The Effects of Credit Derivatives on U.S. Bank Risk and Return, Capital and Lending Structure

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ABSTRACT

We examine the effects of credit derivatives on BHC risk and return by separating users of credit derivatives into three categories: protection buyers, protection sellers, and active users (market makers). Protection buyers use credit derivatives to decrease their total risk, and they simultaneously increase capital and shift their loan portfolio into riskier loan types. Protection sellers increase total risk, but appear to be compensated with higher returns. Active users see little change in risk or return. Overall, the evidence suggests that BHCs use credit derivatives as increasingly important instruments to execute effectively their overall risk and return strategies.

JEL codes: G0, G2

Keywords: credit derivatives, bank holding companies, risk-adjusted return

I. Introduction

An explosion of new products and an increasing number of participants have generated rapid growth of the credit derivatives market in recent years. The Office of the Comptroller of the Currency (OCC) reports that the market for credit derivatives among commercial banks in the U.S. market skyrocketed from $97 billion in notional value at year-end 1997 to $9 trillion at year-end 2006.[1]

The most common type of credit derivative is a credit default swap. In such a swap, the protection buyer (beneficiary) and the seller (guarantor) agree to swap the credit risk of a loan (or bond). The protection buyer pays to the seller a periodic fee, or premium, equal to a percentage of the loan's face value. When a credit default occurs, the guarantor pays the difference between the face value and the market value of the loan to the beneficiary, usually as a cash settlement. Such derivatives have been highlighted in the press recently because many credit default swaps are based on pools of subprime mortgage loans, which declined in value significantly in late 2006 and early 2007.

Credit derivatives provide banks with a credit-risk management tool that does not require them to adjust their underlying loan portfolios. In contrast, traditional hedging methods such as portfolio diversification, loan sales, and asset securitization require adjustments of underlying assets. A portfolio diversification strategy may require the bank to lend to customers in a number of different industries and/or geographic locations. Credit risk may increase rather than decrease if the bank is unfamiliar with the industries or areas in which it lends. Loan sales can potentially reduce credit risk, but this market suffers from the lemons problem in that banks have

[1] The data is obtained form Office of the Comptroller of the Currency(OCC)'s *Report on Bank Derivatives Activities* at website: http://www.occ.gov/deriv/deriv.htm

incentives to sell sub-par loans. Asset securitization may also reduce credit risk, but such a proposition can be expensive and many loan types cannot be securitized.

Credit derivatives offer two additional advantages. First, they offer banks a new source of fee income. Instead of simply buying protection against loan defaults, banks can sell credit protection and use these new instruments as trading vehicles. According to Fitch's global survey in 2005, banks' market-making activities are a prime reason that banks are engaging in credit derivatives activities. Second, credit derivatives offer banks opportunities to reduce their regulatory capital. Under the 1998 Basel I Capital Accord, the eight percent risk-based capital charge likely exceeds the amount of economic capital that a bank would choose to hold against a high rated borrower, and a bank can carry only a 1.6 percent capital charge if its only exposure is to a bank. For a bank that has purchased loan protection in the credit derivatives market, it is only exposed to the counterparty bank. Thus the credit protection provided by credit derivatives allows banks to reduce the capital they are required to hold against corporate loans. Basel II, however, proposes to close this loophole by imposing higher capital charges than bank guarantees.

Of course, credit derivatives also have disadvantages relative to other hedging tools. Credit derivative protection is not cheap; consequently, they are economical only for large credit exposures. In addition, the use of credit derivatives may exacerbate reported earnings volatility. Under FAS 133 (Accounting for Derivative Instruments and Hedging Activities), most credit derivatives do not qualify for hedge accounting treatment; consequently, GAAP treats the accounting for derivatives and loans differently. Loans are booked at historical cost while credit derivatives are generally recognized at fair value; therefore, the gain or loss resulting from the change in fair value does not affect the loan book value and must be recorded in earnings.

The rapid growth of the credit derivative market highlights an ongoing debate about whether credit derivatives reduce or exacerbate credit risk in financial institutions. Although protection buyers clearly can reduce certain credit risk by using credit derivatives, the risk effect on protection sellers and market makers is less clear. Moreover, even protection buyers may endogenously increase other risk components after hedging with credit derivatives. Instefjord (2005) argues that the risk sharing benefits from credit derivatives may encourage banks to take more risk, thus creating a potential for greater bank instability. Duffee and Zhou (2001) demonstrate that a capital constrained bank may prefer to use credit derivatives rather than loan sales in risk transfers, potentially destabilizing the loan sales market. Morrison (2005) argues that credit derivatives could reduce banks' incentives to monitor their loan portfolios. Two studies show that the benefits of actively hedging credit risk may lead to greater credit availability, rather than reduced risk in the banking system. Froot and Stein (1998) present a rigorous theoretical analysis and find that active risk management can allow banks to hold less capital and to invest more aggressively in risky and illiquid loans. Cebenoyan and Strahan (2004) find that actively managing credit risk through loan sales allows banks to have lower risk-adjusted capital than banks that don't actively manage their credit risk. Although these studies do not directly examine the effect of using credit derivatives, they suggest that active users of credit derivatives may have incentives to reduce capital and increase their holdings of risky loans.

Given the brief history and the sparse quantitative data regarding credit derivatives, there is to our knowledge no published empirical research that investigates their effect on banks' risk-taking behavior. Most research focuses on measuring credit risk and pricing of credit derivatives.

We empirically investigate the use of credit derivatives by U.S. bank holding companies (BHCs) between 1997 and 2005, and we ask three related questions. First, what effect do credit derivatives have on overall bank risk and return? Second, do users of credit derivatives shift their loan portfolios into riskier loan types? Third, do users of credit derivatives alter their capital levels? Our empirical approach distinguishes between three types of credit derivatives users: protection buyers, protection sellers, and active users. The effect of credit derivatives on risk may differ among these user types.

