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How Much Do Banks Use Credit Derivatives to Hedge Loans?

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Abstract Before the credit crisis that started in mid-2007, it was generally believed by top regulators that credit derivatives make banks sounder. In this paper, we investigate the validity of this view. We examine the use of credit derivatives by US bank holding companies with assets in excess of one billion dollars from 1999 to 2005. Using the Federal Reserve Bank of Chicago Bank Holding Company Database, we find that in 2005 the gross notional amount of credit derivatives held by banks exceeds the amount of loans on their books. Only 23 large banks out of 395 use credit derivatives and most of their derivatives positions are held for dealer activities rather than for hedging of loans. The net notional amount of credit derivatives used for hedging of loans in 2005 represents less than 2% of the total notional amount of credit derivatives held by banks and less than 2% of their loans. We conclude that the use of credit derivatives by banks to hedge loans is limited because of adverse selection and moral hazard problems and because of the inability of banks to use hedge accounting when hedging with credit derivatives. Our evidence raises important questions about the extent to which the use of credit derivatives makes banks sounder.

Keywords Credit derivatives · Hedge · Loans · Banks

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1 Introduction

Credit derivatives are bilateral financial contracts with payoffs linked to a credit related event such as non-payment of interest, a credit downgrade, or a bankruptcy filing. A bank can use a credit derivative to transfer some or all of the credit risk of a loan to another party or to take on additional risks. In principle, credit derivatives are tools that enable banks to manage their portfolio of credit risks more efficiently. The promise of these instruments has not escaped regulators and policymakers. In various speeches as the head of the Federal Reserve System, Alan Greenspan concluded that credit derivatives and other complex financial instruments have contributed "to the development of a far more flexible, efficient, and hence resilient financial system than existed just a quarter-century ago." (Greenspan 2004). He further stated in the same speech that "The new instruments of risk dispersion have enabled the largest and most sophisticated banks in their credit-granting role to divest themselves of much credit risk by passing it to institutions with far less leverage." Recently, however, the positive view of the role of credit risk transfer has been criticized and credit derivatives have been blamed for part of the difficulties associated with the subprime credit crisis. For instance, Partnoy and Skeel (2006) argue that credit derivatives "create the risk of systemic market failure," partly because they reduce borrowers' incentives to monitor and hence "fuel credit expansion." More recently, an article in the *Wall Street Journal* on the credit crisis stated that "Much of the trouble is in the opaque 'credit derivatives' markets."[1] Another article in *Time* stated in March 2008 that "A meltdown in the CDS market has potentially even wider ramifications nationwide than the subprime crisis."[2] This debate on the role of credit derivatives raises the question of how much banks actually use credit derivatives to manage risk and whether their credit derivatives positions reduce or increase systemic risk.

The largest sector of the credit derivatives market is the credit default swap market where the most liquid individual names on which credit derivatives are written are large US investment grade firms, foreign banks, and large multinational firms, but much of the most recent growth of the market has been in index derivatives (Fitch 2006). Statistics from the Bank for International Settlements (BIS) show that the market for credit default swaps has grown dramatically in recent years. The notional amount of credit default swaps was $698 billion at the end of June 2001. This amount was ten times larger by the end of June 2004 and grew to $57,894 billion by December 2007. Despite the growth of the credit derivatives market, we know little about how banks use credit derivatives to change their credit exposures. In particular, we know of no published academic research which investigates whether banks systematically use credit derivatives to reduce their overall credit risk.[3] In this paper, we examine the use of credit derivatives by U.S. bank holding companies with total assets greater than one billion dollars for the period from 1999 to 2005.

The use of credit derivatives is not widespread among banks, but the amount of credit derivatives held by the banks that use credit derivatives is extremely large at the end of our sample period. At the end of our sample period, there are 395 banks in our sample and only 23 of these banks, or 5.82%, report the use of credit derivatives. The total amount of credit

[1] "Why this 'credit crisis' hits everyone," by Dave Kansas, *Wall Street Journal Online*, October 5, 2008.

[2] "Credit default swaps: The next crisis," by Janet Morrissey, *Time*, March 17, 2008.

[3] Two papers on this topic were circulated on SSRN subsequently to the posting of the first version of this paper (Ashraf et al. 2006 and Mahieu and Xu 2007). These papers have results consistent with ours about which banks use credit derivatives. They do not have the precise quantification of the extent of use of credit derivatives for hedging purposes we have in this paper.

protection bought and sold by these 23 banks is $5,526 billion, an amount which exceeds the total amount of loans held by banks at the time by 20%.

Through a detailed study of the disclosures of these banks, we find that most of the gross amount of positions they have on their books is for dealer activities and not for risk management. With the available data, the best proxy for whether a bank uses credit derivatives to hedge its loan portfolio is whether the bank is a net buyer of credit protection. In 2005, the last year in our sample, 16 of the 23 banks using credit derivatives (4.05% of the banks in 2005) are net buyers of credit protection.

After documenting that the use of credit derivatives is limited to a small number of banks and that the net transfer of credit risk from the banking system using credit derivatives is small, we investigate why this is so. We first compare banks that are net buyers of protection to the other banks in our sample. Consistent with existing empirical research on derivatives use by financial and non-financial firms, net buyers of protection are larger firms.[4] While the two groups of banks are not different with respect to the average ratio of total loans to total assets, they differ with respect to the composition of their loan portfolios. Net buyers of protection have larger fractions of commercial and industrial (C&I) loans and foreign loans than non-users and a lower fraction of loans secured by real estate than non-users. There is evidence for the medians (but not for the means) that net buyers of protection have lower capital ratios and a higher ratio of risk-based assets to total assets. Finally, a larger percentage of banks that are net buyers of protection also use interest-rate, foreign exchange, equity, and commodity derivatives.

We examine the extent to which the use of credit derivatives to hedge loans can be predicted using existing theories about why firms hedge. Hedging theories typically predict that firms with a greater probability of costly distress are more likely to hedge.[5] If higher profitability is associated with a lower probability of financial distress, then the likelihood of a bank using credit derivatives to hedge should be lower for more profitable firms. Using probit regression analysis, we find this to be the case. The likelihood of using credit derivatives is negatively related to a bank's equity capital, tier I risk capital, and net interest margin. Consistent with existing research on banks' and non-financial firms' use of interest-rate, foreign exchange, and commodity derivatives, we find that an increase in bank size is positively and significantly associated with the likelihood of hedging with credit derivatives. From these findings, it follows that the use of credit derivatives is consistent with the predictions of hedging theories.

We also study whether the likelihood of hedging with credit derivatives is related to the type of loans a bank makes. We find that banks are more likely to be net buyers of credit protection if they have more C&I loans in their portfolio and they originate foreign-denominated loans. However, while statistically significant, the point estimates on the C&I loan variable imply small economic increases in the likelihood of hedging with credit derivatives.

Banks also can manage the credit risk of their loans by selling loans directly or through loan securitization. We find that banks that securitize loans or sell loans are more likely to be net buyers of credit protection. Consequently, the various tools banks can use to reduce their credit risk appear to be complements rather than substitutes.

Our results provide an explanation for the limited use of credit derivatives. Larger bank holding companies are more likely to have exposures to larger investment grade US firms, foreign banks and foreign multinational firms and are more likely to be net buyers of credit

[4] See, for example, Nance et al. (1993), Géczy et al. (1997), Mian (1996) and Graham and Rogers (2002), among others.

[5] See Stulz (2003) for a review of hedging theories.

protection than are small bank holding companies. A bank choosing to manage credit risk exposures with credit derivatives must consider liquidity costs, transactions costs, and basis risk. As mentioned previously, the most liquid names in the credit default swap market (the largest sector of the credit derivatives market) are large investment grade US firms, foreign banks, and large foreign multinational companies. This is not surprising since adverse selection and moral hazard problems are substantial for loans to firms where banks have their greatest comparative advantage over the capital markets (see Duffee and Zhou 2001). These adverse selection and moral hazard problems make the market for credit derivatives less liquid for single-name protection for the riskier credits. Evidence supportive of our conclusion is that the banks which report hedging by loan rating report proportionately less hedging for the riskier loans they have. Recent research shows that firms use derivatives less when they cannot qualify for hedge accounting (see Lins et al. 2007). Though we have no direct evidence showing the economic importance of this issue, we note that banks report that they cannot use hedge accounting when they use credit derivatives to hedge. As a result, hedging with credit derivatives can actually increase the volatility of a bank's earnings, which is likely to deter usage of credit derivatives as well.

Our evidence raises important questions about the view that credit derivatives reduce systemic risk because they enable banks to reduce the riskiness of their loan portfolios. Since most banks' credit derivatives positions result from dealer activities rather than from loan hedging, credit derivatives positions can reduce systemic risk only if the positions resulting from dealer activities have a sufficiently small amount of risk compared to the risk reduction brought about through loan hedging. For these positions to pose little risk, it is not enough for banks to have a so-called matched book, where they simultaneously buy and sell protection. This is because the risk of a matched book can be large if the bank is exposed to significant counterparty risk on the side of its books where it is supposed to receive payments. Throughout 2008, concerns about counterparty risk in credit derivatives have been a significant issue. For instance, AIG was a counterparty on credit default swaps with many significant financial institutions, so that a collapse of AIG would have created systemic risk. If the dealer activities create substantial risk for banks, the risk reduction from loan hedging could be more than offset by the risk created by other credit derivatives positions. Further research is therefore required to evaluate the systemic risk implications of credit derivatives.

This paper proceeds as follows. Section 2 describes the sample and investigates the extent to which banks use credit derivatives. Section 3 discusses testable hypotheses explaining the use of credit derivatives for hedging based on theories of risk management and banking intermediation. Section 4 examines derivatives use by individual banks and shows what they disclose about their use of credit derivatives. Section 5 presents our empirical results on why banks use credit derivatives. Finally, Section 6 concludes.

2 Sample description

We construct our sample of banks from the Federal Reserve Bank of Chicago Bank Holding Company database.[6] Using this database, we select all commercial bank holding companies with total assets greater than $1 billion (book value) and non-missing data on credit derivatives use for fiscal year-ends 1999 to 2005. We then exclude banks which are major subsidiaries of foreign banks and other domestic bank holding companies. A bank is classified as a major subsidiary if at least 50% of its shares are owned by another domestic bank

[6] http://www.chicagofed.org/economicresearchanddata/data/bhcdatabase/index.cfm

holding company or foreign bank. The sample includes 260 banks in 1999 and 395 in 2005. The average amount of total assets for the banks in the sample is $23 billion in 2005, but the median is only $2 billion, reflecting the extraordinarily skewed distribution of bank sizes.

