The Impact of Derivatives' Usage on Bank Holding Companies

Research Proposal

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1. Research Problem

1.1 The Research Problem

During the past two decades, financial markets in many countries have experienced dramatic development and transformations. In the U.S., traditional business of banks has declined significantly and the main activities of commercial banks have turned to the fee-producing business and charge fees as the main source of their profit. The financial markets, mainly the stock and bond market, have expanded in size dramatically. The financial innovations accelerate developing of financial instruments market, including the introducing of new financial products, such as mortgage backed securities and derivative instruments. At the same time, there also appear some new changes for financial futures, options and other derivative securities and these instruments become a major market and take large account of the transaction. The growth in the usage of financial derivatives by commercial banks has a tremendous speed.

Here questions come: Why do banks use derivatives? Is the usage of financial derivatives having impact on the bank’s risks? In the previous literatures, these studies failed to control for current risks in derivatives usage, did not take account of macroeconomic factors and did not control for size and risk capital. Also, as there has been a dramatic increase in derivatives usage by banks since 1995, most of the previous research directly relating risk exposure to bank derivatives usage only examined sample periods that ended in the early to 2005. Furthermore, none of the previous studies took account of the effects of level of derivatives held for trading in relation to total derivatives usage, examined the purpose and relationship between bank characteristics and the propensity for derivatives. In this study, the research will distinguish trading from other-than trading usage by BHCs, study the impactation of derivatives usage on the BHCs stock return sensitivity, and the risk sensitivity of interest rate exposure, exchange rate exposure and liquidity exposure by the usage of derivatives. Additionally, the study will put special focus on the affection during the financial crisis and find the empirical difference between different economy periods.

The research will focus on the investigation to gain insights on the usage of derivatives by financial companies. The following topics that form the framework and basic contents of the dissertation will be examined and studied:

(1) The impact of bank usage of derivatives on overall bank risk, including interest rate risk, exchange rate risk, and liquidity and credit risk;
(2) The bank-specific motivations, financial factors and macroeconomic environment which determine the bank's usage of derivatives;
(3) The relationship between bank characteristics and the propensity for derivatives trading activity as for the purpose of other than trading.
The studies will employ a research design, data, and statistical tests that correct for these limitations as follows: the impact of bank usage of derivatives on overall bank risk will be assessed through the simultaneous inclusion of interest rate risk, exchange risk and liquidity and credit risk. Additionally, improvements of the following in research design and sampling are expected: (1) recent and more representative data will be implemented; (2) improved sampling to overcoming definition changes will be employed; (3) differentiation between derivatives usage for trading versus other than trading activities will be implied; (4) examining the motivations of derivatives usage for, not only interest rate and exchange rate exposure management, but also basis risk exposure control; (5) taking account of macroeconomic conditions and the effects of level of derivatives held for trading in relation to total derivatives usage.

1.2 Hypothesis

The 1st paper will study the influence of the macroeconomic factors (market return, interest rate, exchange rate and credit and liquidity risk) on the stock return of the bank holding companies, figuring out the factors which have significant impact on the stock return. Based on this, the impaction of usage of different derivatives (interest rate derivative, exchange rate derivative and credit and liquidity derivative) on the bank holding companies exposures (interest rate exposure, exchange rate exposure and basis exposure) will also be studied, while the bank asset size is taken into consideration. In the first paper, following hypothesizes will be tested:

$H_{1A}$: The sensitivity of a financial company’s stock return to market, interest rate, exchange rate, and basis exposures is similar for all companies, irrespective of the size of the companies;

$H_{2A}$: There is no difference in use of derivatives by the financial companies due to the influence of related macroeconomic factor;

Based on derivatives information coming from quarterly Bank Holding Company performance reports from the Federal Deposit Insurance Corporation (FDIC), the usage of financial derivative by bank holding companies has two purposes: trading, which will increase the profit of the bank holding companies while increasing the exposures; other-than trading, using the financial derivatives to hedge the risks exposed to the bank holding companies. The 2nd paper will focus on this topic and will examine the difference in the levels of traditional banking activities because of the use of derivatives, also the difference between two different groups: bank holding companies use derivative for trading, and bank holding companies use derivative for hedging, also will be studied. In the second paper, the following hypothesizes will be tested:

$H_{3A}$: There is no difference in the levels of traditional banking activities as a result of use of derivatives by the financial companies;
\( H_{4A} \): There is no difference in the levels of traditional earnings measures as a result of the use of derivatives trading or other-trading activities in either of the two different groups;

Based on the research conclusions we will get from the above papers, the 3\textsuperscript{rd} paper will investigate on the difference of the on- and off-balance sheet variables between two groups: bank holding companies use derivative for trading and bank holding companies use derivatives for hedging, the exposures faced by the two groups and also the bank characteristics on the two groups. Also, the earning level and also the relationship with the macroeconomic factors will taken in the studies and figure out whether there is difference between recent years and the other years. In the third paper, the following hypothesis will be tested:

\( H_{5A} \): Risk, in term of current credit exposure and earnings volatility, is no difference in either group of financial companies as a result of using derivatives for trading or other-than-trading activities.