Across several regression models, our full-sample results show that the use of credit derivatives increases overall risk but lowers return. In addition, credit derivatives usage is associated with a shift from relatively safe residential mortgage loans to riskier commercial and industrial (C&I) loans. The aggregate results, however, mix together the different reasons that banks use credit derivatives. Among the different user categories, we show that protection buyers reduce overall risk and return, and they hold more capital. Protection sellers increase their overall level of risk and Tier 1 risk-adjusted capital but do not change their loan portfolio structure. Finally, active users increase overall bank risk and have lower returns. They also shift their lending from mortgage loans to C&I loans. In sum, the evidence suggests that the ultimate effect of credit derivatives on bank risk depends upon the banks' risk-management strategies.

We begin our analysis in Section II with a description of our data and sample. Section III explains our regression methodology, and Section IV reports the results. Section V concludes.

II. Data and Variable Definitions

Most credit derivatives are concentrated in large BHCs. Consequently, we focus our attention on publicly traded BHCs with real total assets (using 1997 as the base year) of more

than $5 billion. To identify publicly traded banks, we use an algorithm based on name and total assets that matches BHC FRY-9C regulatory reports with stock returns from the Center for Research in Security Prices (CRSP) obtained from the Wharton Research Data Services (WRDS) database.[2] The Y-9C is a quarterly report called the *Consolidated Financial Statements for Bank Holding Companies* that each domestic top-tier BHC greater than $150 million must file quarterly with the Federal Reserve.[3] Our publicly traded BHC sample contains 2289 quarterly observations between 1997 and 2005.

Credit derivatives data come from the Y-9C and they include the total notional amount of credit derivatives a bank has outstanding in a given quarter. The notional values are classified as beneficiary positions (protection buyer) or guarantor positions (protection seller) and are available starting from March 30, 1997. Beginning March 31, 2002, the Y-9C added gross fair values of the beneficiary and guarantor positions, respectively. In this analysis we use notional data because the notional amounts have a longer time series and, more importantly, they identify the *ex ante* intentions of credit derivative users. In contrast, fair values of individual contracts could fluctuate substantially from quarter to quarter, making it difficult to align a bank's current fair value position with its original purpose for using the credit derivative.

The BHC sample includes those that use credit derivatives and those that do not. We define the latter as non-users, and we categorize the former into three types of users: net protection buyers, net protection sellers, and active users. Net protection buyers and sellers are BHCs that act only as beneficiaries and guarantors, respectively, in credit derivative contracts throughout the entire sample period. Active users actively manage their positions in credit

[2] The matching algorithm matches Y-9C bank name and total assets against the same information on Compustat to obtain the CUSIP number, which is then matched with CRSP. The matches are then scanned and cleaned visually.
[3] The asset threshold was raised to $500 million beginning in 2006. This change does not affect our sample, which ends in 2005.

derivatives contracts and their positions switch between net guarantors and net beneficiaries frequently. Table 1 reports the number of bank holding companies (both publicly and privately held) using credit derivatives in each year from 1997 through 2005. It also lists the total notional amount of credit derivatives held by BHCs at the end of each year. Notice that more BHCs act as beneficiaries than guarantors. Moreover, though only a small proportion of BHCs utilize credit derivatives—59 during 2005—the number is increasing through time.

To examine how the use of credit derivatives affects a BHC's performance, we define a comprehensive set of risk, return, capital, and loan variables. We measure risk with the volatility of return on assets (ROA), the volatility of operating income, and the volatility of daily stock returns. The volatilities of ROA (net income divided by average assets) and operating income (net income plus income taxes and extraordinary losses) are computed as the annualized standard deviation of current quarterly net income and operating income, respectively, and three lags for each BHC on a rolling quarterly basis. The volatility of stock returns is calculated as the annualized standard deviation of daily stock returns over the previous year, also on a rolling basis. In addition, the stocks must be traded over the entire sample period. Return is measured as the one-year holding period return (HPR), calculated as the geometric return from daily stock returns on a rolling quarterly basis. Finally, risk-adjusted return is the one-year HPR divided by the volatility of the stock return over the same time period.

Capital ratios include the capital to asset ratio, defined as the book value of equity divided by total assets; the Tier 1 risk-based capital ratio, equal to Tier 1 capital divided by risk-weighted assets as defined by the 1988 Basel Accord; and the Total risk-based capital ratio, equal to the sum of Tier 1 and Tier 2 capital divided by risk-weighted assets.

We track loan performance and credit risk by analyzing total loans and four major loan categories defined in the Y-9C—commercial and industrial loans (CI), commercial real estate loans (CRE), residential mortgages (MORTG), and consumer loans (CONSM). Loan performance ratios are calculated for total loans and each of the loan categories and include these three ratios: loan share, non-performing loans (NP), and loan losses (LS). The loan share is the dollar amount of loans in a certain category divided by total loans; nonperforming loans are loans that are 90 days or more past due or are no longer accruing interest, divided by total loans (in that category); and loan losses are net charge-offs (gross charge-offs less recoveries) divided by total loans (in that category). In all, there are 4 loan share ratios, five nonperforming loan ratios, and five loan loss ratios. For example, for the CI category:

- CI/TL = commercial and industrial loans / total loans;
- NPCI/CI = nonperforming commercial and industrial loans / total C&I loans; and
- LSCI/CI = net loan losses in commercial and industrial loans / average C&I loans.

Table 2 reports summary statistics for the key variables in our sample of publicly traded BHCs, and it reveals interesting differences. The table includes mean values for all users of credit derivatives, nonusers, protection buyers, protection sellers, and active users. As a whole credit derivative users are much larger than nonusers, and they have higher average profitability, higher risk and lower capital ratios. Reflecting the markets that mega-banks operate in, credit derivative users have high levels of commercial and industrial loans, but lower levels of commercial real estate loans. The credit derivatives users also have higher proportions of loan losses and non-performing loans, both in terms of total loans and individual loan types.

The mean ratios among protection buyers, sellers and active users also reveal interesting differences. For most of the variables, the differences in means between protection buyers and

active users are statistically significant at the 5% level or less. Active users have significantly more assets than the other two users; protection buyers have the fewest assets. Protection buyers have the highest profitability and the highest capital ratios. Active users have the highest return volatility and the highest levels of nonperforming loans and loan losses. For the most part, ratios of protection sellers tend to lie in between those of the protection buyers and active users.

