but also daily prices at a given point in time in each month (end-of-month, end-of-week).

Corporate bond spreads are calculated from a monthly time series of the Lehman Brothers U.S. corporate high-yield indices (for rating grades BB, B and all non-investment grade firms) minus a risk-free rate. For the risk-free rate, we follow previous studies and take the five-year plain vanilla swap rate from Thomson Financial DataStream (e.g. Hull, Predescu and White, 2004, Norden and Weber, 2006).[9] This makes bond spreads comparable to loan and CDS spreads because these are calculated above swap rates as well. We construct monthly averages for the bond spreads as well as end-of-month bond spreads.

Moreover, we consider a large set of variables to control for the most important macroeconomic determinants of credit spreads (e.g. Collin-Dufresne, Goldstein and Martin, 2001, Elton et al., 2001). More specifically, we use aggregate stock market information (the S&P 500 return and the implied volatility index VIX for S&P 500 stock index options from the CBOE), debt markets information (the 5 year swap rate, the term premium calculated as the ten-year minus the one-year yield), the liquidity of CDS markets (the relative bid-ask

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[7] For a description of this data, see Blanco, Brennan and Marsh (2005) and Acharya and Johnson (2005).

[8] The bank requests to stay anonymous. Another potential data source would be a CDS index, such as the iTraxx and DJ CDX. However, a U.S. version of both indices did not exist at the beginning of our sample period.

[9] In preliminary analyses we also calculated bond spreads above same-maturity yields of U.S. Treasury bonds, which yielded similar results.

spread of CDS quotes), general macroeconomic conditions (industrial production IP, consumer price index CPI), and rating agency actions (the percentage share of all downgrades by Standard & Poor's, Moody's and Fitch relative to all rating changes in a particular month, DOWN). The latter variable reflects changes in the opinion of rating agencies which may contain relevant information for the pricing of new loans or new CDS contracts.

The final data set results from the intersection of the above described variables, leading to a monthly time series of 72 observations from January 2000 to December 2005.

2.2. Descriptive statistics of key variables from the loan, bond and CDS market

Figure 1 depicts the evolution of loan, bond and CDS spreads over the sampling period. We decided to use CDS spreads from all global reference entities in our analysis (and not only from the U.S.) because preliminary analyses showed that the U.S. loan spreads are driven by global CDS spreads.[10]

Insert Figure 1 here

It can be seen that the loan spreads are relative high and stable during the period 2000-2002, while they decrease during the second half of the sample. CDS and bond spreads both rise in the first half and decrease, similar to loan rates, in the second half. Generally speaking, the three series behave similar but there seem to be also important differences between them.

Table 1 displays descriptive statistics such as the time series mean, standard deviation etc. for spread levels and for first differences of spread levels.[11] The two rightmost columns report results from two types of stationarity tests.[12]

[10] However, both variables are highly correlated (their correlation is 0.95).

[11] Note that we use matching rating data for bond and loans but use averages across ratings for CDS spreads. The reason is that some rating classes had few or no observations during the first half of our sample (this may bias our results when there are rating migrations, an issue to which we return later).

Insert Table 1 here

In can be seen that loan spreads L^B exhibit a mean of 344 basis points, ranging between 235 and 511 basis points during the sample period. As expected, loan spreads for the better rating grade L^{BB} display a lower mean of 277 basis points. Bond spreads are on average higher than their corresponding loan spreads. CDS spreads, either end-of-month or monthly average, are on average roughly 82 basis points. From stationarity tests we have that all time series of spread levels are non-stationary, i.e. they are not suited as inputs for a standard regression analysis. However, both stationarity tests reveal that the time series of spread changes are stationary for all variables. Consequently, we will use in our regression analysis all variables in first differences.

3. Empirical analysis

3.1. The baseline model

In this section we introduce a simple regression model to analyze whether there is a link between the prices of CDS and loan spreads.

Some methodological explanations are in order. First, we expect primary loan markets to react more sluggishly than CDS markets. Therefore, we focus on identifying a lagged relationship between both markets (in Section 3.4 we analyze whether there is also a contemporaneous relationship). In particular, we will use the end-of-month CDS spread of the previous month to explain the loan spreads of the current month. This ensures that there is no overlap with the loan rate data (which are monthly averages) but allows loans to react to most recent (lagged) data (to check robustness, we also run regressions with average CDS spreads,

[12] The (augmented) Dickey Fuller test has a null hypothesis of non-stationarity while the KPSS test has a null hypothesis of stationarity.

both contemporaneous and lagged). Second, we consider the lowest rated loans in our sample (S&P rating: B), for which we expect the largest variations. Third, as mentioned beforehand, we use global CDS spread changes since they seem to dominate those of U.S. reference entities. Finally, we include the lagged loan spread change to control for serial correlation of this variable. The lagged loan spread change can also be interpreted as a naive benchmark for the lagged CDS spread change. The estimation results for the baseline model are summarized in Table 2.