To examine the use of derivatives by banks, we report in Table 1 selected descriptive statistics on banks' use of derivatives, bank loan sales, and securitization activities for year-ends 2001 to 2005. Data on banks' use of derivatives are from Schedule HC-L of banks' FR Y-9C filings by bank holding companies (see Appendix 1 for data details).

Credit derivatives include "credit default swaps, total rate of return swaps, synthetic collateralized loan, debt, and commercial paper obligations, and other credit derivative instruments." (Board of Governors of Federal Reserve 2002). Table 1 shows that over our sample period, the largest percentage of banks using credit derivatives is in 2001. In that year, 8.16% of the banks used credit derivatives.

Regulators require banks to report separately the notional amount of credit derivatives for which the bank is the guarantor in the credit derivative and for which the bank is the

Table 1 Derivatives, loan sales, and securitization activities. Frequency of derivatives, loan sales, and securitization activities by large US bank holding companies compiled from data reported in Schedule HC-L of the Federal Reserve System's FY-9C filings (Consolidated Financial Statements for Bank Holding Companies) for bank holding companies at year-end. The sample includes all bank holding companies which filed report FR Y-9C with the Federal Reserve System with total assets (book value) equal to or greater than one billion dollars. Credit derivatives are off-balance-sheet arrangements that allow one party (the "beneficiary") to transfer the credit risk of a "reference asset" to another party (the "guarantor"). Credit derivatives include credit default swaps, total rate of return swaps, synthetic collateralized loan, debt, and commercial paper obligations, and other credit derivative instruments." (Board of Governors of Federal Reserve 2002)

	2005 (n=395)	2004 (n=366)	2003 (n=345)	2002 (n=305)	2001 (n=245)
Credit derivatives					
User of credit derivatives	5.82%	5.46%	5.51%	4.92%	8.16%
Seller of credit risk protection	4.30	3.83	3.77	4.26	5.31
Buyer of credit risk protection	4.81	4.92	5.22	3.61	7.35
Loan sales					
Auto loans	0.25%	0.27%	0.87%	0.66%	0.42%
1–4 family residential	23.51	22.40	23.19	22.92	20.75
Credit card receivables	1.77	1.64	1.74	1.66	1.67
Other consumer loans	0.25	0.27	0.87	1.66	1.67
C&I loans	2.27	3.00	3.19	4.32	4.98
Other loans	4.05	4.64	3.48	3.65	3.75
Loan securitization					
Auto loans	3.98%	3.83%	4.64%	6.64%	9.58%
1–4 family residential	8.86	9.56	12.75	15.28	16.94
Home equity lines	3.54	3.28	3.77	3.99	4.96
Credit card receivables	2.20	2.19	2.90	3.65	5.00
Other consumer loans	3.04	3.28	3.48	4.32	5.42
C&I loans	1.77	2.19	3.19	4.30	4.15
Other loans	4.30	4.64	5.22	5.65	5.83
Other derivatives use					
Interest rate	55.95%	56.01%	56.23%	53.09%	51.61%
Foreign exchange	15.19	17.21	19.13	19.34	20.33
Equity	8.35	8.74	8.70	7.54	7.76
Commodity	3.54	3.00	2.90	3.93	4.08

beneficiary in the credit derivative. As the *guarantor* in the transaction, the bank is selling credit risk protection. As the *beneficiary* in the transaction, the bank is buying credit risk protection. As reported in Table 1, except for 2002, the percentage of banks buying credit protection exceeds the percentage of banks selling protection. This means that each year, except for 2002, there are some banks that only buy credit protection.

Table 1 also reports percentages of banks engaged in loan sales and asset securitization, activities which also can be used by banks to manage credit risk exposures. Data on asset sales and asset securitizations are from Schedule HC-S of banks' FR Y-9C filings. Loans secured by one-to-four family residential real estate represent the largest groups of loan sales which is not surprising since banks typically keep only a fraction of the mortgages they originate. Loan sales are small for other types of loans, but C&I loans are typically the second most important type of loans sold. Insofar as securitizations are concerned, again mortgages represent by far the largest category of loans securitized.[7]

Loan sales and securitizations reduce the credit exposures of banks on the loans sold or securitized, but the extent to which the credit exposures fall depends on the extent of the risk transferred. Whereas buying credit protection with a credit default swap on a name for which a bank has an exposure hedges the bank's credit risk to the extent of the notional amount of the credit default swap, loan sales without recourse achieve the same reduction in credit exposure. With securitizations, the same is also true as long as the bank does not keep any of the securities issued in the securitization or does not make implicit guarantees.[8] Overall, it is evident from Table 1 that loan sales and securitization of mortgages are much more pervasive in the banking system than credit derivatives usage.

Among the credit management activities considered in Table 1, selling loans is by far the most common activity among banks. Though we do not report these results in a table, it is interesting to note that in 2005, over 64% of the banks do not use loan sales, asset securitization, or credit derivatives as credit risk management strategies. Using only loan sales is the most frequently used credit risk management strategy. In 2005, 16.75% of bank holding companies reported only using loan sales. By contrast, 4.56% and 1.27% of banks reported using only asset securitization and only credit derivatives, respectively in 2005. Only about 2.5% of the banks engaged in all three credit risk management activities, i.e., securitization, loan sales, and use of credit derivatives.

The last part of Table 1 considers the use of other derivatives by banks. Banks also are required to report the notional amount of the types of interest-rate, foreign exchange, equity, and commodity derivatives used, as well as the notional amounts of total interest-rate, foreign exchange, equity and commodity derivatives used for trading and non-trading purposes. Interest-rate derivatives represent the largest type of derivatives used by banks. Over 50% of the sample banks report using interest-rate derivatives at year-ends 2001 to 2005.[9] Foreign exchange derivatives are the second largest type of derivatives used by banks with less than

[7] A securitization involves a loan sale. The category loan sale therefore only involves the loans sold but not securitized. The data on loan sales and securitizations are only for loan sales and securitizations with recourse or some type of credit enhancement by the bank. As such, the data underestimate the total amount of loan sales and securitizations done.

[8] See Gorton and Souleles (2006) and Franke and Krahnen (2006).

[9] This number is significantly higher than previous studies which focus on all commercial banks and not large bank holding companies. For example, in a recent study of risk management by US commercial banks by Purnanandam (2004), only 5% of the commercial banks reported using interest-rate derivatives. Unlike our sample of bank holding companies with at least $1 billion in total assets, Purnanandam's sample includes all banks with non-missing assets.

20% of the banks reporting the use of foreign exchange derivatives in recent years. Less than ten percent of the sample banks report using equity and commodity derivatives.[10]

Table 2 provides a more detailed look at the use of credit derivatives. This table makes it possible to understand how purchases and sales of credit protection relate to loans of all banks as well as to the loans of the banks that use credit derivatives. Unfortunately, the data we present is limited by the fact that, unlike for other derivatives, banks are not required by bank regulators to report information about the type of credit derivatives instruments used and banks do not have to split the total notional amount of credit derivatives positions between positions taken for trading and non-trading purposes.

Table 2 reports statistics on the notional amounts of credit derivatives used. As reported in panel A, the total notional amount of credit risk protection bought and sold by banks with total assets of at least $1 billion was $5,526 billion at year-end 2005, up from $630 billion at year-end 2002. The total notional amount of credit risk protection bought and sold was 61.16% of the total assets of all sample banks and 120.02% of the total loans of the same banks at year-end 2005, compared to only 9.44% and 18.30%, respectively, in 2002. Thus, the total notional amounts on bank books increased sharply both in dollars and as fractions of loans or assets. However, it is important to note that not all of the derivatives recorded in these calculations represent transfers of risk with counterparties outside the sample. For instance, it is likely that some derivatives bought are sold by other banks in the sample. We have no way of knowing when that is the case.

As a group, buyers and sellers of credit risk protection represent a large fraction of the sample's total assets and total loans. The total amount of assets for these banks represents over 60% of the total assets for all sample banks. The total loans of buyers and sellers of credit risk protection similarly represent over 60% of total loans of sample banks in most sample years. Hence, while few banks hold credit derivatives, those that do own two thirds of the assets of all banks in our sample.

In the following, we use a bank's net purchase of credit protection as a measure of the extent to which the bank uses credit derivatives to hedge credit risk. This measure is a reasonable estimate because a net purchase reduces the bank's exposure to credit risk in general, but this measure has at least three important limitations. First, a bank could have a net purchase of credit protection as part of its dealer activities. Second, the simultaneous purchase and sale of credit protection on different names could also decrease the bank's exposure to credit risk by diversifying its exposures, but we have no way to measure this effect. Third, it ignores basis risk that could arise from net purchases of credit protection to names other than the names in the bank's credit portfolio. The last two limitations cannot be addressed with the existing data, but an investigation of banks' disclosures of credit hedging, which we undertake in Section 4, can help address the first issue.

Panel B shows that the net amount of protection bought relative to total loans outstanding by the banks in our sample in 2005 is 10.62%. In contrast, this percentage was 1.70% in 2002, this shows an almost tenfold increase from 2002 to 2005, which would be consistent with credit derivatives playing a dramatically greater risk transfer role towards the end of our sample period. The problem with reaching this conclusion is that the

[10] While not reported in Table 2, data on the breakdown of derivatives use for trading and non-trading purposes show that for banks that report using interest-rate derivatives, interest-rate derivatives for trading purposes represent only 14% of the total notional of interest-rate derivatives used by these banks. In contrast, for equity and commodity derivatives users, derivatives used for trading purposes represent, on average, 39.3% and 78.6% of total equity and commodity derivatives. About 54% of the banks which use foreign exchange derivatives use them for trading purposes. These patterns and those reported in Table 2 are not surprising given that interest-rate exposure is the largest type of exposure faced by banks.