III. Methodology

We compute a series of fixed-effect regressions to test how the use of credit derivatives affects a BHC's risk, capital and loan portfolio. A concern with ordinary least squares (OLS) regressions is that the choice of whether or not to use credit derivatives is endogenous. That is, the BHC's use of credit derivatives might be influenced by the *ex-ante* risks facing the banks, which may be correlated with our *ex-post* risk measures. To control for this endogeneity, we employ a Heckman two-stage methodology. In the first stage, we run a probit model to determine the likelihood that a BHC will use credit derivatives. To identify the model, we must find a selection variable that is correlated with the decision to use credit derivatives but is uncorrelated with the firm's risk and loan portfolio. Although perfect selection variables do not exist, we use the log of total assets of BHCs in 1996 and a dummy variable for interest rate derivatives usage in 1996 as instruments in our first stage regression. The assumption is that the BHCs' size and use of interest rate derivatives in 1996 are indicative of the likelihood of using credit derivatives, but are uncorrelated with BHCs' future performance. In the first stage, we also include as explanatory variables the same explanatory variables used in the second stage.

The probit model to estimate the likelihood that a BHC uses credit derivatives is:

$$F^{-1}(CDR\_DUM_{it}) = S_0 + S_1 SIZE96_i + S_2 IRDR\_DUM96_i + \sum_{k=0}^{3} S_{3k} ALTHG/TL_{it-k} + S_4 EQ/TA_{it} + S_5 TL/TA_{it} + S_6 GAP/TA_{it} + S_7 JumboCD/TA_{it} + S_{8\tau} DATE_\tau + u_{it}, \tau = 2 \sim T \quad (1)$$

where $F^{-1}(.)$ is the inverse of the probit function, and CDR_DUM_{it} equals one if bank *i* uses credit derivatives in period *t*, and zero otherwise; $SIZE96$ is the log of total assets in 1996. $IRDR\_DUM96$ is a dummy variables where one indicates the use of interest rate derivatives in 1996, and zero otherwise. The $ALTHG/TL_{it}$ variable controls for the effect of alternative credit risk hedging against the loan portfolio; it is calculated as the sum of loan sales and loan securitization divided by the total loans of bank *i* in period *t*. EQ/TA_{it} is the ratio of equity capital to total assets for bank *i* at period *t*, and it captures the bank's leverage risk. All else equal, firms with higher equity should have lower total risk. TL/TA_{it} is the ratio of total loans to total assets for bank *i* at period *t*. GAP/TA_{it} measures the interest risk to which bank *i* is exposed in period *t* and is computed as the differences between 1-year assets and 1-year liabilities, divided by total assets. The $JumboCD/TA_{it}$ ratio is the proportion of jumbo CDs (CDs above $100,000) to total assets; it captures the liquidity risk of bank *i* in period *t*. Finally, $DATE_\tau$ is a vector of dummy variables that captures business cycle effects from time period 2 through *T*, and u_{it} is the error term. From this regression, we compute an inverse Mills ratio, which is equal to the probability density function divided by the cumulative density function of the estimated *CDR_DUM* value for each bank and time period.

In the second stage, we run fixed-effect OLS regressions in which the dependent variables are the total risk, return, capital, and loan performance variables defined previously.

The structure of the second-stage regression for the total risk and return dependent variables is as follows:

$$\begin{aligned} Risk_{it} = {} & S_{0i} + \sum_{k=0}^{3} S_{1k} CDR/TL_{it-k} + S_2 SIZE_{it} + \sum_{k=0}^{3} S_{3k} ALTHG/TL_{i,t-k} \\ & + \sum_{k=0}^{3} S_{4k} IRDR/TA_{i,t-k} + S_5 EQ/TA_{it} + S_6 TL/TA_{it} + S_7 GAP/TA_{it} \\ & + S_8 JumboCD/TA_{it} + S_{9\tau} DATE_{\tau} + S_{10} Mills_{it} + u_{it} \ , \tau = 2 \sim T \end{aligned} \tag{2}$$

where *Risk* (or return) is the dependent variable; CDR/TL_{it} is the net notional amount of credit derivatives (guarantor position less beneficiary position) divided by total loans to capture the effect of credit derivatives on credit risk hedging against loan portfolio; and $Mills_{it}$ is the inverse Mills ratio derived from equation (1). Other explanatory variables are the same as those in equation (1). Given that hedging activities can affect bank performance for several time periods, we include the contemporaneous values and three lags of CDR/TL_{it} , $ALTHGTL_{it}$ and $IRDR/TA_{it}$ in equation (2).

For the regressions with the capital ratios and lending performance ratios as dependent variables, we drop the explanatory variables that are contemporaneously correlated. For example, GAP/TA represents the interest rate risk exposure resulting from the loan portfolio, and changes in loan shares will affect *GAP* directly. EQ/TA is directly correlated with the risk-based capital ratios, and the ratio of total loans to assets increases directly with an increase in any of the loan categories. The other explanatory variables are retained.

IV. EMPIRICAL RESULTS

Tables 3 through 5 report the second-stage Heckman regression results for the entire sample, regardless of how BHCs use credit derivatives.[4] Because our focus is on the overall effect of credit derivatives on BHCs' risk and return, we report only the sum of the contemporaneous and lagged coefficients and the corresponding F statistics.

Table 3 shows that credit derivative usage increases BHCs' stock-return volatility and decreases the HPR and the risk-adjusted return by statistically significant amounts. The effect on the volatility of accounting earnings, however, is statistically insignificant. Table 4 shows that the use of credit derivatives has no effect on risk-adjusted capital, but the equity to asset ratio increases by a statistically significant but economically small 2 basis points. Credit derivative users also seem to shift somewhat into riskier loan categories as seen by the eight basis point increase in C&I loans given a one percentage point increase in the credit derivatives to total loan ratio. Changes in other loan shares are not statistically significant. Finally, Table 5 documents a statistically significant but economically small one basis point increase in nonperforming loans as banks increase their usage of credit derivatives. More interesting is the 12 basis point increase in mortgage nonperforming loans, perhaps reflecting the BHCs' subprime mortgage activity. Loan losses, however, fall by a statistically significant but economically small one basis point.