Insert Table 2 here

It turns out that the baseline model does a surprisingly good job. The estimated coefficient of lagged CDS spread changes is highly significant (p-val. < 0.01), correctly signed and with a magnitude of 1.14 economically meaningful. In other words, CDS spread changes from the previous month translate roughly 1:1 into loan spread changes of the current month. The explanatory power of this simple model is relatively high (R^2=0.33). This is striking because we expected that a model which explains (primary) loan spreads would perform substantially worse than models for corporate bond spread changes, which usually produce R^2 values around 0.25 (e.g. Collin-Dufresne, Goldstein and Martin, 2001, Blanco, Brennan and Marsh, 2005). The lagged loan spread change is significantly negative at the 0.05-level but its magnitude is much smaller than the CDS coefficient. The negative sign is evidence for serial correlation which leads to a mean-reverting behavior of loan spreads. We re-estimate this model without the lagged dependent variable and obtain an R^2 of 0.25 and a coefficient of 1.01 for ΔC^{eom}_{t-1}.

To our knowledge, this finding represents the first empirical evidence of a significant and positive link between credit derivatives and loan markets. In the next section, we check the robustness of this result to the inclusion of additional variables, alternative estimation techniques, and alternative variable definitions.

3.2. Model extensions and robustness tests

We first extend the baseline model by macroeconomic variables which have been identified as important determinants of credit spread changes (e.g. Collin-Dufresne, Goldstein and Martin, 2001). First and foremost, we include bond spreads. Bond spreads, like CDS spreads, also represent a required compensation for credit risk and are thus the natural ‘rival’ for CDS spreads. In addition, we include lagged changes of the implied volatility of equity (ΔVIX), the return on the S&P 500 index (R_SP500), the five year swap rate (ΔSWAP5), the term premium (ΔTERM), the consumer price index (ΔCPI), industrial production (ΔIP), the change of the share of rating downgrades relative to all rating changes (ΔDOWN), and, as a liquidity proxy, the relative bid-ask spread from the CDS market (ΔRELS). Accounting for changes in liquidity is important since recent research has suggested that CDS spreads, in addition to a compensation for default risk, include also liquidity premia (see Longstaff, Mithal and Neis, 2005). Table 3 displays the estimation results for four model specifications. In addition to CDS spreads, Model I includes two main control variables, bond spreads and equity volatility. Model II is based on bond spreads, equity volatility and the share of rating downgrades (but no CDS spreads) while Model III includes all control variables (except CDS spreads). Finally, we consider all macro variables and CDS spreads in Model IV.

Insert Table 3 here

The main observation is that the CDS spread remains highly significant when controlling for other variables. In Model I its coefficient decreases modestly to 1.08, from 1.14 in the baseline model. In the full model (Model IV) it decreases to 1.05. Also, adding the control variables to a model with CDS spreads does not substantially increase the goodness-of-fit: the adjusted R^2 only increases from 0.31 in the baseline model (Table 2) to 0.34 in the full model (Model IV). Hence, CDS spread changes are our most important determinant of loan spread changes. Note also that, although macro variables on their own have explanatory power (R^2=0.23 in Model II and Model III), only the lagged dependent variable appears as significant in most of the specifications. Nonetheless, it can be seen that equity volatility and the share of downgrades are statistically significant and correctly signed when we leave out CDS spreads (Model II).

One may argue that loan and CDS spread levels are cointegrated. If this is the case, then information about the adjustment towards the long run equilibrium can be used as additional information for the analysis of spread changes. Therefore, we also estimate a vector error correction model (VECM) for loan spreads, CDS spreads and bond spreads. For this (as in the previous table), CDS and bond spread changes are measured at the end of each month to ensure synchronicity between these variables. Table 4 reports the cointegration equation (Panel A) and the short-run adjustment model for the loan spread changes (Panel B).

Insert Table 4 here

From Panel A, it can be seen that there is indeed a long-run relationship between the three variables. Most important, Panel B shows that the results from the baseline model are confirmed. The relation between CDS spread changes and loan spreads changes remains basically unchanged. The coefficient for ΔC^{eom}_{t-1} slightly increases to 1.26 and remains significant at the 0.01-level. The error correction term (EC_t) is significantly negative at the 0.01-level with a coefficient of –0.27. The R^2 increases to 0.42, indicating the importance of the adjustment process towards the long-run equilibrium.

Moreover, we also conduct several additional tests to examine the sensitivity of the baseline model to the choice of variables and the model specification. For example, using the loan spread change for BB-rated firms ΔL^{BB}_t (instead of B-rated firms) as dependent variable in the baseline model gives similar results. The only noteworthy effect is that the coefficient of the CDS spread change is slightly lower. A potential concern about the baseline model may be that it includes the average CDS spread across all firms, but loan spreads are always considered for firms with the same rating. Our results may hence be influenced by rating migration. We check this issue by using instead the CDS spread for BBB-rated firms and CDS spreads which are scaled to a rating level of BB[13] in order to adjust for the difference in the underlying default risk and find our main results confirmed.[14] Our baseline model is also confirmed in terms of statistical and economic significance when we replace the lagged end-of-month CDS spread change ΔC^{eom}_{t-1} by the lagged monthly average CDS spread change ΔC_{t-1} (however, as already said earlier, we prefer the end-of-month measure to allow for the most current information to be reflected in loan rates). Furthermore, we also run our baseline model for spreads which are computed in relative rather than absolute terms. The results support those of the baseline model. Finally, instead of running the OLS regression with robust standard errors we re-estimate the baseline model using the Newey-West estimator (for a lag length of 3), which also adjusts for serial correlation, and obtain highly similar results.

We conclude that the various model extensions and tests of robustness confirm the results of the baseline model.