Table 2 Credit derivatives use. Selected descriptive statistics on credit derivatives use by large US bank holding companies compiled from data reported in Schedules HC-L and HC-S of the Federal Reserve System's FY-9C filings (Consolidated Financial Statements for Bank Holding Companies) for bank holding companies at year-end. The sample includes all bank holding companies which filed report FR Y-9C with the Federal Reserve System with total assets (book value) equal to or greater than one billion dollars. Data are obtained from Federal Reserve Bank of Chicago Bank Holding Companies Database

	2005	2004	2003	2002
Panel A: Total notional amount of credit risk protection bought and sold by all banks				
Notional amount ($US millions) by all banks	$5,526,184	$2,272,604	$988,215	$630,152
Percentage of total assets of all banks	61.16%	27.36%	13.44%	9.44%
Percentage of total loans of all banks	120.02	54.23	26.75	18.30
Buyers and sellers of credit risk protection				
Total assets of buyers and sellers of credit risk protection/total assets of all banks	75.01%	72.67%	66.69%	61.02%
Total loans of buyers and sellers of credit risk protection/total loans of all banks	68.57	66.48	64.42	57.59
Panel B: Total net notional amount of credit risk protection bought by all banks				
Notional amount ($US millions) by all banks	488,948	87,498	$67,720	$58,412
Percentage of total loans of all banks	10.62%	2.09%	1.83%	1.70%
	Average [Median]	Average [Median]	Average [Median]	Average [Median]
Panel C: Total notional amount of credit risk protection bought and sold by users of credit derivatives				
Number of banks using credit derivatives	23	20	19	15
Notional amount ($US millions)	$240,269 [598]	$113,630 [812]	$52,011 [612]	$42,010 [1,818]
Percentage of total loans	49.59% [1.55%]	26.00% [1.55]	21.70% [2.98]	18.27% [5.68]
Panel D: Net notional amount of credit risk protection bought by net buyers of credit risk protection				
Number of banks	16	16	17	8
Net notional amount ($US millions)	$30,559 [579]	$5,469 [385]	$3,984 [166]	$7,301 [1,793]
Percentage of total loans	7.43% [1.41]	2.26% [1.41]	2.84% [0.69]	4.94% [3.06]
Panel E: Net notional amount of credit risk protection sold by net sellers of credit risk protection				
Number of banks	7	4	2	7
Net notional amount ($US millions)	$20.15 [14]	$84 [20]	$8,312 [8,312]	$673 [233]
Percentage of total loans	0.14% [0.11]	0.33% [0.28]	3.13% [3.13]	1.38% [0.64]

percentage of net protection bought relative to total loans is extremely sensitive to one observation in 2005. If Bank of America is omitted from our sample, we instead find that the net notional amount of credit risk protection bought by all banks in 2005 is only 1.54% of bank loans. In Section 4, we will discuss why Bank of America bought so much protection in 2005. Omitting Bank of America, there is no evidence of a positive trend in the net protection bought by the banks in our sample. In fact, the net protection bought as a percentage of all loans is lower in 2005 than it was in any of the three previous years.[11]

[11] One bank holding company is Metlife. It could make sense not to include that bank holding company in our sample since it has an insurance parent. We decided to keep it in the sample so that we would have all domestic bank holding companies that are not subsidiaries of other bank holding companies. Omitting Metlife would not affect our conclusions. In 2005, it would decrease further the net purchase of protection by banks.

The next three panels report averages across banks. Panel C reports the average total notional amount of credit protection bought and sold by users of credit derivatives. The first row shows the number of banks that use credit derivatives. The highest number of banks reporting using credit derivatives is 23 in 2005. This number does not change much in our sample since it is 18 in 1999. The average percentages of total assets and of total loans are smaller than the percentages reported in panel A. This can only be the case if the larger banks have larger percentages of total notional amount to assets and to loans than the smaller banks in the sample.

So far, we have focused on the total notional amount of credit protection bought and sold. We now turn to the banks that are net buyers of credit protection. A recent survey by Fitch (2006) reports that in 2005 banks and broker-dealers were net buyers of protection for an amount of $268 billion, but that amount was lower than the amount for 2004 by $159 billion. The first row of panel D shows the number of banks that are net buyers of credit protection in our sample. This number varies across years. Though it is 16 in 2005, it is only eight in 2002. The average net notional amount of credit protection bought is small compared to the total notional amount of credit bought and sold. The average net notional amount bought by banks in 2005 is roughly $30 billion, which is 12.5% of the average total notional amount bought and sold. For a net protection buyer, the net amount bought represents 7.43% of total loans. Again, however, this percentage is seriously distorted by Bank of America. Without Bank of America, the net notional amount of credit risk protection bought is 3.17% of the buyers' total loans outstanding.

We finally turn to banks which are net sellers of credit protection in panel E. Seven banks are net sellers in 2005. The average percent of net credit protection sold by banks represents 0.14% of the total loans of these banks.

So far we have discussed the extent to which banks use credit derivatives. The next obvious questions are why banks use credit derivatives for risk management and what is the theory that supports this use.

3 The determinants of the use of credit derivatives by banks

There is a growing literature that examines why firms hedge. Some of that literature addresses directly issues concerning banks, but most of it does not. In this section, we use the risk management and banking literature to derive predictions on when banks are likely to use credit derivatives to hedge.

3.1 Why banks hedge?

In Diamond (1984), banks are delegated monitors with comparative advantage in assessing and monitoring the credit risk of obligors. In his model, it is optimal for banks to eliminate all hedgeable risks because the resulting equilibrium ensures that banks monitor credits efficiently and avoid costly liquidations. We would therefore expect banks to hedge all their interest rate risk as well as other risks in which they do not have a comparative advantage such as foreign currency risk. To extend Diamond's (1984) model, one would have to allow for hedging of risks in which the bank has a comparative advantage. The literature that focuses on the comparative advantage of banks in monitoring points out, however, that this comparative advantage of banks is likely to be smaller for loans to large firms because these firms tend to be more transparent and monitored more actively by other market participants. One would expect banks to hedge these credit risks and take on the credit risk in which they

had a relative comparative advantage. Thus, banks with exposures to large investment grade firms or large foreign rated firms might be more likely to hedge these exposures using credit derivatives because they do not have a relative comparative advantage.

More generally, risk management theories emphasize the benefit from hedging risks that increase the expected costs of financial distress (Smith and Stulz 1985). We would therefore expect banks that are more likely to bear greater costs of financial distress to hedge more. In the banking literature, banks benefit from leverage. In particular, deposits can be a source of information (Fama 1985) and a source of cheap capital if competition is imperfect. Further, following Diamond and Rajan (2000), higher leverage increases the incentives of banks to monitor and prevents hold-up problems. Since banks benefit from higher leverage, they can increase their value through hedging since it allows them to have more leverage for a given probability of financial distress. Through hedging, banks also can take on more risks for which they have a comparative advantage for a given probability of financial distress. Schrand and Unal (1998) provide empirical evidence of this phenomenon for savings and loan institutions.

We would expect banks with less capital, banks with more non-performing loans, with weaker liquidity, and with smaller interest margins to be more likely to hedge since such banks are more likely to face financial distress. We investigate the impact of these determinants of hedging with the following variables. Liquidity is measured as cash and liquid assets as a percentage of total assets. Non-performing assets equals the sum of loans over 90 days late and loans not accruing, all divided by total assets. Profitability is measured using the return on assets (net income scaled by total assets), return on equity (net income scaled by total equity capital), and net interest income scaled by total assets. We expect the likelihood of credit derivatives use to be positively associated with non-performing assets and loan loss provisions, and negatively associated with liquidity and profitability.

The presumption is, however, that the banks have a sufficiently high franchise value and that costs of financial distress are significant for them, since they might otherwise be tempted to take on risk in order to take advantage of the deposit insurance put option they hold (James 1988).

3.2 Why do banks use credit derivatives to manage risks?

Banks have a comparative advantage in monitoring credits and hence in bearing credit risks. This suggests that the reasoning for why banks use credit derivatives has to be more subtle than the reasoning that leads the literature to conclude that banks should hedge interest rate risks.[12] Morrison (2005) argues that the availability of credit derivatives could adversely affect banks by reducing their incentives to monitor and to screen borrowers. Further, the use of credit derivatives could make bank loans less valuable to borrowers because the loans would entail less of a certification effect. Marsh (2006) provides some evidence supportive of this view, showing that loan announcement returns are less for borrowers when a bank issues collateralized loan obligations (CLOs).

A clean loan sale or securitization removes the risk of a loan completely from the bank's balance sheet. Hence, if a bank does not want to bear the risk associated with all or part of a loan, such transactions can achieve that purpose leaving no residual risk or capital requirements. In practice, however, the lemons problem in loan sales and securitizations

[12] Kiff et al. (2002) review the issues that arise with various instruments for credit risk transfer.

forces banks to take steps to reduce that problem. As discussed by Gorton and Pennachi (1995) and others, loan sales do so through implicit guarantees and by retaining risk associated with the loans. For instance, in loan sales banks do not sell the whole loan and with securitizations banks may keep first loss positions.

By using credit derivatives, banks keep the loan on their balance sheets. Transferring credit risks with credit derivatives therefore has risks that credit risk transfers with loan sales or securitizations do not have. Banks using these derivatives have to bear associated counterparty, operational, and legal risks. As Duffee and Zhou (2001) point out, the difficulties associated with the use of credit derivatives suggest that everything else equal a bank would rather sell loans or securitize loans when these mechanisms can be used at low cost. Consequently, credit derivatives are most likely to be used when the costs of selling or securitizing loans are too high.

Loans could be expensive to sell for a number of reasons. We already discussed the adverse selection and moral hazard problems that arise with banks wanting to reduce their exposure to a counterparty. These problems are reduced if banks want to reduce their exposure for a period that terminates before maturity of the loan. A credit derivative would achieve that purpose if it matures before the maturity of the loan. Since the bank would have exposure at maturity of the loan, it would have greater incentives to screen and monitor the borrower.

Most importantly, the existence of a relationship between the lender and the borrower will make it less likely that the loan will be sold. First, the borrower may not want the loan to be sold since it would be harder to negotiate with a lender who has no experience with the borrower. Second, the lender may want to protect the relationship with the borrower. Third, relationship-based lending can involve implicit commitments on both parties that would become worthless if the loan is sold. In all these cases, the bank may not be in a position to sell the loan either by itself or through a securitization. In general, these issues do not arise with small loans that meet recognizable criteria, such as mortgages, retail loans, and credit card loans because these loans can be packaged in pools and relationships do not play much of a role in how borrowers are treated in the event of default when the bank is large.

We expect banks to be more likely to sell or securitize loans secured by real estate and retail loans. In contrast, we would expect banks to be more likely to retain C&I loans, agriculture loans (loans to finance agricultural production and other loans to farmers), and foreign loans.

When banks want to reduce their credit exposure by buying credit protection, they create a lemons problem. The protection seller has to be concerned that the bank wants credit protection because it has adverse information about the name on which it wants to buy protection. Acharya and Johnson (2007) show that adverse information about a company can be incorporated in credit default swap prices before it gets incorporated in the stock price. Dahiya et al. (2003) show that the announcement by a bank of a loan sale has an adverse impact on the borrower's stock price. Duffee and Zhou (2001) argue that a bank can use a credit-derivative contract to transfer loan risk for which its informational advantage is small and retain the portion of risk for which the bank's informational advantage is relatively large. The lemons problem is sharply reduced when a bank buys credit protection on a name with a credit rating since the rating provides a public evaluation of credit quality for the name. The problem also is much smaller when credit derivatives and public debt are actively traded for the name since adverse private information is likely to make its way into prices. We would therefore expect banks to find it more advantageous to use credit derivatives to hedge credit exposures to rated names and to names for which

there is a market for credit instruments. However, if that is the case, banks are most likely to use credit derivatives on those loans where their comparative advantage is smallest and be unable to use them where their comparative advantage is largest.