In sum, as banks increase their usage of credit derivatives, total risk increases and risk-adjusted returns decline. Banks also shift into somewhat riskier loans, though loan losses do not increase.

To account for the possibility that BHCs use credit derivatives for different purposes, we divide the sample into three categories: protection sellers, protection buyers, and active users

[4] The results from the first-stage probit regression are not reported in this paper, but are available upon request.

(market makers). We run separate regressions for each subgroup, including nonusers in the sample for all three categories. Results are reported in Tables 6 through 8. For each table, Panel A reports the results for the protection buyer sample, Panel B reports the protection seller results, and Panel C reports the active user results.

Table 6 Panel A shows that users of credit derivatives for hedging purposes have modestly lower stock return volatility. A one percentage point increase in the ratio of credit derivatives to loans reduces equity volatility by 49 basis points, and the change is statistically significant at the 10 percent level. The 49 basis point reduction, however, is only 3 percent of the 14.2 percentage point change required to move a BHC from the first to third quartile (inter-quartile) of the distribution. HPR and risk-adjusted returns are higher, but the changes are statistically insignificant. For protection sellers in Panels B, credit derivatives usage increases stock return volatility by a statistically significant 4.13 percentage points, a change that would move a BHC's risk approximately 30 percent of the inter-quartile distribution. The volatility of ROA also increases by a statistically significant 21 basis points, or 44 percent of the inter-quartile change. And the protection sellers seem to be compensated for the additional risk because holding period and risk-adjusted returns are up 8.71 and 31.1 percentage points, respectively. Each of these coefficients represents about 25 percent of the inter-quartile change. Usage of credit derivatives by active users leads to an economically small but statistically significant 10 basis point increase in equity volatility. This small coefficient makes sense if the bank is laying the risk off to other counterparties. Holding period returns and risk-adjusted returns are negative and statistically significant for active users, but the coefficients represent only about two percent of the inter-quartile distribution.

Table 7 illustrates that protection buyers and sellers increase their capital by statistically significant amounts. The Tier 1 risk-based capital ratio rises by 27 basis points for protection buyers—a change that represents 3 percent of the mean ratio. The Tier 1 risk-based capital ratio rises by 53 basis points for protection sellers, or 6.2 percent of their mean capital ratio. Active users do not change their risk-based capital ratios by statistically or economically significant amounts.

Table 7 also documents the effects of credit derivatives on loan portfolios across the different users. Protection buyers increase their holdings of CRE loans by 1.2 percentage points and consumer loans by 40 basis points. Meanwhile, they decrease their holdings of residential mortgages by 1.52 percentage points. This shift makes sense if protection buyers are hedging against commercial real estate loans. Protection sellers do not show any statistically significant changes in loan portfolios, but the coefficients suggest that they increase their holdings of C&I and mortgage loans. Active users, in contrast, show little change in loan composition. They increase their holdings of C&I loans by 7 basis points and decrease their holdings of residential mortgages by 10 basis points.

Finally, Table 8 tracks the effects of credit derivatives on nonperforming loans and net chargeoffs. On the whole, none of the groups experience large changes in credit quality. Protection buyers experience a statistically significant 5 basis point increase in net loan losses, while active users experience just a one basis point drop in the same ratio. In addition, active users experience a 2 basis point increase in nonperforming loans. All of these changes are economically small.

V. CONCLUSION

This study examines the relationship between credit derivatives at BHCs and their risk, return, capital and lending performance between 1997 and 2005. We split credit derivative users into three subgroups: protection buyers, protection sellers, and active users. Banks that use credit derivatives to buy protection significantly reduce total risk and increase capital. They alter their loan portfolios towards CRE and consumer loans, away from mortgage loans. These results suggest that banks book credit derivatives to offset losses on relatively risky loans. Protection sellers experience increases in equity volatility, returns, and capital ratios. These results are consistent with a bank strategy to sell credit protection to generate additional fee income. Finally, active users of credit derivatives experience a small increase in total risk and a small reduction in (risk-adjusted) returns. Capital and loan shares also are little changed. These results are consistent with a market-maker strategy to offset risks to other counterparties. The lower returns from this activity, however, are unexpected.

Our results suggest that credit derivatives are useful and flexible instruments in banks' risk-management toolkits. Depending on the strategy, credit derivatives allow a bank to reduce risk by purchasing default protection, or to increase risk and generate additional fee income by selling default protection.

References

Batten, J. and Warren Hogan, 2002, "A Perspective on Credit Derivatives," *International Review of Financial Analysis*, Vol. 11, n3, 251-278.

Brewer, E., William E. Jackson and James T. Moser, 1996, "Alligators in the Swamp: The Impact of Derivatives on the Financial Performance of Depository Institutions," *Journal of Money, Credit and Banking*, Vol.28, No. 3, 482-497.

Cebenoyan, A. Sinan and Strahan, Philip E., "Risk Management, Capital Structure and Lending at Banks" (October 2001). Available at SSRN: http://ssrn.com/abstract=293378.

Das, S., 1995, "Credit Risk Derivatives," *Journal of Derivatives*, Spring, 7-23.

Demsetz, R.S. and Strahan E.P., 1997, "Diversification, Size and Risk at Bank Holding Companies," *Journal of Money, Credit, and Banking*, 29, 300-313.

Diamond, D. 1984, "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies*, 51, 393-414.

Dufey, Gunter, 2000, "An Introduction to Credit Derivatives," University of Michigan Business School, Working Paper.

Duffee, G.R. and Zhou, C., 2001, "Credit Derivatives in Banking: Useful Tools for Managing Risk?" *Journal of Monetary Economics* 48, 25-54.

Froot, K. A., and Jereour C. Stein, 1998, "Risk Management, Capital Budgeting and Capital Structure Policy for Financial Institutions: An Integrated Approach," *Journal of Financial Economics*, 47, 55-82.

Heckman J. J. (1976), "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models," *Annals of Economic and Social Measurement* 5, 475-492.