3.3. Loan-specific information in CDS and bond spreads

[13] We have data on CDS spreads for BB-rated firms only for the period April 2002 to December 2005. For the scaled CDS spreads we calculate synthetic CDS spreads for the period January 2000 to March 2002 by estimating the relationship between CDS spread changes for BBB- and BB-rated firms during the period for which the data is available.

[14] This is consistent with the fact that the mean rating of all CDS reference entities changes only modestly over the sample period. It deteriorates by 1.10 grades from 5.98 (A) to 7.08 (A-), measured on a 17 grade scale (1=AAA, 2=AA+, …, 17=CCC+).

An interesting result from the previous section is that, although CDS and loan markets are closely linked, there does not appear to be a similarly strong relationship between bond and loan markets. This is surprising, since CDS and bond spreads both price credit risk. In this section we examine this issue further.

We first add bond prices to our baseline model. Table 5, Panel A, reports the estimation results for the baseline model augmented by lagged corporate bond spread changes.

Insert Table 5 here

The coefficient of bond spread changes is not significant at all, while the CDS-loan relationship is as in the baseline model. Since CDS and bond spread levels are correlated (the Pearson correlation coefficient is 0.72), this result may be partly driven by multicollinearity. Therefore, we repeat the same regression with bond spread changes only. As can be seen from the two rightmost columns in Panel A, we obtain a positive coefficient for bond spread changes of 0.11 but it is only marginally significant. The CDS coefficient of 1.34 estimated earlier is substantially larger, indicating that the link is much stronger for the CDS market. The difference is even more pronounced when the explanatory power of bonds is considered: in comparison to the baseline model (Table 2) the inclusion of bond spreads does not help to increase the adjusted R^2 at all. We conclude that bond spreads contain considerably less loan-specific information than CDS spreads.

Our next step is to study the loan-CDS link and the loan-bond link separately. For this purpose we separately regress loan spread changes on CDS and on bond spread changes (both contemporaneous and lagged). Results are summarized in Table 5, Panel B. Consistent with the baseline model and results from Panel A, we find that lagged CDS spread changes are significantly positively related to loan spread changes while bond spread changes are not significantly linked (neither contemporaneous nor lagged) to loan spread changes. Most striking, comparing the goodness-of-fit of both regressions reveals that the explanatory power of the CDS model (R^2 = 0.34) is roughly three times higher than that of the bond model (R^2= 0.12).

A potential explanation for these results may be that bond prices are not strongly related to loan prices simply because they do not reflect general credit risk well. Therefore, we investigate how CDS and bond spread changes are related to other general (that is not loan-specific) credit risk factors. More specifically, we take important determinants of credit spreads from the stock market (the equity volatility ΔVIX and the S&P 500 returns R_SP500) and debt markets (the five year swap rate ΔSWAP5 and the term premium ΔTERM) to explain both types of credit spreads. Estimation results are presented in Table 5, Panel C. CDS spread changes are significantly positively related to ΔVIX and significantly negatively to R_SP500 and ΔSWAP5. Bond spread changes are significantly positively related to ΔVIX and ΔTERM and significantly negatively to ΔSWAP5. The signs of these factors are in line with theoretical explanations and existing empirical evidence (e.g. Blanco, Brennan and Marsh, 2005). Most interesting in our context, however, is that the R^2 is much higher for the bond spread regression (0.71 vs. 0.42). Estimating the same model with loan spread changes as dependent variable gives a very small R^2 of 0.04 (see also Table 3). Consequently, corporate bond spreads are more strongly related to general credit risk factors than CDS spreads (and loan spreads).

Taken together, the following picture of the relation between loans, bonds, and CDS emerges. Loan markets cannot be well explained by general credit spread determinants. Secondary market spreads from the CDS market can explain loan spreads but secondary market bond spreads cannot. However, this is not due to a better ability of the CDS to price (general) credit risk. In fact, both CDS and bonds relate highly to general credit risk factors (and bonds even more so). Thus, it seems to be that the CDS prices a considerable amount of loan-specific information (that is, information unrelated to general credit risk).[15] This in turn also explains why bonds may be more related to general credit risk factors.

There are good economic explanations for the better ability of CDS markets to generate loan-specific information and the better ability of the bond market to reflect general credit risk. Market participants in CDS and bond markets are rather different. Bonds mainly represent buy-and-hold investments for institutional investors. These institutions may not have loan exposures and hence bond markets mainly reflect general market risk. By contrast, in the CDS markets banks do a large part of the trading. They have incentives to exploit their informational advantage, leading to loan-information being revealed in the CDS market. In a related paper, Acharya and Johnson (2005) have provided evidence consistent with such insider trading by banks. Banks, moreover, also have a demand for hedging their loan exposures. They now increasingly use CDS for hedging,[16] further causing loan market conditions to be priced into the CDS market. By contrast, large-scale hedging is practically unfeasible in bonds markets, as it is difficult to go short in bonds (e.g. Hull, Predescu and White, 2004, Blanco, Brennan and Marsh, 2005).

3.4. Lag length and responsiveness of loan spread changes over time

The previous analysis has shown that loan spreads respond to previous-month information from the CDS market. In this section we take a closer look at the lag relationship and how it evolves over time. We also address the question of whether loan spreads have perhaps become more responsive to CDS markets over time. A faster and stronger response of loan

[15] Examples for loan-specific information are structural changes in the banking sector (like mergers and acquisitions, changes in competition, new regulatory requirements for banks etc.) or changes in the demand for loans (e.g., arising from changes in collateral).