\( H_{6A} \): The earning and the relationship with the macroeconomic factors have no difference between the most recent years and other years.

The above hypotheses are tested by considering the alternative form of the null, as followings:

\( H_{1b} \): The use of derivatives by the larger ones is significantly influenced by the related macroeconomic factor (such as the interest rate, exchange rate, and basis sensitivities);

\( H_{2b} \): The market, interest rate, exchange rate, and basis exposure in case of the larger ones are significantly greater than similar exposure faced by smaller ones;

\( H_{3b} \): The use of derivatives by larger ones will be lead to an increase in these traditional businesses;

\( H_{4b} \): Derivatives trading activities in both groups of the financial companies will result in positive trading or related earnings for both groups with the trading related revenues predominating in the first group and non-trading related revenues predominating in the later group;

\( H_{5b} \): The use of derivatives by the control group would significantly reduce current credit exposure and earning volatility, and the current credit exposure and earning volatility for the primary group would increase significantly.

\( H_{6b} \): The earning and the relationship with the macroeconomic factors have
significantly difference between the most recent years and the other years.

2. Critical Literature Review

In the prior literatures, many of the studies have assessed the BHCs’ risk and find the use of derivatives has shift bank's risks. Several of the studies have found the increased use of derivatives by banks will lead to the increase of risks. For instance, Gorton and Rosen (1995), as the first to evaluate the relationship between the market value and interest rate sensitivity of bank derivatives positions, study the interest rate swaps and the empirical result shows banking system’s position has strong significant to the changes of interest-rate. Gorton and Rosen point out that, when the banks use derivatives, they will face twoserve problems: (1) it is hard for the banks to know how subject to interest rate and other risks the entire bank would be; (2) the bankruptcy of the bank has external effects. The failure of large banks can lead to the breakdown of the whole banking system and the collapse of the economy.

In the empirical study of the paper, Gorton and Rosen (1995) restrict attention on the banks organizations whose assets are greater than $500 million, for the smaller banks generally do not use swaps and have insignificant on the derivatives market. By exploring the reasons that a few large banks account for large proportion of the derivatives market, they concludes that one is because of the interest rate risk the large bank face in their business and the other reason is for the regulations which give incentives for the large banks to absorb interest risk that other institutions do not hedge. The result of this study indicates banking system as a whole, and dealer banks in particular, are exposed to interest rate risk, but the banking system can hedge most of the risk and the banks should pay little concerns about the systemic risk from swaps.

Géczy, Minton, and Schrand (1997) use the currency derivatives data of U.S banks and examine the use of derivatives, in ordering to find the difference among the exiting theories about hedging behavior. They argue that incentives for banks to hedge, created by the capital market imperfections, are necessary but not sufficient conditions for the banks to use derivatives instrument. Beside this, the banks also have to consider the level of risk they face, the cost of managing and hedging risk and the regulation of capital market. Their study investigates the determinates of corporate use of currency derivatives from different perspective and the empirical result shows companies that have higher growth opportunities but low accessibility to the financing will turn to the currency derivatives, and the firms of derivative users, generally more larger than the nonusers, are affected by the potential benefits of using currency derivative and the costs of implementing a specific derivative strategy.

Choi and Elyasiani (1997), first explain the difference between the derivative activities and the traditional off-balance sheet activities and then study the two issues
which concerned by the public: whether the bank customers are adequately informed about the nature and characteristic of the derivatives in the transaction and how the derivative transactions affect the banks’ risk. Focusing on the interest rate exposure and foreign exchange exposure, the paper examines the effect of off-balance sheet and on-balance sheet exposures by employing the monthly data from January 1975 to December 1992.

As the first formal estimates of the joint effect of derivatives exposure on interest rate and exchange rate, the empirical results show that exchange rate risk is more significant than interest rate risk and the traditional financial statement variables and derivative variables have great importance on the determinants of firm-specific interest rate and exchange rate exposure. The uses of derivative contracts have created another significant potential systematic risk beyond the traditional financial statement exposure. Choi & Elyasiani (1997) get the conclusion that exchange rate exposure risks is significantly greater than interest rate risk exposure and larger banks have significantly greater exposure risk than smaller banks.