Instefjord, N., 2005, "Risk and Hedging: Do Credit Derivatives Increase Bank Risk?" *Journal of Banking and Finance*, 29, 333-345.

Minton, B.A., Rene S. and Rohan Williamson, 2005, "How Much Do Banks Use Credit Derivatives to Reduce Risk?" NBER Working Paper No. 11579 (Cambridge, Massachusetts: National Bureau of Economic Research).

Morrison, A.D., 2005, "Credit Derivatives, Disintermediation and Investment Decisions," *Journal of Business*, Vol. 78 (March), 621-48.

Neal, R.S., 1996, "Credit Derivatives: New Financial Instruments for Controlling Credit Risk," *Federal Reserve Bank of Kansas City Economic Review*, 2nd quarter, 15-27.

Shrieres, R.E. and Drew Dahl, 1992, “The Relationship between Risk and Capital in Commercial Banks,” *Journal of Banking and Finance*, 16, 439-457.

Sinkey, J. F. and David Carter, 2000, “Evidence on the Financial Characteristics of Banks That Do and Do Not Use Derivatives,” *Quarterly Review of Economics and Finance* V40, N4, 431-439.

Table 1 Descriptive Statistics of Credit Derivatives Usage Among all BHCs that File the Y-9C

Number of banks using credit derivatives	1997	1998	1999	2000	2001	2002	2003	2004	2005
Protection buyers	12	7	6	10	10	10	14	12	15
Protection sellers	12	5	12	12	9	6	6	4	11
Active users	15	14	18	15	21	21	24	33	33
Total credit derivatives users	39	26	36	37	40	37	44	49	59
Total number of BHCs	1467	1588	1649	1715	1842	1946	2104	2246	2234
Notional amounts of credit derivatives at end of period									
Beneficiary positions ($, tril)	0.04	0.12	0.24	0.38	0.29	0.55	0.8	1.98	5.51
Guarantor positions ($, tril)	0.02	0.08	0.17	0.24	0.27	0.46	0.74	1.78	4.71

Table 2 Summary statistics of selected variables for publicly traded BHCs with more than $5 billion in inflation-adjusted assets

Variables	All users		Nonusers		Buyers	Active users	Sellers
	Mean	STD	Mean	STD	Mean	Mean	Mean
N	772		1517		185	512	75
Total assets ($ bil)	167.13	238.43	16.62	15.09	27.23 [a]	236.72 [b]	37.21 [c]
Operating ROA(%)	2.08	1.04	2.01	1.11	2.30 [a]	1.98	2.20
ROA(%)	1.37	0.69	1.33	0.77	1.52 [a]	1.30	1.46
Volatility of ROA	0.54	0.80	0.39	0.67	0.41 [a]	0.61 [b]	0.36
Volatility of Operating ROA	0.82	1.19	0.60	0.95	0.63 [a]	0.94 [b]	0.52
Volatility of Stock return	31.84	10.53	29.35	9.40	30.77 [a]	32.47 [b]	30.14
Risk-adjusted return(%)	47.77	95.43	61.21	99.27	58.89 [a]	42.22	58.20
Holding period return(%)	11.61	28.78	14.97	27.74	14.55	10.08	14.89
1-Year gap/TA(%)	25.99	13.03	18.88	19.24	22.68 [a]	26.61	29.98 [c]
JumbCD/TA(%)	7.79	5.65	11.83	6.95	8.39 [a]	6.68 [b]	13.90 [c]
Total loan/TA(%)	66.42	17.40	69.26	15.52	65.38	65.55 [b]	74.92 [c]
C&I loans/TL(%)	29.53	10.95	20.44	9.84	26.47 [a]	29.37 [b]	38.20 [c]
CRE loans/TL(%)	15.15	7.97	29.26	14.17	20.36 [a]	12.69 [b]	19.06
Mortgage loans/TL(%)	27.86	13.64	25.98	12.69	32.29 [a]	26.14	28.62
Consumer loans/TL(%)	12.70	7.35	14.89	14.77	11.19 [a]	14.17 [b]	6.36 [c]
NPL/TL(%)	1.03	0.56	0.78	0.50	0.74 [a]	1.18 [b]	0.78
Nonperforming C&I loans(%)	1.47	1.02	1.07	0.84	1.37 [a]	1.60 [b]	0.80 [c]
Nonperforming CRE loans(%)	0.93	0.81	0.68	0.65	0.63 [a]	1.07 [b]	0.72
Nonperforming Consumer loans(%)	0.94	0.65	0.60	0.86	0.61 [a]	1.03	1.14 [c]
Nonperforming Mortgage loans(%)	1.13	2.90	0.72	0.68	0.60 [a]	1.39	0.69 [c]
T1 risk-weighted capital ratio(%)	8.49	1.33	11.14	2.67	9.09 [a]	8.26	8.60 [c]
Total risk-weighted capital ratio(%)	12.10	1.41	13.39	2.76	12.38 [a]	11.92 [b]	12.67
Equity capital to assets(%)	8.90	1.75	9.75	2.52	9.08	8.90 [b]	8.47 [c]
Loan losses/TL(%)	0.65	0.60	0.42	0.58	0.36 [a]	0.79 [b]	0.44
CRE loan losses(%)	0.06	0.34	0.07	0.29	0.05	0.06	0.10
Consumer loan losses(%)	1.84	2.09	1.27	1.38	0.84 [a]	2.22	1.79 [c]
C&I loan losses(%)	0.85	1.20	0.58	0.96	0.69 [a]	0.97 [b]	0.41 [c]
Mortgage loan losses(%)	0.21	0.60	0.03	2.27	0.09 [a]	0.26	0.14 [c]
CDR (GUA-BEN)/TL(%)	-2.42	11.24	0.00	0.00	-0.97 [a]	-3.38 [b]	0.59 [c]
Althg/TL(%)	20.07	43.96	9.88	46.21	9.00 [a]	19.10 [b]	55.38 [c]
IRDR/TA(%)	391.45	817.83	9.79	12.69	21.58 [a]	562.14 [b]	138.53 [c]

[a] mean value is statistically different from active users at the 5 percent level