[16] Minton, Stulz and Williamson (2006) analyze the motivation of large U.S. banks to engage frequently in the credit derivatives markets. Consistent with our presumption of credit derivatives being used for hedging, they find that the probability of a bank being a net risk hedger is positively linked to the percentage of commercial and industrial loans in a bank's credit portfolio.

spreads would be consistent with the views expressed by practitioners that banks increasingly make use of CDS information to price loans.

We first take a rough approach to check whether the lag relationship has changed over time. We take the baseline model and add the contemporaneous average monthly CDS spread change ΔC_t as the explanatory variable. We then run separate regressions for the first and the second half of our sample (March 2000 – January 2003 vs. February 2003 – December 2005). In these regressions we use the monthly averages of the contemporaneous CDS spread (rather than the end-of-month spread) to ensure that it covers the same time period as the loan spread variable (which is also a monthly average). Results are shown in Table 6, Panel A.

Insert Table 6 here

The results indicate a change in the average lag length. In the first half of the sample the coefficient of the lagged CDS spread change is 1.21 and significant but the contemporaneous CDS spread change is insignificant. In the second half of the sample, the coefficient of the lagged CDS spread change becomes insignificant and the contemporaneous one becomes positive and significant. This suggests that information from CDS markets is incorporated into loan decisions faster. Moreover, Panel A also shows that the estimated coefficient of ΔC_t takes a value of 2.06 in the second half, while the significant CDS coefficient in the first half was 1.21. This indicates that loan spread changes have also become more responsive to CDS spread changes in recent years.

Our next test takes are more refined look at the lag relationship, using weekly data from the CDS market. To this end we transform daily CDS spreads into end-of-week CDS spreads[17] and calculate the corresponding monthly first differences (denoted ΔC_w). We then

[17] These end-of-week variables are constructed from splitting the month into four equal periods (whenever possible) and hence do not literally refer to the end of a calendar week.

include various versions of these spreads into our loan regressions. Again, we split the sample in two sub-periods. For each sub-period we run eight regressions, each including a different end-of-week CDS spread change, starting with the change between the last week of the current month and the last week of previous month and finishing with the change between the first week of the previous month and the first week of the month before. Results are displayed in Table 6, Panel B.

For the first half of the sample we obtain significantly positive coefficients for ΔC_w for weeks 3, 2, 1 of the current month and week 4 of the previous month. The maximum coefficient of 1.40 is found for week 4 of the previous month. Note also that the significant coefficients decrease as they become more recent. For the second half of the sample, only coefficients from the current month are significant. A comparison between the sub-samples suggests that the loan market now reacts more to recent CDS information. For example, while the maximum coefficient for ΔC_w in the first half is observed in week 4 of the previous month, the same coefficient is no longer significant in the second half. Instead, CDS information from the current month becomes more important in terms of statistical and economic significance. The maximum coefficient is now observed for week 3 of the current month. Analyzing the R^2 values for the different regressions gives a similar picture.

To shed more light on the evolution of the loan market reaction to CDS spreads over time we carry out a rolling window analysis of the model in Panel A. We start with the first half of the sample (March 2000 – January 2003) and then roll forward a window of 35 observations on a month-by-month basis until we obtain the second half of the sample period (February 2003 – December 2005). Regression results are displayed in Figure 2.

Insert Figure 2 here

The rolling window analysis indicates a relatively clear pattern. Figure 2a indicates that the coefficient of the lagged end-of-month CDS spread change is above one for a long period and then decreases. At the time where the lower bound of the 95% confidence interval (the shaded area above and below the solid line) reaches zero, the coefficient is no longer statistically significantly different from zero. From Figure 2b it can be seen that the coefficient of the contemporaneous CDS spread change is near to zero for most of the time but then rises quickly above one in the last of the rolling windows. Overall, the analysis indicates that the link between CDS and loan markets has been a lead-lag relationship during windows 1-23. Then, there is a period of transition of six months with no clear lag. Starting from window 30 (July 2002) we observe a contemporaneous link between both markets. Interestingly, during that period many firms experienced credit rating downgrades and there was a sharp increase in CDS spreads.

We now analyze whether the move towards a more contemporaneous loan pricing relationship is unique to CDS spreads, or whether it also applies to other determinants of credit spreads. To examine this issue, we compare loan spread regressions which include contemporaneous credit spread determinants with ones where the determinants are lagged. We do this for the first and the second subperiod and then draw conclusions from how the goodness-of-fit of the regressions has changed over time.[18] For the regressions we use the macro model without CDS spread changes (see Model III in Table 3) and a simple CDS model, which includes only the lagged dependent variable and CDS spread changes.

Insert Table 7 here

[18] Since there are now a variety of explanatory variables, it is less instructive to draw conclusions about the strength of the lead-lag relationship from estimated coefficients (as we did in Table 6 for CDS spreads).

It can be seen that for the macro model (the model without the CDS spread changes) the regression with lag 1 of the explanatory variables leads to a higher R^2 in both sub-periods. Moreover, the difference in the R^2 remains basically unchanged in the sub-periods (0.27 versus 0.22 in the first, and 0.20 versus 0.16 in the second half). Hence, there does not seem to be a shift towards a contemporaneous relationship between these variables and loan spread changes. In contrast, for the CDS model (which includes only CDS spread changes as explanatory variables) we find a considerably higher goodness-of-fit for lagged CDS spreads (relative to contemporaneous ones) in the first half (0.43 versus 0.18). The opposite is true in the second half of the sample (0 versus 0.16), where the ability of lagged CDS spread changes to explain loan spread changes completely vanishes in favor of a contemporaneous loan-CDS relationship. These results suggest that the faster response of loan pricing is unique to information from the CDS markets.