An additional difficulty with the use of credit derivatives to hedge loans is that the credit derivatives hedges usually do not qualify for hedge accounting treatment (see Yarish 2003). To qualify for hedge accounting treatment, a derivative used as a hedge has to have a high correlation coefficient with the exposure it hedges. Since loans are not marked-to-market, the correlation between the return of credit derivatives and the return to loans is too low for credit derivatives to qualify for hedge accounting. When derivatives used for hedging do not qualify for hedge accounting, the derivative hedge can make accounting earnings more volatile than if the hedge had not been put on because earnings are directly affected by the mark-to-market losses of the derivative even when the balance sheet value of the exposure being hedged does not change. To the extent that banks are concerned about earnings volatility, they may use credit derivatives less because of the accounting treatment of credit derivatives. Lins et al. (2007) show that hedging policies are affected by the accounting treatment of derivatives.

We expect banks to use all available instruments to manage risk. Therefore, we would expect banks that use other derivatives or other forms of credit risk management to be more likely to use credit derivatives. In our sample, all the banks that use credit derivatives also use interest-rate derivatives. We expect banks that use loan sales, securitization, foreign exchange, equity or commodity derivatives also to use credit derivatives. Since, as mentioned earlier, there are economies of scale in using derivatives, we expect larger banks to be more likely to use credit derivatives.

Credit derivatives also can be used by banks in their intermediary roles. In particular, banks can offer credit support in transactions they underwrite using credit derivatives. They can also make a market in credit derivatives. For example, banks can sell credit protection to clients who wish to hedge their credit exposures and buy credit protection (i.e., sell credit risk) from other clients who want to be long the same credit exposures.

If banks use credit derivatives in an intermediary capacity, then we would expect banks which are dealers in the derivatives market or have clients with which they trade or for which they provide hedging products to be more likely to use credit derivatives. If credit derivatives are used as credit enhancement for commercial paper conduit facilities or asset securitization facilities, then we expect the use of credit derivatives to be positively related to asset securitization. If larger banks and banks which use other derivatives are more likely to have trading departments for bank and client accounts, we expect to observe positive associations between the likelihood of using credit derivatives and bank size, and the use of foreign exchange, equity and commodity derivatives.[13]

4 Which banks are large users and what do they say about their use of credit derivatives?

Table 2 shows that a small fraction of large bank holding companies use credit derivatives. Because few banks use credit derivatives, it is feasible to examine what each bank says about its use of credit derivatives. Table 3 reports, for 2005, the list of banks that use credit

[13] We do not include interest rate derivatives use in our empirical tests because all banks in the sample which use credit derivatives also use interest rate derivatives.

Table 3 Sample of Bank Holding Companies Credit Protection Activity for year-end 2005. Sample of credit derivatives activity for sample banks which disclosed using credit derivatives at year-end 2005. Data are from FY-9C filings (Consolidated Financial Statements for Bank Holding Companies) with the Federal Reserve System. The sample includes all bank holding companies which filed report FR Y-9C with the Federal Reserve System with total assets (book value) equal to or greater than one billion dollars. Data are obtained from Federal Reserve Bank of Chicago Bank Holding Companies Database

Bank holding company	Total loans ($ Mils)	Credit protection			Bought−sold ($Mils)	(Bought−sold)/total loans	
		Bought ($ Mils)	Sold ($Mils)	Total amount ($ Mils)		2005	2000–2004 average
JPMorgan Chase & Co.	448,888.00	1,127,255.00	1,114,192.00	2,241,447.00	13,063.00	2.91%	7.35%
Bank of America	586,299.70	1,217,954.00	799,941.80	2,017,895.80	418,012.20	71.30	7.96
Citigroup	619,160.00	531,422.00	499,323.00	1,030,745.00	32,099.00	5.18	−0.39
Wachovia	271,608.00	113,610.00	96,293.00	209,903.00	17,317.00	6.38	1.46
KeyCorp	69,858.26	3,378.17	3,395.71	6,773.87	−17.54	−0.03	0.10
Metlife, Inc.	49,068.33	5,563.93	593.04	6,156.97	4,970.89	10.13	−0.69
Wells Fargo & Company	351,983.00	2,766.00	2,688.00	5,454.00	78.00	0.02	0.03
National City	115,719.30	1,420.68	492.91	1,913.60	927.77	0.80	0.22
Suntrust Banks	128,250.50	902.95	664.27	1,567.21	238.68	0.19	−0.08
The Bank of New York Company	41,160.00	1,099.00	386.00	1,485.00	713.00	1.73	−1.79
The PNC Financial Services Group	51,566.09	956.43	396.17	1,352.59	560.26	1.09	2.09
Mellon Financial	7,149.95	598.48	0.00	598.48	598.48	8.37	8.08
U.S. Bancorp	139,492.00	143.00	169.00	312.00	−26.00	−0.02	0.05
Fifth Third Bancorp	71,228.86	56.29	129.15	185.44	−72.85	−0.10	−0.06
Regions Financial	60,247.90	133.65	0.00	133.65	133.65	0.22	0.00
Northern Trust	20,018.15	116.25	0.00	116.25	116.25	0.58	0.41
Oriental Financial Group	910.78	87.52	0.00	87.52	87.52	9.61	0.00
Countrywide Financial	107,009.50	24.50	0.00	24.50	24.50	0.02	0.00
Texas Regional Bancshares	4,144.11	0.00	10.14	10.14	−10.14	−0.24	0.00
FBOP	9,274.11	0.00	10.00	10.00	−10.00	−0.11	0.00
Community Banks	2,237.07	7.50	0.00	7.50	7.50	0.34	0.65
First South Bancorp	998.08	0.00	3.18	3.18	−3.18	−0.32	−1.70
Stark Bank Group	894.99	0.00	1.31	1.31	−1.31	−0.15	−0.13

derivatives. In this section, we summarize the information provided by these banks in their financial statements in light of the predictions derived in the previous section. In the next section, we empirically test these predictions.

For each bank in Table 3, we provide information on its use of these derivatives. The table shows that within this small group of banks that have positions in credit derivatives, credit derivatives use is even more concentrated. The most striking fact in the table is that the total notional amount of credit derivatives bought and sold by J.P. Morgan Chase & Co. ($2,241 billion) and by Bank of America ($2,017 billion) exceeds the total notional amount

bought and sold by all other banks in our sample combined ($1,268 billion). Out of the 16 banks that are net protection buyers, seven banks have an amount of net protection representing less than 1% of their total loans in 2005. However, 12 banks buy a greater amount of net protection in 2005 relative to their loans in 2005 than they did on average from 2002 to 2004. Bank of America is a huge net buyer of protection compared to all other banks in 2005. Bank of America's net buying of protection for 2005 represents 86% of the total net buying of protection of all banks in the sample.

To understand better whether net protection buying corresponds to loan hedging, we review disclosures by banks. Like the Basel Committee on Banking Supervision (2007), we find that bank holding companies make credit risk disclosures in various places in their filings. In general, users of credit derivatives provide information about their credit exposure, net of provisions for loan losses, in their disclosures about the credit risk of their loans. Information about credit risk exposure broken down by credit rating, geographic segments, and industrial segments varies across banks.

Appendix 2 summarizes the disclosures about credit derivatives use for the banks in our sample. These disclosures vary greatly across banks. When information is disclosed, it is discussed in various footnotes to the financial statements including trading accounts and related trading revenues footnotes, derivatives instruments footnotes, fair value of instrument footnotes, securitization footnotes, and in the management's discussion of credit risk management. In cases in which banks are both sellers and buyers of credit risk protection, banks disclose if the transactions are offsetting. Some banks note that the marking-to-market of these two groups of credit derivatives act like natural hedges. In other cases, banks disclose the amount of loans hedged by the credit derivatives but in most cases they do not. Finally, banks disclose that credit default swaps are used to create synthetic collateralized debt, collateralized loan, or collateralized commercial paper obligations.

During our sample period, J.P. Morgan Chase is the largest user of credit derivatives. Its annual reports have a wealth of information on its use of these derivatives. For instance, the 2002 10-K filing for J.P. Morgan Chase has a section on credit derivatives within management's discussion of credit risk management. The bank divides its use of credit derivatives into asset portfolio and dealer/client activity. More than 90% of the total notional amount of credit derivatives bought and sold is related to dealer/client activity. J.P. Morgan Chase reports a sizeable gain from credit derivatives for 2002. This gain of $127 million is included in trading revenue. However, the following year it makes a loss of $746 million on credit derivatives used to manage the firms' credit exposure that it attributes to a tightening of credit spreads. The bank reports a net purchase of credit protection in the credit portfolio section of its 10-K for hedging purposes. In 2005, the bank has a wholesale credit exposure of $553 billion. Its net purchase of protection for hedging that exposure is $29 billion. This amount contrasts with its reported total notional amount of credit derivatives of $2,241 billion. The bank therefore hedges 5.24% of its loan exposure and its net hedging represents 1.29% of its notional amount of credit derivatives. However, in the bank holding company data, the net purchase of credit protection by JP Morgan Chase is $13 billion. Consequently, the Bank offsets more than half of its purchase of protection for hedging of credit exposures through net selling of protection in its other activities. It follows that JP Morgan's net purchase of protection understates the extent to which JP Morgan Chase uses credit derivatives to hedge its loans.

The 2005 annual report of Bank of America makes it possible to understand to what extent the extremely large net amount of protection bought corresponds to loan hedging for that bank. The 2005 10-K states that in 2005 the total net amount of credit exposure hedging through credit derivatives amounts to $14.7 billion, in contrast to an amount of $10.8 billion in 2004.

Consequently, 3.5% of the net credit protection bought by Bank of America actually corresponds to loan hedging. The same 10-K explains that "The increase in credit derivatives notional amounts reflects structured basket transactions and customer driven-activity."

Citigroup is the third highest user of credit derivatives. It reports that at year-end 2002, it hedged $9.6 billion of credit risk exposure through the use of credit derivatives and other risk mitigating techniques. By 2005, the Bank's hedging of credit exposure is substantially larger, corresponding to a notional amount of $40.7 billion. The Bank had outstanding loans of $185 billion and unfunded commitments of $332 billion. Consequently, the bank hedges 7.87% of its credit exposure.