[b] mean value is statistically different from protection seller at the 5 percent level

[c] mean value is statistically different from protection buyer at the 5 percent level

Table 3. Effects of credit derivatives on total risk and return for publicly traded BHCs

	Dependent variables				
	Volatility of ROA	Volatility of operating income	Volatility of equity returns	Risk-adjusted return	Holding period return
Mills Ratio	0.32 ***	0.44 ***	-2.51 ***	-12.17	-10.11 ***
	2.78	2.59	-2.97	-1.07	-2.94
Size	0.01	-0.02	1.29 **	-56.43 ***	-15.15 ***
	0.20	-0.22	2.32	-7.54	-6.71
Equity ratio	-0.04	-0.04	0.54 ***	4.69 *	2.74
	-1.52	-0.98	2.99	1.93	3.74
Total loan	-0.01 ***	-0.02 ***	-0.09 ***	1.19 ***	0.42 ***
	-4.97	-5.31	-4.95	4.61	5.33
Gap Ratio	0.00 *	0.01 ***	0.03 **	-0.33 **	-0.05
	1.77	2.78	2.27	-2.10	-1.03
JumboCD ratio	0.01	0.01	0.04	-0.14	-0.11
	1.42	0.73	0.94	-0.27	-0.75
CDR/TL	0.00	0.01	0.13 ***	-2.07 ***	-0.73 ***
	0.75	0.66	14.00	20.70	28.59
Althg/TL	0.00	0.00	-0.03 ***	0.00	-0.03
	2.04	1.36	22.10	0.00	1.37
IRDR/TL	0.00	0.00	0.00	0.03 ***	0.01 ***
	1.36	1.10	0.15	7.98	13.67
N	2104	2104	2104	2104	2104
R2	0.08	0.09	0.77	0.66	0.61

t/F statistics in parentheses
*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Effects of credit derivative usage at publicly traded BHCs on capital ratios and loan shares

	Capital ratio			*Loan shares*			
	Tier 1 risk-based capital	Total risk-based capital	Capital/TA	CRE loans	C&I loans	Mortgage loans	Consumer loans
Mills ratio	1.51 ***	1.33 ***	0.77 ***	-1.18 *	2.96 ***	-1.66	-0.42
	5.46	4.30	3.05	-1.51	3.37	-1.38	-0.69
Size	-1.58 ***	-1.58 ***	0.68 ***	-1.89 ***	2.52 ***	1.82 ***	-1.61 ***
	-10.57	-9.53	5.02	-4.51	5.32	2.81	-4.91
CDR/TL	-0.01	-0.01	0.02 ***	-0.03	0.08 ***	-0.06	0.01
	1.07	0.83	7.22	0.98	8.33	2.37	0.19
Althg/TL	0.00 **	0.00	0.00	-0.01 **	-0.01	0.02 ***	-0.02 ***
	4.88	1.34	0.99	4.69	1.22	11.84	31.70
IRDR/TL	0.00	0.00	0.00	0.00 ***	-0.01 ***	0.01 ***	0.00 ***
	0.01	1.77	1.38	16.52	101.17	33.69	109.76
N	2104	2104	2104	2104	2104	2104	2104
R2	0.12	0.13	0.44	0.31	0.24	0.09	0.27

t/F statistics in parentheses
*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5. Effects of credit derivative usage of publicly traded BHCs on nonperforming loans and loan losses by loan category

	Nonperforming loans variables					*Loan losses variables*				
	Total loans	CRE loans	C&I loans	Mortgage loans	Consumer loans	Total loans	CRE loans	C&I loans	Mortgage loans	Consumer loans
Mills ratio	-0.19 ***	-0.30 ***	-0.88 ***	0.87 ***	0.07	-0.25 ***	-0.06	-0.68 ***	-0.07	-0.47
	-3.01	-2.51	-5.75	3.07	0.83	-2.85	-0.88	-3.07	-0.79	-1.62
Size	0.26 ***	0.34 ***	0.39 ***	-0.09	0.23 ***	0.09 *	0.05	0.26 **	0.03	0.21
	7.60	5.35	4.73	-0.59	5.34	1.93	1.26	2.16	0.75	1.36
CDR/TL	0.01 ***	-0.01	0.00	0.12 ***	-0.01 ***	-0.01 **	0.00	0.00	-0.01 **	-0.01
	45.67	6.42	0.42	169.26	10.52	4.52	0.62	0.00	5.90	1.86
ALTHG/TL	0.00 ***	0.00 ***	0.00 ***	0.00	0.00 **	0.00 ***	0.00 **	0.00 *	0.00	0.00
	12.08	0.01	8.58	0.74	5.96	8.23	6.30	3.54	0.19	0.49
IRDR/TL	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00	0.00	0.00 *	0.00 **	0.00	0.00
	13.69	12.28	94.60	6.98	1.98	1.97	3.17	4.60	1.36	0.00
N	2104	2104	2104	2104	2104	2104	2104	2104	2104	2104
R2	0.27	0.10	0.28	0.18	0.11	0.13	0.06	0.14	0.03	0.04

t/F statistics in parentheses

*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6. Effects of credit derivatives on total risk and return by user type