Summarizing, the analysis in this section provides evidence that during the last years loan markets have started to reflect information from the CDS markets faster and have also become more responsive to CDS information. This is consistent with a growing importance of CDS for loan pricing. It provides no support for the alternative hypothesis that there have been changes in CDS markets which have left loan pricing unaffected. This is because CDS markets have most likely become more efficient in recent years. Hence, information should be incorporated into CDS markets faster. If loan pricing had not changed at all, the lag between CDS and loan markets should then have increased, which is the opposite of what we observe.

4. Conclusions

The markets for credit derivatives have provided banks with new instruments for hedging and pricing loans. They have also given them an opportunity to trade on the information they have gained in the lending process. In this paper we studied the relationship between the markets for loans and credit derivatives. We found that prices on credit derivatives, as observed in credit default swaps (CDS), are strongly linked with the spreads on new syndicated loans. They have also become the dominant factor in explaining these spreads. In particular, CDS prices explain loans much better than the spreads on same rated bonds, the natural alternative loan pricing benchmark. This is both suggestive of an incorporation of lending information into CDS prices through the banks' active role in CDS markets and an impact of CDS on loan prices.

We also found that, over time, loan rates reflect more current conditions in CDS markets, rather than being based on past CDS prices. However, at the same time, non-CDS information does not seem to get incorporated faster into loan decisions. This indicates that the presence of the CDS markets has influenced banks' loan pricing behavior, consistent with the fact that banks have started to use routinely CDS to hedge credit risk and to use pseudo CDS prices as a loan pricing benchmark. Taken together, our results are thus suggestive of important relationships between loan markets and the new markets for credit derivatives.

If loan rates continue to be more based on actual conditions in CDS markets, this may lead to an overall more market-oriented pricing of loans. Such a development should be welcomed in that it may lead to a more efficient allocation of resources in the financial system. However, there are also downsides. For example, it may induce more volatility into the financing costs of firms. A more market-oriented pricing also suggests that banks may be less willing to subsidize firms which experience adverse credit conditions. This may impose significant costs for firms reliant on bank financing. There are also potential implications for financial stability. Banks have been credited with exercising a stabilizing influence over the business cycle since their loan decisions are less procyclical than market financing. An increasing dependence of loan rates on current conditions in CDS markets may reduce this effect and may potentially amplify business cycle volatility.

Our study has analyzed the pricing of syndicated loans to U.S. firms. Syndicated loans are typical for larger firms, for which relationship-based pricing arguably play less of a role. An interesting question for further research would be to study how CDS markets interact with the pricing of loans which are based on strong bank-firm relationships, for example by studying loan rates in more bank-based financial systems, such as Germany and Japan.

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Table 1: Descriptive statistics of key variables

This table reports the mean, standard deviation (SD), minimum, median, and maximum of spread levels and first differences of spread levels (spread changes) in basis points. The column DF indicates the p-value from a Dickey-Fuller test of the null hypothesis "time series is non-stationary" while the column KPSS reports the result from a Kwiatkowski, Phillips, Schmidt, Shin-test of the null hypothesis "time series is stationary".

Type	Description	Var.	Mean	SD	Min	Median	Max	DF	KPSS
Levels	Loan spread B	L^{B}	344.51	61.44	235.23	358.25	511.07	0.831	No
	Loan spread BB	L^{BB}	277.38	63.55	168.54	291.62	425.00	0.798	No
	Bond spread B eom	$B^{B, eom}$	556.12	219.11	238.09	557.19	1046.19	0.671	No
	Bond spread BB eom	$B^{BB, eom}$	339.33	127.61	156.09	325.07	666.19	0.537	No
	CDS spread eom	C^{eom}	82.47	37.67	24.27	70.95	199.53	0.314	No
	CDS spread mean	C	82.26	37.06	27.84	71.16	187.83	0.336	No
First differences	Loan spread B change	ΔL^{B}	-1.26	29.83	-96.70	0.00	96.20	0.000	Yes
	Loan spread BB change	ΔL^{BB}	-1.59	27.60	-81.25	-2.03	80.00	0.000	Yes
	Bond spread B eom change	$\Delta B^{B, eom}$	-2.10	75.21	-204.22	-7.67	257.92	0.000	Yes
	Bond spread BB eom change	$\Delta B^{BB, eom}$	-0.19	45.91	-94.11	-9.15	170.37	0.000	Yes
	CDS spread eom change	ΔC^{eom}	0.52	14.55	-35.10	-1.03	57.23	0.000	Yes
	CDS spread mean change	ΔC	0.49	11.94	-33.61	-0.39	46.77	0.000	Yes

Table 2: The baseline model

The dependent variable is the loan spread change $\Delta L^{B}{}_{t}$, explanatory variables are the lagged dependent variable $\Delta L^{B}{}_{t-1}$ and the lagged end-of-month CDS spread change $\Delta C^{eom}{}_{t-1}$. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: $\Delta L^{B}{}_{t}$	Coeff.		p-val.
$\Delta L^{B}{}_{t-1}$	-0.26	**	0.035
$\Delta C^{eom}{}_{t-1}$	1.14	***	0.000
Const.	-1.72		0.567
Obs.	70		
R^2	0.3338		
Adj. R^2	0.3140		