Eight of the 31 banks reviewed, such as Wells Fargo, disclose using credit derivatives for trading and "customer accommodations," which suggests they do not use them for hedging the credit risks they are exposed to through their loans. Since seven of these banks are net buyers of protection in the majority of the years that they use credit derivatives, our approach to treat banks that are net buyers of protection as hedgers appears to likely overstate the proportion of banks that actually hedge credit exposures from the loans. Wells Fargo notes that almost all the protection purchases are exact offsets of sales of credit protection. In contrast, other banks, such as Bank One, disclose primarily using credit derivatives to hedge the credit risk of their commercial loans and loan commitments.

Citigroup and JP Morgan Chase report the extent of their hedging by loan rating categories, where the rating grades corresponds to agency ratings as well as the distribution of their exposures across loan rating categories. Both banks hedge investment grade credits proportionately more than they hedge non-investment grade credits. JP Morgan Chase reports that 18.87% of its wholesale credit exposure is to non-investment grade credits. However, the bank hedges 6.22% of its exposure to investment grade credits but only 2.97% of its exposure to non-investment grade credits. Similarly, Citigroup has 15% of its exposures in credits rated BB/B, but only 6% of the notional amount of its hedges has that rating.

A final issue is that the banks, when they address the issue, report that they cannot use hedge accounting for credit derivatives. For instance, JP Morgan Chase states in its 2005 annual report that "these derivatives do not qualify for hedge accounting under SFAS 133." (p. 65). Since credit derivatives have to be marked to market but loans are not, the use of credit derivatives increases the variability of accounting earnings. Bank of America points out this issue in its 2005 10-K, stating that "Earnings volatility increases due to accounting asymmetry as we mark to market the CDS, as required by SFAS 133, while the loans are recorded at historical cost less an allowance for credit losses or, if held-for-sale, at the lower of cost or market." (p. 53).

In sum, while the use of credit derivatives is concentrated in a few banks, the reasons reported for their use are varied. A review of the banks' financial statements suggests that banks use credit derivatives for a variety of reasons such as to hedge the credit risk of their loan portfolio and in their role as financial intermediaries. The disclosures make it possible to assess precisely the amount of credit derivatives used to hedge loans and we find that this amount is small. Using only the amounts of protection that banks explicitly say was purchased to hedge loans, the percentage of loans by sample banks hedged with credit derivatives is less than 2%. In the next section, we examine empirically the determinants of the use of credit derivatives by banks.

5 Empirical results

We first compare the characteristics of banks that are net buyers of credit derivatives to other banks. After having done this, we estimate probit models to test the predictions derived in Section 3 about which banks are likely to be net buyers of credit protection.

5.1 Univariate comparisons

The results of these comparisons are reported in Table 4 for the banks in our sample at year-end 2005. Sample statistics are similar for other years. We report means and medians.

The size of the average and median bank holding company (BHC) that is not a net buyer of credit protection, as measured by the book value of total assets, are $7.093 and $1.966 billion, respectively, at year-end 2005. The difference between the mean and median is not surprising given the skewed distribution of bank size. The mean and median of net buyers of credit protection are extremely large compared to the mean and median of the other banks—respectively, $396 billion and $158 billion. This result confirms previous research documenting that larger firms use derivatives more. The median assets of net buyers of credit protection are roughly 70 times the median assets of the other banks in the sample.

We turn next to the composition of the balance sheet of the banks in our sample. Surprisingly, the proportion of loans and the proportion of deposits to total assets are smaller for net buyers of credit protection. Banks that are net buyers have more foreign loans. They also have more C&I loans relative to total loans. They have a smaller amount of loans secured by real estate (59.99% of total loans versus 71.55%) and they make fewer agricultural loans.

The large difference in the proportion of loans secured by real estate is the most striking difference between banks that hedge with credit derivatives and those that do not. Banks that make mortgage loans are not expected to use credit derivatives to hedge these loans—though recently credit default swaps on commercial mortgages have become available. C&I loans and foreign loans are more likely to be hedged with credit derivatives than other loans because most liquid names in the credit default swap market are large investment grade US firms, foreign banks, and large foreign multinational companies (Fitch 2006). Thus, it is not surprising that the net buyers of credit protection have relatively more such loans. The credit derivatives indexes, which are quite liquid, also cover larger firms, but across the spectrum of credit ratings.

We turn next to profitability measures. There is no significant difference in return on assets and return on equity between net buyers and other banks, but net buyers have a lower net interest margin.

When we compare capitalization measures, we see that average measures are indistinguishable between net buyers and other banks. There is very limited evidence that median risk-adjusted capital ratios are lower for net buyers. For example, the median tier-1 risk-adjusted capital ratio for net buyers of credit risk protection is 8.56% compared with 10.92% for all other banks. This result is consistent with Cebenoyan and Strahan (2004) who find that banks that sell loans have less capital. There is also no difference in non-performing loans.

The last panel considers derivatives use. At this point, it is not surprising that firms that use credit derivatives are more likely to use other derivatives. In fact, all firms that are net buyers of credit protection also use interest-rate derivatives. Almost all banks that buy credit protection also securitize assets and sell loans.

The last two rows show the total trading revenue of banks and total trading revenue scaled by total assets. This trading revenue includes derivatives trading. Banks with net protection buying have dramatically more trading revenue than other banks. Strikingly, the median trading revenue of banks which are not net buyers of credit protection is zero.

5.2 Regression analysis

We now turn to probit regressions to test the predictions derived in Section 3 about the determinants of the decision to hedge with credit derivatives.

We report estimates of probit regressions in Table 5. The dependent variable is the probability of being a net buyer of credit protection using credit derivatives. We have

Table 4 Selected Characteristics of net buyers of credit risk protection and all other banks. Selected characteristics of banks that were net buyers of credit risk protecting based on their use of credit derivatives at year-end 2005 A bank is defined as a net of buyer of credit protection if the notional amount outstanding of credit derivatives on which the reporting bank is beneficiary is greater than the notional amount outstanding of credit derivatives on which the reporting bank is a guarantor on Schedule HC-L of form FR Y-9C (Consolidated Financial Statements for Bank Holding Companies). All data are measured as of fiscal year-end 2005. The last column report *p*-values for tests of the equality of means (medians) between credit derivative users and non users

Variable	All other banks Mean [Median]	Net buyers of credit protection Mean [Median]	*p*-values for tests of equality of Means [Medians]
Total assets ($ million)	$7,093.0 [1,966.4]	$396,727.6 [158,747.9]	0.007*** [0.000]***
Total loans/total assets	0.6811 [0.6990]	0.4899 [0.4873]	0.003*** [0.042]**
Total deposits/total assets	0.7478 [0.7748]	0.5311 [0.6285]	0.000*** [0.000]***
Composition of loan portfolio			
Total C&I/total loans	0.1591 [0.1426]	0.1657 [0.1828]	0.796 [0.010]***
Loans secured by real estate/ total loans	0.7155 [0.7475]	0.5999 [0.6004]	0.012** [0.042]**
Agriculture/total loans	0.0148 [0.0017]	0.0024 [0.0011]	0.000*** [0.312]
Total consumer loans/total loans	0.0759 [0.0395]	0.0958 [0.0679]	0.503 [0.123]
Total foreign loans/total loans	0.0039 [0.000]	0.0285 [0.0011]	0.013** [0.000]***
Profitability measures			
Return on assets	0.0122 [0.0111]	0.0127 [0.0129]	0.691 [0.302]
Return on equity	0.1336 [0.1294]	0.1598 [0.1456]	0.299 [0.123]
Net Interest Margin/total assets	0.0344 [0.0337]	0.0235 [0.0242]	0.000*** [0.002]***
Risk measures			
Total equity capital/total assets	0.0915 [0.0843]	0.0902 [0.0890]	0.832 [0.603]
Tier 1 risk-adjusted capital ratio (%)	11.91 [10.92]	10.43 [8.56]	0.349 [0.002]***
Total risk-adjusted capital ratio (%)	13.51 [12.42]	13.33 [11.86]	0.909 [0.041]**
Risk adjusted assets/total assets	0.7586 [0.7704]	0.7112 [0.7269]	0.114 [0.610]
Liquidity/total assets	0.2418 [0.2263]	0.2768 [0.2084]	0.496 [0.617]
Non-performing assets/total assets	0.0041 [0.0032]	0.0046 [0.0035]	0.662 [0.603]
Credit management and derivative activities			
Asset securitization	10.82%	75.00%	0.000***
Loan sales	27.18	50.00	0.047**

Table 4 (continued)

Variable	All other banks Mean [Median]	Net buyers of credit protection Mean [Median]	*p*-values for tests of equality of Means [Medians]
Use interest-rate derivatives	54.09	100.00	0.000***
Use foreign exchange derivatives	12.14	87.50	0.000***
Use equity derivatives	5.80	68.75	0.000***
Use commodity derivatives	1.58	50.00	0.002***
Total trading revenue	$3.59 [0.00]	$1,000.85 [172.61]	0.072* [0.000]***
Total trading revenue/total assets	0.0001 [0.000]	0.0018 [0.0010]	0.007*** [0.000]***

*p=0.10; **p=0.05; ***p=0.01

7 years of data, but the early years do not have data on all the variables we use. Further, the market for credit derivatives evolved during that period. We therefore proceed as follows. We reproduce pooled regressions for the period from 2001 to 2005. In addition, we estimate regressions for the period of 2003 to 2005 as well as for 2005. These three sets of regressions lead to qualitatively similar conclusions.

We estimate the pooled regressions using year indicator variables and account for clustering of residuals at the firm level. The table reports the marginal effect of each regressor and the associated probability value (p-value) of the test that the marginal probability is equal to zero. For indicator variables, the coefficient represents the change in the probability associated with moving the indicator from 0 to 1.

Panel A uses equity capital as the capitalization measure. Overall, the results in panel A are very supportive of the predictions of our analysis of the determinants of hedging of Section 3. We find that a bank is less likely to be a net buyer of credit protection if it has more capital, is more profitable, and has more agricultural loans. It is more likely to be a net buyer of credit protection if it has more C&I loans. We would expect banks with more consumer loans to be less likely to be net buyers of credit protection since a large fraction of consumer loans are more standardized and can easily be securitized or sold. However, the coefficient on the ratio of total consumer loans to total loans is positive and significant at the 10% level. We also add an indicator variable that takes value one if a bank uses commodity or equity derivatives. A bank that trades actively or is a derivatives dealer will report use of such derivatives, but other banks are unlikely to do so. We find that banks reporting the use of such derivatives are significantly more likely to use credit derivatives.