Panel A. Protection buyers and non users

	Dependent variables				
	Volatility of ROA	Volatility of operating income	Volatility of equity returns	Risk-adjusted return on equity	HPR
Mills ratio	-0.66 **	-0.91 **	-4.79 **	-68.23 **	-22.68 **
	-2.46	-2.22	-2.16	-2.26	-2.54
Size	-0.05	-0.19	1.62 **	-65.03 ***	-17.66 ***
	-0.64	-1.49	2.39	-7.03	-6.47
Equity capital ratio	0.14 ***	0.22 ***	0.69 **	9.72 **	3.26 ***
	4.03	4.21	2.36	2.45	2.79
Total loan	0.00	0.00	-0.03	2.87 ***	0.88 ***
	0.03	-0.31	-0.42	3.12	3.27
Gap Ratio	0.01 ***	0.01 ***	0.07 ***	0.25	0.15
	2.67	2.78	2.63	0.67	1.31
JumboCD ratio	0.05 ***	0.06 **	0.45 ***	4.59 **	1.41 **
	2.83	2.38	3.05	2.28	2.37
CDRBEN/TL	0.00	0.00	-0.49 *	2.23	1.12
	0.02	0.00	2.95	0.33	0.95
ALTHG/TL	0.00	0.00	-0.04 **	-0.82 ***	-0.30 ***
	0.18	0.09	3.85	8.01	12.02
IRDR/TA	0.00	0.00	-0.10 ***	-0.46	-0.15 *
	1.66	1.35	25.62	2.67	3.19
N	1550	1550	1550	1550	1550
R2	0.09	0.10	0.75	0.67	0.62
Panel B. Protection sellers and non users					
Mills ratio	-0.10	-0.16	1.94 **	0.87	-1.55
	-1.12	-1.17	2.32	0.08	-0.49
Size	0.12	0.04	1.53 **	-70.85 ***	-20.27 ***
	1.52	0.35	2.13	-7.47	-7.47
Equity capital ratio	0.11 *	0.19 **	-1.25 **	1.77	2.00
	1.67	1.98	-2.09	0.22	0.89
Total loan	-0.01	-0.02	-0.09	-0.04	-0.25
	-1.11	-1.58	-1.43	-0.05	-1.11
Gap Ratio	0.00	0.00	0.02	-0.38 **	-0.07
	-0.64	0.25	1.38	-2.18	-1.39
JumboCD ratio	0.00	-0.01	0.14 ***	-0.02	0.01
	-0.66	-1.05	3.15	-0.03	0.03
CDRGUA/TL	0.21 **	0.22	4.13 ***	31.09 **	8.71 **
	4.05	1.82	17.18	5.57	5.34
ALTHG/TL	0.00 **	0.00 *	0.00	-0.06	-0.04
	4.05	3.54	0.22	0.18	0.93
IRDR/TA	-0.01 ***	-0.01 ***	-0.02	0.05	-0.02
	10.93	9.83	2.03	0.07	0.13
N	1452	1452	1452	1452	1452
R2	0.06	0.06	0.74	0.69	0.66
Panel C Active users and non-users					
Mills ratio	0.10	0.15	-2.20 ***	5.28	-1.05
	1.64	1.56	-4.48	0.83	-0.55
Size	0.12	0.11	1.13 *	-68.46 ***	-18.49 ***
	1.51	0.94	1.87	-8.71	-7.91
Equity capital ratio	-0.02	-0.01	0.59 ***	2.06	1.40 **
	-0.84	-0.24	3.87	1.03	2.36
Total loan	0.00	0.00	-0.12 ***	0.15	0.05
	-0.20	-0.75	-5.26	0.51	0.57
Gap Ratio	0.00	0.01 **	0.00	-0.33 *	-0.08
	1.11	2.10	-0.07	-1.93	-1.62
JumboCD ratio	0.00	0.00	-0.05	1.68 **	0.25
	0.17	-0.51	-1.08	2.57	1.27
CDR/TL	0.00	0.00	0.10 ***	-2.20 ***	-0.76 ***
	0.47	0.54	7.78	23.74	32.08
ALTHG/TL	0.00	0.00	-0.04 ***	0.04	-0.03
	0.19	0.47	11.50	0.07	0.41
IRDR/TA	0.00	0.00	0.00	0.01	0.00
	0.19	0.20	1.05	1.08	2.20
N	1868	1868	1868	1868	1868
R2	0.07	0.08	0.75	0.67	0.62

t/F statistics in parentheses

*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7. Effects of credit derivatives on capital ratios and loan shares by user type

Panel A. Protection buyers and non users

	Capital Ratios			*Loan shares ratio*			
	Tier 1 risk-based capital ratio	Total risk-based capital ratio	Capital/TA	CRE loans	C&I loans	Mortgage loans	Consumer loans
Mills ratio	2.31 **	1.71	-0.53	-17.47 ***	-18.78 ***	36.17 ***	1.04
	2.38	1.57	-0.66	-6.68	-7.09	9.74	0.53
Size	-1.81 ***	-1.56 ***	1.78 ***	-1.51 ***	2.84 ***	0.39	-1.61 ***
	-9.27	-7.14	11.09	-2.87	5.33	0.52	-4.12
CDRBEN/TL	0.27 ***	0.35 ***	0.34 ***	1.20 ***	-0.01	-1.52 ***	0.40 ***
	17.04	23.15	39.59	46.93	0.00	37.04	9.21
ALTHG/TL	-0.04 ***	-0.04 ***	-0.02 ***	0.06 ***	0.04 **	-0.21 ***	0.02
	51.94	37.56	13.35	12.43	5.90	83.79	2.41
IRDR/TA	0.00	0.02 ***	0.01 *	-0.06 ***	0.01	0.10 ***	-0.01
	0.00	8.90	3.37	10.69	0.70	17.48	0.45
N	1550	1550	1550	1550	1550	1550	1550
R2	0.19	0.18	0.52	0.41	0.15	0.15	0.22
Panel B. Protection sellers and non users							
Mills ratio	-1.21 **	-1.32 **	-0.02	1.14	6.48 ***	-10.65 ***	1.05
	-3.14	-3.09	-0.05	1.13	6.54	-7.32	1.39
Size	-1.88 ***	-1.58 ***	2.01 ***	-0.71	3.96 ***	-1.04	-1.69 ***
	-8.97	-6.77	11.52	-1.28	7.33	-1.31	-4.12
CDRGUA/TL	0.53 *	0.32	0.96 ***	-0.68	1.12	1.18	0.07
	3.06	0.92	14.37	0.71	2.07	1.07	0.01
ALTHG/TL	-0.01 ***	-0.02 ***	0.00	0.00	0.03 ***	-0.05 ***	-0.01
	14.06	18.38	1.38	0.07	9.42	19.57	1.46
IRDR/TA	0.00	0.01 *	0.01 **	-0.03 **	0.04 ***	-0.02	0.01
	0.05	3.35	6.03	4.15	11.87	1.30	2.17
N	1452	1452	1452	1452	1452	1452	1452
R2	0.14	0.13	0.48	0.38	0.13	0.10	0.27
Panel C Active users and non-users							
Mills ratio	0.83 ***	0.59 ***	0.69 ***	0.71	0.75	-4.18 ***	0.17
	4.08	2.61	3.79	1.29	1.18	-4.85	0.40
Size	-1.46 ***	-1.37 ***	1.07 ***	-0.60	3.42 ***	0.09	-1.37 ***
	-8.96	-7.57	7.28	-1.35	6.69	0.13	-3.91
CDR/TL	-0.01	0.00	0.03 ***	0.01	0.07 **	-0.10 **	0.02
	0.53	0.09	11.43	0.05	5.24	6.48	1.46
ALTHG/TL	0.00 *	-0.01 **	-0.01 ***	-0.04 ***	-0.04 ***	0.05 ***	-0.01 **
	2.73	4.09	22.78	25.37	18.67	17.10	4.43
IRDR/TA	0.00 **	0.00	0.00	0.00 ***	-0.01 ***	0.01 ***	0.00 ***
	4.66	0.32	0.20	18.90	95.66	44.52	114.24
N	1868	1868	1868	1868	1868	1868	1868
R2	0.13	0.12	0.44	0.29	0.22	0.10	0.26