Table 3: Model extensions with macro variables

The dependent variable is the loan spread change ΔL^{B}_{t}. Explanatory variables are the lagged dependent variable ΔL^{B}_{t-1}, the lagged end-of-month bond spread change $\Delta B^{B,\ eom}_{t-1}$, the lagged change of the implied volatility ΔVIX_{t-1}, the lagged return of the S&P 500 index R_SP500_{t-1}, the lagged change of the five year swap rate $\Delta SWAP5_{t-1}$, the lagged change of the term premium $\Delta TERM_{t-1}$ (10 year risk-free rate – 1 year risk-free rate), the lagged change of the consumer price index ΔCPI_{t-1}, the lagged change of industrial production ΔIP_{t-1}, the lagged change of the percentage share of downgrades by the three major rating agencies $\Delta DOWN_{t-1}$, the lagged relative bid-ask spread from the CDS market $\Delta RELS_{t-1}$, and the lagged end-of-month CDS spread change ΔC^{eom}_{t-1}. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.:	Model I			Model II			Model III			Model IV		
ΔL^{B}_{t}	Coeff.		p-val.	Coeff.		p-val.	Coeff.		p-val.	Coeff.		p-val.
ΔL^{B}_{t-1}	-0.24	*	0.061	-0.25		0.106	-0.27	**	0.047	-0.27	**	0.015
$\Delta B^{B,\ eom}_{t-1}$	-0.10		0.117	-0.06		0.458	-0.04		0.621	-0.10		0.127
ΔVIX_{t-1}	2.67		0.167	5.44	***	0.006	3.37		0.215	1.42		0.583
R_SP500_{t-1}							-202.68		0.292	-144.97		0.414
$\Delta SWAP5_{t-1}$							10.83		0.478	10.23		0.461
$\Delta TERM_{t-1}$							0.02		0.893	-0.06		0.712
ΔCPI_{t-1}							8,17		0.177	7.61		0.147
ΔIP_{t-1}							-1.60		0.816	-3.18		0.614
$\Delta DOWN_{t-1}$				25.29	*	0.075	13.25		0.496	17.08		0.326
$\Delta RELS_{t-1}$							261.98		0.411	269.57		0.362
ΔC^{eom}_{t-1}	1.08	***	0.000							1.05	***	0.001
Const.	-1.47		0.623	-0.28		0.929	-3.28		0.447	-3.96		0.316
Obs.	70			70			70			70		
Adj. R^2	0.334			0.231			0.230			0.341		

Table 4: Vector error correction model for loan spread changes

Panel A: Cointegration equation

The cointegration equation reflects the long-run relationship across markets and is equivalent to a regression model with loan spread levels as dependent variable and contemporaneous bond and CDS spread levels as explanatory variables. The displayed coefficients are normalized to obtain a coefficient of 1.0 for loan spread changes. Results are based on the Johansen maximum likelihood estimation. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: EC_t	Coeff.		p-val.
L^B_t	1.00		---
B^B_t	-0.33	***	0.000
C_t	0.44	*	0.081
Const.	-196.04		---
Obs.	70		

Panel B: VECM results for loan spread changes

VECM results indicate the short-run adjustment across markets. This tables reports findings for the equation with loan spread changes ΔL^B_t as dependent variable and the error correction term EC_t (from the cointegration equation in Panel A), the lagged dependent variable ΔL^B_{t-1}, the lagged end-of-month bond spread changes $\Delta B^{B,eom}_{t-1}$, and the lagged end-of-month CDS spread changes ΔC^{eom}_{t-1} as explanatory variables. Results are based on the Johansen maximum likelihood estimation. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: ΔL^B_t	Coeff.		p-val.
EC_t	-0.27	***	0.004
ΔL^B_{t-1}	-0.12		0.215
$\Delta B^{B,eom}_{t-1}$	-0.10	**	0.051
ΔC^{eom}_{t-1}	1.26	***	0.000
Const.	-2.52		0.375
Obs.	70		
R^2	0.4212		

Table 5: The influence of CDS and bond spread changes on loan spread changes

Panel A: Baseline model with bond spread changes

The dependent variable is the loan spread change $\Delta L^{B}{}_{t}$, explanatory variables are the lagged dependent variable $\Delta L^{B}{}_{t-1}$, the lagged end-of-month bond spread change $\Delta B^{B,\ eom}{}_{t-1}$, and the lagged end-of-month CDS spread change $\Delta C^{eom}{}_{t-1}$. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

	Bond and CDS spreads			Bond spreads only		
Dep. Var.: $\Delta L^{B}{}_{t}$	Coeff.		p-val.	Coeff.		p-val.
$\Delta L^{B}{}_{t-1}$	-0.25	*	0.057	-0.23		0.164
$\Delta B^{B,\ eom}{}_{t-1}$	-0.05		0.303	0.11		0.100
$\Delta C^{eom}{}_{t-1}$	1.34		0.000			
Const.	-1.93	***	0.533	-0.84		0.810
Obs.	70			70		
R^2	0.3450			0.1072		
Adj. R^2	0.3150			0.0810		