In model (2), we replace the net interest margin with three variables: the ratio of total deposits to total assets, the liquidity ratio, and the ratio of non-performing loans to total assets. Banks that have higher total deposits to total assets are significantly less likely to be net buyers of credit protection. This could be because banks that use more borrowings to finance themselves instead of deposits are more vulnerable to adverse changes in their credit condition. Alternatively, hedging with derivatives decreases the value of the deposit insurance put for a given amount of equity capital. More liquid banks are also less likely to be net buyers of credit protection. Nonperforming assets does not have a significant coefficient.

In model (3), we add an indicator variable for banks that securitize loans and remove the indicator variable for the use of equity and commodity derivatives. Firms that securitize loans are more likely to use credit derivatives. Similarly, model (4) shows that banks that

Table 5 The likelihood of buying net credit risk protection using credit derivatives. Probit regression estimates of the likelihood of buying net credit risk protection using credit derivatives. The dependent variable equals one if a bank is a net buyer of credit risk protection and zero otherwise. ΔProb measures the change in the probability of using credit derivatives per unit change in the relevant explanatory variables. For indicator variables, the coefficient represents the change in the probability associated with moving the indicator variable from 0 to 1. Panel A uses a banks total equity capital ratio as a measure of a bank's capital ratio. Panel B uses tier 1 risk-adjusted capital ratio as a measure of a bank's capital ratio. All regressions are estimated with robust standard errors to control for heteroskedasticity across banks and with year indicator variables. All explanatory variables are lagged 1 year. *p*-values are in parentheses

Variable	Model (1) ΔProb (*p*-value)	Model (2) ΔProb (*p*-value)	Model (3) ΔProb (*p*-value)	Model (4) ΔProb (*p*-value)	Model (5) ΔProb (*p*-value)	Model (6) ΔProb (*p*-value)
Panel A						
Total equity capital ratio	−0.1224** (0.023)	−0.4589*** (0.002)	−0.1515*** (0.001)	−0.2505** (0.012)	−0.1988*** (0.008)	−0.0322 (0.157)
Natural logarithm (total assets)	–	–	–	–	–	0.0039*** (0.000)
Net interest margin/ total assets	−0.7388** (0.019)	–	–	–	–	−0.2247** (0.033)
Total deposits/total asset	–	−0.1276*** (0.000)	−0.0231*** (0.001)	−0.0805*** (0.000)	−0.0595*** (0.000)	–
Liquidity ratio	–	−0.0709** (0.049)	0.0073 (0.450)	−0.0207 (0.381)	−0.0193 (0.229)	–
Non performing loans/ total assets	–	0.2016 (0.713)	−0.0999 (0.685)	−0.1364 (0.726)	0.5107 (0.871)	–
Total C&I loans/total loans	0.0333*** (0.001)	0.1319*** (0.000)	0.0362*** (0.000)	0.0881*** (0.000)	–	0.0101** (0.020)
US C&I loans/total loans	–	–	–	–	0.0392*** (0.007)	–
Agricultural loans/total loans	−0.5522** (0.046)	−0.7927** (0.040)	−0.2844* (0.075)	−0.6639** (0.010)	−0.3451 (0.142)	−0.1365 (0.239)
Total consumer loans/ total loans	0.0208* (0.089)	0.0355 (0.369)	−0.0004 (0.975)	0.0276 (0.244)	−0.0031 (0.903)	0.0006 (0.925)
Uses equity or commodity derivatives	0.2057*** (0.000)					–
Securitizes loans	–	–	0.1220*** (0.000)	–	–	–
Sells loans	–	–	–	0.0496*** (0.000)	–	–
Originates foreign loans	–	–	–	–	0.0728*** (0.000)	–
Pseudo R^2	0.4307	0.2178	0.4211	0.2866	0.3433	0.5581
Number of observations	1,681	1,692	1,231	1,231	1,700	1,692

Table 5 (continued)

Variable	Model (1) ΔProb (*p*-value)	Model (2) ΔProb (*p*-value)	Model (3) ΔProb (*p*-value)	Model (4) ΔProb (*p*-value)	Model (5) ΔProb (*p*-value)	Model (6) ΔProb (*p*-value)
Panel B						
Tier 1 risk-adjusted capital ratio	−0.0007* (0.052)	−0.0030** (0.045)	−0.0009* (0.058)	−0.0020* (0.057)	−0.0011* (0.084)	−0.0008 (0.581)
Natural logarithm (total assets)	–	–	–	–	–	0.0023*** (0.000)
Net interest margin/ total assets	−0.4662*** (0.001)	–	–	–	–	−0.1893*** (0.008)
Total deposits/total asset	–	−0.0765*** (0.000)	−0.0217*** (0.000)	−0.0538*** (0.000)	−0.0370*** (0.000)	–
Liquidity ratio	–	0.0198 (0.382)	0.0200** (0.012)	0.0209 (0.205)	0.0123 (0.218)	–
Non performing loans/ total assets	–	0.2328 (0.474)	0.0397 (0.808)	0.0626 (0.795)	0.1423 (0.382)	–
Total C&I loans/total loans	0.0108** (0.020)	0.0683*** (0.000)	0.0242*** (0.000)	0.0486*** (0.000)	–	0.0069** (0.018)
US C&I loans/total loans	–	–	–	–	0.0192** (0.023)	–
Agricultural loans/total loans	−0.3263** (0.016)	−0.5591** (0.020)	−0.2310* (0.083)	−0.4316** (0.019)	−0.2496* (0.097)	−0.0965 (0.128)
Total consumer loans/ total loans	0.0043 (0.448)	0.0060 (0.823)	−0.0067 (0.448)	0.0054 (0.757)	−0.0097 (0.553)	−0.0022 (0.621)
Uses equity or commodity derivatives	0.1024*** (0.000)	–	–	–	–	–
Securitizes loans	–	–	0.0754*** (0.000)	–	–	–
Sells loans	–	–	–	0.0257*** (0.000)	–	–
Originates foreign loans	–	–	–	–	0.0455*** (0.000)	–
Pseudo R^2	0.4657	0.2877	0.4425	0.3363	0.3921	0.5961
Number of observations.	1,177	1,181	1,181	1,181	1,183	1,181

*p=0.10; **p=0.05; ***p=0.01

sell loans are more likely to use credit derivatives. Finally, in model (5), the same is true for banks that originate foreign loans. In that regression, total C&I loans is replaced by total US C&I loans in this regression. Model (6) adds the natural logarithm of a bank's total assets as an explanatory variable. Not surprisingly, it is positive and significant. However, that variable removes the significance of the equity capital ratio.

In regressions we do not report, we use trading income instead of the dummy variable for the use of equity and commodity derivatives. Not surprisingly given the results for univariate comparisons, trading revenue does not have a significant coefficient.

Panel B has similar results to panel A. Instead of using equity capital as our measure of equity capitalization, we use the tier I risk-adjusted capital ratio. We find that this ratio always has a negative coefficient and it is significant in all regressions which do not control for total assets. The other regression coefficients of panel B do not differ much from the comparable coefficients of panel A. In some cases, coefficients that are significant in panel A are not significant in panel B, but this does not affect our main conclusions.

In the regressions, we only include explanatory variables with correlation coefficients of less than 0.3 (Table 7 in Appendix III reports correlation coefficients.) For example, the ratio of loans secured by real estate to total assets is highly negatively correlated with the ratios of C&I loans to total assets and of total consumer loans to total assets. Thus, we do not include a measure of loans secured by real estate in the probits. In robustness tests, we include this measure and exclude the other two measures of loan activity. The other regression coefficients are not affected.

In other robustness tests, we use alternative measures of profitability and capitalization. Specifically, we include the ratio of net income to total assets as a measure of profit instead of net interest margin in models (1) and (6). Overall the results are qualitatively similar to those reported in panels A and B of Table 5 with the exception that net income is not significant in model (1). We also estimate probit regressions using total risk adjusted capital as a measure of capitalization. The results are qualitatively similar to those reported in panel B of Table 5 but total risk-adjusted capital is not significant in models (3) to (5). Finally, we estimate the regressions reported in Table 5 excluding banks which are net sellers of credit risk protection. Doing so only affects the significance of total equity capital in model (6). It is now statistically significant.

6 Conclusion

In this paper, we examine the extent to which U.S. bank holding companies with assets in excess of $1 billion use credit derivatives to hedge. We find that few of these companies use credit derivatives. Further, among the banks that have positions in credit derivatives, a detailed review of their disclosures reveals that the typical position in credit derivatives is taken on for dealer activities rather than for hedging credit exposures from loans. If we use net credit protection purchase as our measure of credit risk hedging by a bank, the median amount of hedging is zero for the banks in our sample. Using bank disclosures, we find that, in total, the banks in our sample hedge with credit derivatives less than 2% of loans outstanding for the banks in our sample even though the total notional amount of credit derivatives on the books of banks exceeds their total credit exposure.

Though we interpret a bank's net protection buying as hedging, we recognize that this is a coarse measure of hedging. In fact, we find that for some banks with positive net protection buying, loan hedging represents a small fraction of the net protection bought. However, when we try to predict which banks buy protection, we find that the predictions

of hedging theories are supported by our regression analysis, in that banks that according to these theories would benefit more from hedging are more likely to be net buyers of credit protection. Our evidence helps understand why the use of credit derivatives for hedging is limited. First, the market for credit derivatives is the most liquid for investment grade corporations and for countries. As a result, use of credit derivatives is going to be more intense for firms that have exposures to such credits, which we find to be the case. Second, for non-investment grade corporates, the market for credit derivatives is less liquid. Further, private information is more important for banks for loans to such corporates. As a result, hedging will be more expensive and banks will hedge such loans less. Using disclosures of banks, we find that banks that report hedging across credit ratings hedge relatively more credits that are less risky, which is consistent with our prediction. Finally, hedge accounting cannot typically be used for credit derivatives.

Though there has been much discussion about the benefits of credit derivatives for the soundness of banks, our results show that one has to be careful in drawing conclusions. A small number of banks buy net credit protection, but these banks also have less capital. To the extent that credit derivatives make it easier for banks to maximize their value with less capital, they do not increase the soundness of banks as much as their purchases of credit derivatives would imply. However, if credit derivatives enable banks to save capital, they ultimately reduce the cost of loans for bank customers and make banks more competitive with the capital markets for the provision of loans. Yet, our overall evidence shows that the main use of credit derivatives of banks, by far, is in their role as dealers rather than for hedging bank loans.