t/F statistics in parentheses

*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 8. Effects of credit derivatives on nonperforming loans and loan losses by loan category and user type.

Panel A. Protection buyers and non users

	Nonperforming loans ratio variables					*Loan losses ratio variables*				
	Total loans	CRE loans	C&I loans	Mortgage loans	Consumer loans	Total loans	CRE loans	C&I loans	Mortgage loans	Consumer loans
Mills ratio	-0.25	-1.01 **	-0.44	-0.54 *	-0.28	-0.50 **	-0.42 *	-0.50	-0.02	0.12
	-1.28	-2.51	-0.88	-1.77	-1.13	-2.11	-1.92	-0.75	-0.16	0.20
Size	0.24 ***	0.34 ***	0.50 ***	0.21 ***	0.14 ***	0.11 **	0.06	0.32 **	0.00	0.31 ***
	6.15	4.23	4.99	3.43	2.89	2.35	1.42	2.38	0.13	2.64
CDRBEN/TL	0.00	0.04	0.03	-0.03	-0.10 ***	0.05 ***	0.00	0.05	-0.01	-0.03
	0.07	1.96	0.93	2.06	40.08	9.78	0.07	1.33	0.46	0.61
ALTHG/TL	0.00	0.00	0.01 *	0.01 ***	-0.01 ***	0.00	0.00	0.01	0.00 ***	-0.01 ***
	2.22	0.26	3.03	22.99	34.64	0.40	1.22	1.96	19.56	14.11
IRDR/TA	0.00	0.00	-0.01 **	-0.01 ***	0.00	0.00	0.00	0.00	0.00 *	0.00
	1.01	1.64	4.27	11.49	0.00	1.77	1.70	0.91	2.75	1.31
N	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
R2	0.17	0.09	0.14	0.05	0.19	0.18	0.04	0.14	0.06	0.09
Panel B. Protection sellers and non users										
Mills ratio	0.02	0.04	0.25	-0.07	-0.02	0.05	0.04	0.02	0.02	-0.11
	0.22	0.25	1.32	-0.58	-0.26	0.60	0.47	0.10	0.38	-0.51
Size	0.23 ***	0.27 ***	0.50 ***	0.23 ***	0.11 **	0.13 ***	0.03	0.34 **	-0.04	0.21 *
	5.63	3.26	4.83	3.45	2.30	2.76	0.59	2.56	-1.43	1.76
CDRGUA/TL	-0.04	-0.30 **	0.05	-0.08	0.27 ***	0.06	-0.05	-0.09	0.03	0.45 ***
	0.44	6.28	0.11	0.63	13.90	0.75	0.53	0.19	0.66	7.17
ALTHG/TL	0.00	0.00	0.00 *	0.00	0.00	0.00	0.00 ***	0.00	0.00 **	0.00
	0.12	0.92	3.71	0.03	0.10	0.04	6.95	0.29	4.48	0.00
IRDR/TA	0.00	0.00 **	0.00	0.00 ***	0.00 **	0.00 **	0.00	0.00	0.00 *	0.00
	0.16	5.70	0.57	8.06	5.12	5.67	4.45	0.04	2.77	2.34
N	1452	1452	1452	1452	1452	1452	1452	1452	1452	1452
R2	0.16	0.08	0.13	0.04	0.12	0.10	0.06	0.09	0.06	0.07
Panel C. Active users and non users										
Mills ratio	-0.23 ***	-0.29 ***	-0.54 ***	-0.05	0.06	-0.14 **	-0.08	-0.45 ***	-0.02	-0.12
	-4.94	-3.40	-4.80	-0.23	1.11	-2.18	-1.63	-2.75	-0.30	-0.55
Size	0.25 ***	0.30 ***	0.39 ***	-0.10	0.11 **	0.11 **	0.00	0.25 **	0.02	0.08
	6.81	4.32	4.36	-0.57	2.42	2.07	0.00	1.96	0.35	0.46
CDR/TL	0.02 ***	-0.01 **	0.00	0.12 ***	-0.01 ***	-0.01 *	0.00	0.00	-0.01 **	-0.01
	48.50	4.80	0.01	146.15	26.59	3.05	0.53	0.10	4.91	1.91
ALTHG/TL	0.00	0.00	0.00	0.00	0.00	0.00 ***	0.00	0.00	0.00	-0.01 ***
	0.76	0.32	0.54	0.14	2.03	20.23	1.28	1.65	0.21	11.67
IRDR/TA	0.00 ***	0.00 ***	0.00 ***	0.00 ***	0.00 **	0.00	0.00 **	0.00 *	0.00	0.00
	17.52	14.28	86.20	15.62	4.52	1.26	3.90	3.25	2.12	0.16
N	1868	1868	1868	1868	1868	1868	1868	1868	1868	1868
R2	0.28	0.10	0.28	0.18	0.10	0.13	0.06	0.14	0.03	0.05

t/F statistics in parentheses

*,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.