Panel B: The loan-CDS and loan-bond relationship in separate regressions

The dependent variable is the loan spread change $\Delta L^{B}{}_{t}$ and the explanatory variables are the contemporaneous and lagged CDS spread changes (ΔC_t, $\Delta C^{eom}{}_{t-1}$) and bond spread changes (ΔB_t, $\Delta B^{B,\ eom}{}_{t-1}$). P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

	Loan-CDS			Loan-bond		
Dep. Var.: $\Delta L^{B}{}_{t}$	Coeff.		p-val.	Coeff.		p-val.
$\Delta L^{B}{}_{t-1}$	-0.22	*	0.092	-0.23		0.156
ΔB_t				0.19		0.298
$\Delta B^{B,\ eom}{}_{t-1}$				0.10		0.154
ΔC_t	0.34		0.285			
$\Delta C^{eom}{}_{t-1}$	0.96	***	0.003			
Const.	-1.74		0.562	-1.02		0.772
Obs.	70			70		
R^2	0.3435			0.1183		
Adj. R^2	0.3140			0.0780		

Panel C: Determinants of CDS and bond spread changes

The dependent variables are the CDS and bond spread changes ΔC_t and ΔB_t. Explanatory variables are the contemporaneous change of the implied volatility ΔVIX_t, the return of the S&P 500 index R_SP500_t, the change of the five year swap rate $\Delta SWAP5_t$, and the change of the term premium $\Delta TERM_t$ (10 year risk-free rate – 1 year risk-free rate). P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.:	ΔC_t			ΔB_t		
	Coeff.		p-val.	Coeff.		p-val.
ΔVIX_t	1.29	**	0.013	1.58	**	0.043
R_SP500_t	-88.81	*	0.069	-32.69		0.626
$\Delta SWAP5_t$	-8.24	*	0.053	-47.94	***	0.000
$\Delta TERM_t$	0.07		0.272	0.24	***	0.000
Const.	0.38		0.705	-074		0.515
Obs.	70			70		
R^2	0.4239			0.7141		
Adj. R^2	0.3890			0.6970		

Table 6: Responsiveness of loan spread changes to CDS spread changes over time

Panel A: Results for the baseline model by sub-periods

The dependent variable is the loan spread change ΔL^B_t, explanatory variables are the lagged dependent variable ΔL^B_{t-1}, the contemporaneous average monthly CDS spread change ΔC_t, and the lagged end-of-month CDS spread change ΔC^{eom}_{t-1}. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

	First half of sample			Second half of sample		
Dep. Var.: ΔL^B_t	Coeff.		p-val.	Coeff.		p-val.
ΔL^B_{t-1}	-0.31	*	0.084	-0.00		0.983
ΔC_t	-0.01		0.965	2.06	**	0.016
ΔC^{eom}_{t-1}	1.21	***	0.001	-0.85		0.168
Const.	-1.06		0.820	-1.71		0.603
Obs.	35			35		
R^2	0.4662			0.2451		

Panel B: Average lag length and responsiveness of loan spread changes by sub-periods

The dependent variable is the loan spread change ΔL^B_t, explanatory variables are the lagged dependent variable ΔL^B_{t-1}, the lagged bond spread changes ΔB_{t-1}, and the lagged end-of-week CDS spread change ΔC_w from the indicated month and week respectively. P-values are calculated from robust standard errors. *** , **, * denote that the coefficient is statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: ΔL^B_t		First half of the sample				Second half of the sample			
Month	Week w	Coeff. of ΔC_w		p-val.	R^2	Coeff. of ΔC_w		p-val.	R^2
Current month	4	0.17		0.659	0.1127	1.39	**	0.046	0.2031
	3	0.62	**	0.042	0.1808	1.53	***	0.003	0.3053
	2	0.81	***	0.006	0.2448	1.00	***	0.001	0.1753
	1	1.02	***	0.008	0.3036	1.04	**	0.013	0.1379
Previous month	4	1.40	***	0.000	0.4286	0.58		0.209	0.0383
	3	0.82		0.200	0.1848	0.89		0.170	0.0796
	2	-0.03		0.940	0.1072	0.92		0.240	0.1237
	1	-0.62		0.289	0.1623	0.93		0.335	0.0988

Table 7: Analysis of lead-lag vs. contemporaneous relationships over time

The first line ("Macro model *without* …") of this table reports adjusted R^2-values (simple R^2-values in parentheses) from two types of regressions models for the first and second half of the sample. First, we regress loan spread changes ΔL^B_t on the lagged dependent variable ΔL^B_{t-1}, the lagged end-of-month bond spread change $\Delta B^{B,\ eom}_{t-1}$, the lagged change of the implied volatility ΔVIX_{t-1}, the lagged return of the S&P 500 index R_SP500_{t-1}, the lagged change of the five year swap rate $\Delta SWAP5_{t-1}$, the lagged change of the term premium $\Delta TERM_{t-1}$, the lagged change of the consumer price index ΔCPI_{t-1}, the lagged change of industrial production ΔIP_{t-1}, the lagged change of the percentage share of downgrades by the three major rating agencies $\Delta DOWN_{t-1}$, and the lagged relative bid-ask spread from the CDS market $\Delta RELS_{t-1}$. Moreover, the same model is re-estimated with contemporaneous values of the explanatory variables. The second line ("Simple model *with* …") reports adjusted R^2-values (simple R^2-values in parentheses) from regressions with loan spread changes ΔL^B_t as dependent variable and the lagged dependent variable ΔL^B_{t-1} as well as lagged or contemporaneous CDS spread changes (ΔC^{eom}_{t-1} or ΔC_t) as explanatory variables for the first and second half of the sample.