For 2005, we show that the total credit protection bought and sold by banks is roughly $5.5 trillion. In comparison, the net protection bought, which is a measure of hedging of credit risks, is roughly $0.5 trillion, or less than 10% of the overall credit derivatives gross positions of banks. While, the net protection bought is small compared to the loans of the banks that have positions in credit derivatives, the gross position of these banks is large compared to the loans they write. Consequently, since credit derivatives are used only to a limited extent to hedge loans, they can only make banks and the financial system sounder if they create few risks for banks when the banks take positions in them for other reasons than to hedge loans. Contrary to the optimistic view of regulators before 2007, the subprime crisis has shown that the dealer positions of banks in credit derivatives have substantial risks. Evidence from 2008 suggests that the mere existence of these positions creates systemic risk, in that significant policy actions were designed to prevent defaults by large credit derivatives counterparties. Further research is required to evaluate the risks created by credit derivatives for banks when they hold such derivatives in their role as dealers and to devise policies that minimize the possible systemic risks of credit derivatives while extending their use as hedging instruments for credit risks.

Appendix I

Table 6 Variable names and definitions. Variables used in study. Data items are from the FR Y-9C (Consolidated Financial Statements for Bank Holding Companies) filings with the Federal Reserve System for fiscal year-ends 1999 to 2003

Variable	BHC data item
Total assets	BHCK2170
Total loans	BHCK2122
Total deposits	BHDM6631+BHDM6636+BHFN6631+ BHFN6636
Total C&I loans	BHCK1763+BHCK1764

Table 6 (continued)

Variable	BHC data item
US C&I loans	BHCK1763
Loans secured by real estate	BHCK1410
Agriculture loans	BHCK1590
Consumer loans	BHCKB538+BHCK2011
Total foreign loans (including C&I)	BHCK1764+BHCK1296+BHCK2081
Return on assets	BHCK4340/(total assets)
Return on equity	BHCK4340/BHCK3210
Interest margin/total assets	BHCK4074/(total assets)
Total equity capital/total assets	BHCK3210/(total assets)
Total risk-adjusted capital ratio	BHCK7205
Tier 1 risk-adjusted capital ratio	BHCK7206
Total risk-adjusted assets/total assets	BHCK2223/(total assets)
Nonperforming loans	BHCK5525+BHCK5526
Liquid assets	BHCK0081+BHCK0395+BHCK0397+BHCK1350+ BHCK1754+BHCK1773

Appendix II

Summary of banks' disclosures about the use credit derivatives. Information is from year-end selected 10-K filings and annual reports for fiscal year-ends 2001 to 2005. In some cases, information is from 1999 year-end financial statements.

Amsouth

Amsouth reports using credit default swaps (CDS) to buy credit protection at year-end 2001 (notional amount of $85 million) on the BHC database. We are unable to find information in the 10-K filing or annual report for year-end 1999. The bank does not report using credit derivatives at year-ends 2002–2005. Amsouth merged with Regions Bank in 2006.

Bank of America (BOA)

In BOA's annual report and 10-K filing for fiscal year-end 2002, the following information is disclosed: The Global Corporate and Investment Bank Sector of BOA is responsible for managing loan and portfolio counterparty risk. The group uses risk mitigation techniques including credit default swaps (CDS). In footnote (1) of Table VIII (page 62), BOA discloses using credit derivatives to provide credit protection (single name CDS, basket CDS, and CLOs) for loan counterparties in the amounts of $16.7 billion and $14.5 billion at year-end 2002 and 2001, respectively. The 2005 10-K shows that the bank has utilized credit exposure of $320 billion, for which it purchased a net amount of credit protection of $14 billion. Interestingly, as part of its credit portfolio activities, the bank records selling $1.67 billion notional amount of index CDS "to reflect a short-term positive view of the credit markets." The bank also points out that CDS bought to hedge the credit portfolio do not qualify for hedge accounting "despite being effective economic hedges." The total notional amount of credit derivatives reported for 2005 is $2,017 billion, which is four times what it was in the previous year. The bank states that "the increase in credit derivatives notional amounts reflects structured basket transactions and customer-driven activity."

Bank of New York (BONY)

BONY discloses using credit derivatives in the footnotes under the "Credit risk management" section in its 2002–2005 10-K filing. The bank also uses total return swaps (CDS) to provide credit enhancements to its commercial paper securitization program. The fair value of the company's credit derivatives that are held for trading purposes were $7 million in assets and $3 million in liabilities at year-end 2002 ($8 and $3 million, respectively at year-end 2001). The fair value of credit derivatives for trading purposes at year-end 2005 was $1 million for assets and $7 million for liabilities and for 2004 it was $2 million for assets and $6 million for liabilities. The notional amount of BONY's credit derivatives outstanding at year-end was $1,818 million and $1,636 million for 2002 and 2001, respectively. In 2005 BONY was the beneficiary of $1,099 million and the guarantor of $370 million in credit derivatives which was down a little from $1,184 million and $440 million, respectively from 2004.

Bank One

Bank One primarily uses CDS and short bond positions as protection against the deterioration of credit quality on commercial loans and loan commitments. The change in the fair value of credit derivatives is included in trading results in the bank's corporate financial statements, "while any credit assessment change in the identified commercial credit exposure is reflected as a change in the allocated credit reserves." At year-end 2002, the notional amount of credit derivatives "economically hedging" commercial credit exposure equaled $7.3 billion and related trading revenue was $42 million. Bank One merged with JP Morgan Chase in 2004.

Cathay Bancorp

Cathay only reported using credit derivatives in 1999. On the BHC database, $20 million was reported for credit derivatives in which the bank was guarantor (i.e., sold credit risk protection). In the footnotes of the bank's 1999 10-K filing, the bank disclosed a commercial commitment issued by the bank to guarantee the credit performance of $20 million of corporate debt. There is no additional disclosure of credit derivative use in the following years.

Charter One Financial

Charter One reports using credit derivatives in 1999, 2000, and 2001 on the BHC database. We are unable to find any information on the use of credit derivatives by Charter One in the financial statements for these fiscal-year ends. Charter One merged with Citizens Bank in 2004 and there was no reported use of credit derivatives in 2004 or 2005 by Citizens.

Chase Manhattan

Chase is in the sample in 1999. In 2000, the bank became part of JP Morgan Chase. According the BHC database, the bank was a net seller of credit protection in 1999. We are unable to find information on the use of credit derivatives by Chase in its 10-K filing for fiscal year-end 1999.

Citigroup

Citigroup reported large notional amounts of credit derivatives on the BHC database. In its 2003 10-K filings, Citigroup reports its total notional amount of credit derivatives for year-ends 2003 and 2002. In the bank's discussion of "credit risk mitigation," the bank discloses using credit derivatives to hedge portions of the credit risk in its loan portfolio. At year-ends 2003 and 2002, $11.1 billion and $9.6 billion of credit risk exposure was hedged through the use of credit derivatives and other risk mitigating techniques. By 2004, the amount of exposure hedged increased to $27.3 billion. A substantial fraction of the credit risk exposure hedged is for loans rated AAA/AA/A. For instance, in 2004, 48% of the credit risk exposure hedge has that rating. In contrast, while 15% of the loans have a rating of BB/B, only 8% of the hedged exposure has that rating. Credit derivatives also are used for trading purposes. In 2005, $40.7 billion of credit exposure was hedged. Almost half of the hedged exposure had a rating of AAA/AA/A. The total corporate credit portfolio of Citigroup had outstanding loans of $185 billion and unfunded lending commitments of $332 billion. Consequently, 7.88% of the total exposure was hedged. Citibank provides guarantees to customers in the form of CDS, total return swaps, and other written options. Citigroup also uses credit derivatives to create synthetic collateralized debt obligations.

Commerce Bancorp

Commerce is a seller of credit risk protection for all years in the sample and never a buyer of credit risk protection. The bank uses CDS to diversify its loan portfolio by assuming credit exposure from different borrowers or industries without actually extending credit in the form of a loan.

Community Banks

Community Banks only reports using credit derivatives for fiscal year-end 2003 on the BHC database. At year-end 2003, the bank is a buyer of credit risk protection. The notional amount of this protection is $7 million. We are unable to find information on the use of credit derivatives by Community Banks in its 10-K filing for fiscal year-end 2003, 2004, or 2005

Countrywide Financial

In the 2005 10-K, Countrywide states it uses credit default swaps for use in risk management primarily of commercial mortgage loans. The company receives credit protection and pays a fixed fee or premium. It also discloses that it used the credit default swaps to manage credit spread risk associated with interest rate lock commitments.

First Bancorp

First Bancorp is only in the sample as a user of credit derivatives in 1999. At year-end 1999, the bank was net buyer of credit protection ($460.12 million bought and $1.88 million sold) according to the BHC database. We are unable to find information on the use of credit derivatives by First Bancorp in its 10-K filing for fiscal year-end 1999.

First South Bancorp

First South Bancorp is only in the sample as a user of credit derivatives in 2003. At year-end 2003, the bank was a seller of credit protection (notional amount of $25 million) according to the BHC database. We are unable to find information on the use of credit derivatives by First South in its 10-K filing for fiscal year-end 2003.

First Tennessee National Corp

First Tennessee is always a seller of credit protection and never a buyer of credit protection. The bank uses CDS in a synthetic collateralized loan obligation (CLO) structure.

FleetBoston Financial

FleetBoston uses credit derivatives to hedge domestic credit risk ($24 million notional amount) and international credit risk of variable loans ($392 million notional amount). The bank also uses CDS to provide direct credit support to commercial paper conduits. FleetBoston discloses entering into offsetting credit derivatives with third parties. Credit derivatives also are used in trading activities. Credit derivatives are entered into to satisfy customers' investment and risk management needs. The majority of the credit derivatives in the trading portfolio consists of offsetting or back-to-back positions. FleetBoston merged with Bank of America in 2003.

JPMorgan Chase

The bank discusses the use of credit derivatives in a number of places in its 10-K filings. It has the most extensive discussion of credit derivatives of all the sample banks. On page 52 of its 2002 filing, JPMorgan discloses the use of these instruments in the "Credit derivatives" section. The bank discloses that the marking-to-market treatment of these hedges provide some natural offset. Gains of $127 million in 2002 related to credit derivatives used to hedge the firm's credit exposures were included in trading revenue. JPMorgan reports credit derivatives use related to its asset portfolio and dealer/client activity. The notional amount of protection bought was $34 billion and $158 billion, respectively, for the portfolio management and dealer/client activity. The notional amount of protection sold was $495 billion and $172 billion, respectively, for the portfolio management and dealer/client activity. The total sum of all these positions ($366 billion) is reported under "Derivatives contracts" section. Credit derivatives use also is disclosed in "Credit portfolio" section of the 2002 financial statements. The notional amount reported ($33 billion) equals the net credit protection bought and reported on page 52 and discussed above. The bank notes that these derivatives do not qualify for hedge accounting. The amount of credit portfolio hedging does not change much over time. In 2005, the bank has a total wholesale credit exposure of $553 billion. The notional amount of credit derivatives hedges is $29 billion. The bank has $98 billion of exposure to credits with non-investment grade ratings. For these credits, its hedging through credit derivatives is for $2 billion, or less than 2%. The total notional amount of credit derivatives reported by JP Morgan Chase in 2005 is $2,241 billion.