	First half of sample			Second half of sample		
Model and variable specification	Lag 1		Contemporaneous	Lag 1		Contemporaneous
Macro model *without* CDS spread changes	0.267 (0.4827)	>	0.224 (0.4521)	0.196 (0.4325)	>	0.165 (0.4107)
Simple model *with* CDS spread changes only	0.433 (0.4662)	>	0.178 (0.2268)	-0.011 (0.0489)	<	0.162 (0.2111)

Figure 1: Time series of loan, bond and CDS spread levels

All spread levels are presented in basis points. Loan spreads represent monthly averages of loans to U.S. corporates with an S&P rating of BB. Bond Spreads are monthly averages of the Lehman Brothers U.S. corporate high-yield index for rating grades BB and are calculated above the five year swap rate. CDS spreads refer to the average of end-of-month spreads from all references entities in our sample and are in this figure proportionally scaled to reflect the same average default risk as loan spreads.

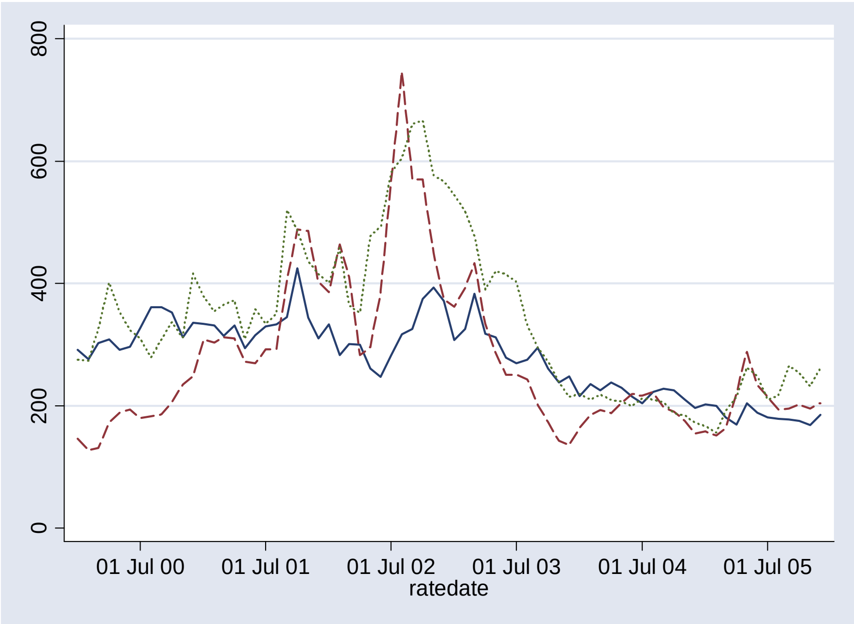

Figure 2: Results from the rolling window analysis

The solid lines represent the simultaneously estimated coefficients ΔC^{eom}_{t-1} and ΔC_t from 36 rolling window regressions (w =1, …, 36) with loan spread changes as dependent variable. Shaded areas correspond to a 95% confidence interval. Each regression is based on 35 observations. Window 1 refers to the period March 2000 – January 2003 (first half of the sample) and window 36 to the period February 2003 – December 2005 (second half of the sample).

Figure 2a: The coefficient of the lagged end-of-month CDS spread change

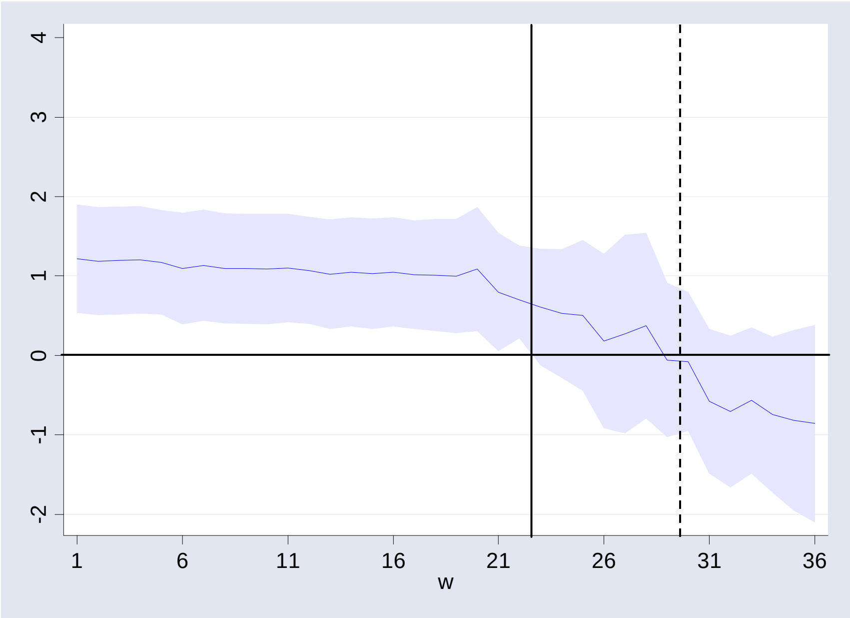

Figure 2b: The coefficient of the contemporaneous average CDS spread change