Johnson International

Johnson International is a buyer of credit risk protection only in 2001 according to the BHC database. The notional amount of the credit protection is $10.24 million. We are not able to find disclosures about the bank's use of credit derivatives in its financial statements.

KeyCorp

KeyCorp was buyer of credit risk protection in years 1999 to 2001 and 2003. It only sold credit risk protection in 2000 and 2001. The bank did not use credit derivatives in 2002. We are unable to find quantitative information on the use of credit derivatives by KeyCorp in its 10-K filing for fiscal year-ends 1999–2001, and 2003–2005. In the 10-K for 2005, KeyCorp states that "Actions taken to manage the loan portfolio could entail the use of derivatives to buy or sell credit protection" but does not report having undertaken such actions.

Mellon Financial

Mellon uses credit derivatives in 2001 and 2003 but not in 2002. In both of these years (2001 and 2003), the bank is only a buyer of credit risk protection ($552.19 million and $612.44 million, respectively). Mellon discloses using CDS to hedge the credit risk associated with commercial lending activities. These hedges do not qualify as hedges for accounting purposes. The bank disclosed a net trading loss of $4 million in 2003 related to its use of CDS. The notional amount of CDS outstanding at fiscal year-end 2003 is reported in "other products" of the table in the bank's footnote on derivative instruments used for trading and risk management purposes. In 2004 and 2005 Mellon reports CDS for trading purposes at $694 million and $598 million respectively.

Metlife

In 2004 and 2005, Metlife reports using credit default swaps to hedge risks. In particular, in 2005, the firm reports "[C]redit default swaps are used by the Company to hedge against credit-related changes in the value of its investments and to diversify its credit risk exposure in certain portfolios." The company also reports that credit default swaps are used in replication synthetic asset transactions (RSAT) to synthetically create investments that are either more expensive to acquire or otherwise unavailable in cash markets. The company reports writing credit default swaps for $593 million and a total notional amount of 5,882 million in 2005, this is a little lower than that reported in the BHC database. In 2004 the total notional amount of credit default swaps was $1,897 million and $615 million in 2003.

Midwest Banc Holdings

Midwest Banc Holdings is in the sample as a user of credit derivatives in 2002. At year-end, the notional amount of credit derivatives was $50 million. This amount represents two CDSs in which the bank sold credit risk protection. The credit ratings of the CDSs were Aa2/AA and Aa1/AAA. The bank receives a quarterly fee of 1.25% of the notional amount and 1% of the notional amount for entering into the swap. There is no further reporting on derivatives use in 2004 and 2005.

National City

National City reports using credit derivatives in 1999, 2000, 2001, and 2003. In all years, the bank was a net buyer of credit risk protection. In its 2001 annual report, the bank discusses other derivatives as a group but we are unable to find any direct information on credit derivatives use in the 2001 and 2003 financial statements. Also, in 2004 and 2005 National does not report the use of any credit derivatives to hedge credit risk.

Northern Trust

Northern Trust is a buyer of credit protection in all years that the bank is a user of credit derivatives according to the BHC database. The financial statements appear to disclose information about these instruments under "other derivatives." In their 2005 10-K Northern Trust states that it enters into credit default swaps with counterparties when the counterparty agrees to assume the underlying credit exposure of the a specific Northern Trust commercial loan or commitment. Credit default swaps are recorded under risk management derivative instruments but are not designated as hedges. Credit default swaps are not listed under client-related or trading derivative instruments. In 2004 and 2005, Northern reports minimal use of CDS with a fair value of $600k and $500k in these years, respectively.

PNC Financial Services Group

PNC Bank uses credit default swaps to hedge credit risk associated with commercial lending activities. The bank discloses that the net realized income in connection with the CDS for 2002 is not significant. The bank also discloses in its filing statements that CDS are used to lower required regulatory capital associated with commercial lending activities (2000 10-K). The bank continues to use credit default swaps to hedge commercial lending in 2004 and 2005 with a net loss of $4.4 million in 2004 and a minimal gain in 2005. PNC also reports a notional amount of credit derivatives of $359 million in 2004 which grows to $1,353 million in 2005.

Provident

Provident is a user of credit derivatives from 2001 to 2003. For all of these years, the bank is a buyer of credit risk protection. The bank discloses using credit risk transfer arrangements to transfer over 97.5% of the credit risk on an auto lease portfolio. Provident discloses that the use of credit derivatives allows the bank to lower its concentration in auto leasing while reducing its regulatory capital requirements. Provident merged with National City in 2004.

Summit Bancorp

Summit was a user of credit derivatives in 2000. At year-end 2000, the bank reports buying $9.83 million in credit risk protection according to the BHC database. We are unable to find any further disclosure about credit derivatives use in Summit's financial statements.

Suntrust

Suntrust buys and sells credit risk protection to customers and dealers using CDS. The notional amounts of these CDS referenced in the "trading activities" footnotes in the 2002 annual report ($180 and $150 million for 2002 and 2001, respectively) correspond to the notional amounts of credit protection sold in the BHC database for these years. Suntrust also sold credit risk protection in 2003. The bank bought credit risk protection in 2001 and 2003. In 2001, the bank was net seller of credit protection. In 2003, the bank was a net buyer of credit risk protection. In 2004 and 2005 Suntrust was a seller of credit protection of $664.2 and $757 million respectively.

U.S. Bancorp

U.S. Bancorp uses credit derivatives in its trading activities according to the bank's financial statements. The bank buys and sells credit protection to customers and dealers using CDS. These credit derivatives are accounted for as trading assets and any gain or loss in market value is recorded in bank's trading income. The notional amounts of credit derivatives are not reported in tables listing derivatives used for risk management purposes.

First Union and Wachovia

First Union is in the sample as a user of credit derivatives in 1999 and 2000. In 2001, First Union merges with Wachovia Bank. The merged bank is called Wachovia Corporation. Wachovia Corporation is a user of credit derivatives from 2001 to 2005. Though the 2005 10-K states that Wachovia uses credit derivatives to hedge loans, no specifics are given except to state that these hedges do not qualify for hedge accounting.

Wells Fargo

Wells Fargo discloses the use of CDS in Note 26 (Derivative Financial Instruments) of its 2002 annual report (pages 104 to 106). The bank uses CDS for trading and "customer accommodations." In the footnote to the table, the Wells Fargo states that it bought $2.2 billion in credit protection and sold $2.5 billion (which correspond to the numbers on the BHC database). In 2004 and 2005 Wells Fargo reports total notional amount of credit swaps of $5,443 and $5,454, respectively. However, there is no discussion of hedging credit risk with credit derivatives. The bank discusses credit derivatives under guarantees and notes that the protection purchases are offsets (defined by the bank as use of the same reference obligation and maturity) to the contracts in which the bank is providing credit protection to a counterparty.

Appendix III

Table 7 Pearson correlations of selected explanatory variables. Pearson correlation coefficients for selected explanatory variables used in the probit regressions for year-end 2005. The sample includes all bank holding companies which filed report FR Y-9C (Consolidated Financial Statements for Bank Holding Companies) with the Federal Reserve System with total assets (book value) equal to or greater than one billion dollars. Data are obtained from Federal Reserve Bank of Chicago Bank Holding Companies Database. KA is the total equity capital ratio. LNTA equals the natural logarithm of total assets. NETINCTA equals net income scaled by total assets. NETINTA equals net interest margin scaled by total assets. L_CITOT equals the ratio of US C&I loans to total loans. L_UCITOT equals the ratio of US C&I loans scaled by total loans. L_RETOT equals the ratio of loans secured by real estate to total loans. L_AGTOT equals the ratio of agricultural loans scaled by total loans. L_TOTCONTTOT equals the ratio of total consumer loans to total loans. FOREIGN is an indicator variable equal to one if a bank originates foreign-denominated loans and zero otherwise. SEC is an indicator variable equal to one if a bank is engages in securitization activity and zero otherwise. SAL is an indicator variable equal to one if a bank is engages in loan sales and zero otherwise. TOTDEPA equals total deposits scaled by total assets. LIQA equals total liquid assets scaled by total assets. NPA equals non-performing assets scaled by total assets

	KA	LNTA	NETINCTA	NETINTA	L_UCITOT	L_RETOT	L_AGTOT	L_TOTCONTOT	FOREIGN	SEC	TOTDEPA	LIQA	NPA
LNTA	−0.001												
NETINCTA	0.501***	0.057**											
NETINTA	0.203***	−0.154***	0.102***										
L_UCITOT	−0.006	0.081***	0.072***	0.091***									
L_RETOT	−0.199***	−0.342***	−0.182***	−0.014	−0.516***								
L_AGTOT	0.120***	−0.170***	0.014	0.102***	0.114***	−0.203***							
L_TOTCONTOT	0.243***	0.146***	0.150***	0.198***	−0.104***	−0.508***	0.040*						
FOREIGN	−0.042**	0.537***	−0.014	−0.050**	0.231***	−0.299***	−0.092***	0.023					
SEC	0.114***	0.593***	0.139***	−0.098***	0.016	−0.273***	−0.030*	0.230***	0.351***				
SAL	−0.041*	0.374***	−0.033	−0.026	−0.005	0.009	−0.048*	0.002	0.177***	0.284***			
TOTDEPA													
LIQA											−0.1**		
NPA											−0.0175	−0.203***	
KA											−0.197***	−0.038*	0.066***
LNTA											−0.440***	−0.036*	0.104***
NETINTA											0.249***	−0.306***	0.252***
L_CITOT											0.198***	0.011	−0.037
L_UCITOT											0.122***	−0.004	0.032
L_RETOT											0.184***	−0.143***	−0.079***
L_AGTOT											0.146***	−0.047**	−0.018
L_TOTCONTOT											−0.140***	−0.000	0.107***
SEC											−0.368***	−0.100***	0.171***
SAL											−0.106***	−0.130***	0.149***
FOREIGN											−0.144***	−0.020	0.092***

*p=0.10; **p=0.05; ***p=0.01

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