Similar as Choi and Elyasiani (1997), Hirtle (1997) study the role played by interest rate derivatives on the stock return on bank holding company from a different point. By employing the financial data of the bank holding companies, the result of the analysis indicates the usage of derivatives has played a significant role in the bank holding companies’ interest rate exposure management. From the empirical study, the bank holding companies in the sample have greater interest rate risk consistent with the increase use of derivatives. The relationship is stronger for the bank holding companies that use derivatives as the dealer, compared to the small, end user banks. While in the early of the sample period, there is no significant relationship between the use of derivatives activities and the interest rate exposure. Hirtle gives two reasons to interpret this: one suggests that the use of derivatives tends to increase interest rate risk for the dealer of derivatives in the bank holding companies, another is derivatives maybe used to partially offset high interest rate risk airing from other activities.

In order to find the relationship between market-based measures of risk and the U.S. commercial banks’ usage of foreign currency, Chaudhry, Christie-David, Koch, & Reichert (2000) examine usage of four types of foreign currency claims by banks and investigate the market’s perception of bank’s risk concerning with different levels of usage. Banks use derivative for different purpose, some as the end users to hedge risk and others are dealers which provide risk management service to their clients. The empirical result gets different conclusions for four types of foreign currency derivatives. Generally speaking, the use of option tends to increase all types of bank risks, in contrast, the swaps seem to used for risk-control, while the use of forward contracts and currency commitments seems to contribute mildly, at most, to any type of risk. The evidence also suggests the use of derivative product by the banks as dealer increases unsystematic risk of banking industry, which is significant to the capital investors and the market regulators.
As public concern about whether the use of derivative reduce or increase the banks exposure, Hentschel and Kothari (2001) study this topic by employing the financial data of 425 large U.S. corporations. In the derivatives market, the financial firms and non-financial firms have different characteristic: nonfinancial firms hold slightly more foreign exchange derivatives, while financial institutions hold slightly more interest rate derivatives. The sample in the study shows no relationship between the volatility of a firm’s stock return and the scale of the firm’s derivatives. And the interest rate and exchange rate exposure of a firm are not directly related to the firm’s derivative position. They also argue that when a firm using derivatives for speculative purpose, more volatile returns and large exposures for firms with large derivative position are expected and there is no significant difference in the financial performance between derivatives users and non-users.

In terms of derivative activities and the exposure of international commercial banks, Reichert and Shyu (2003) find the use of future contacts has weak consistent with the bank risk and both interest rate and currency swaps gradually reduce the risk. These findings are significant and consistent with the U.S. commercial banks who act as dealers, followed by the European bank, and the Japanese banks. This result shows the significant differences in bank regulations in different countries and areas can interpret these findings. The bank regulation should provide banks enough flexibility in the risk management process and allow them to explore the information and technology advantage they have. This research indicate the similar findings as Chaudhry, Christie-David, Koch, & Reichert (2000): not all derivatives affect bank risk in the same way. The empirical results suggest the current managerial and regulatory interest in VaR modeling is justified as the technique to capture importance difference between different derivatives.

Purnanandam (2003) investigates the impact of financial distress cost on off-balance sheet interest rate hedging policies of U.S commercial banks. He concludes the decision to hedge or not is driven by ‘non-distress cost’ considerations such as economies of scale and extent of on-balance sheet risk-management. Purnanandam noted, however, once the decision to engage in derivatives based risk-management activity has been made, the extent of hedging is strongly influenced by the expected financial distress costs. Also, he concludes banks with higher distress likelihood hedge more than other. In essence, he implies larger banks are more likely to use derivatives for risk management and that banks that use derivatives for that purpose do so to reduce the probability of financial distress. This study does not directly assess the impact of derivatives usage on bank risk.

Since 1985 U.S. commercial banks become more active and engage in the derivative product market as end-users, or use them to hedge risks or for both purpose, because of the dramatic growth of derivative market, Brewer III, Minton, and Moser (2000) investigate the relationship between activities of interest rate derivative and the bank
lending business. They employ the sample period from June 1985 to the end of 1992, and find the use of interest rate derivative product and the growth of the banks traditions business have positive relation, and banks using interest rate derivatives have greater growth in their traditional business than banks that do not use these derivatives product. This finding is consistent with Diamond’s (1984) model: bank can reduce the cost of monitor contracts issued by their loans by holding a diversified portfolio. The model suggests derivatives lead to a reduction in the delegation cost, which, in turn, provide incentives for banks to increase their lending activities.

As the use of financial derivative has different impact on the exposure of the banks, then why banks use derivatives? Is there any difference between the users? Brewer, Jackson, and Moser (2001) examine the difference of the financial characteristic of banking organizations that use derivatives compared to those that do not use. They find the user of derivative product seems to increase their business lending faster and has lower level of capital than those that do not use. Consistent with the prior studies, the empirical result also shows large banks are more likely to use more derivative and for the large banking organizations who have a substantial variation in the usage of interest rate derivative product, the users tend to have less exposure to interest rate risk than nonusers and have the same sensitivity to the stock market return. At the end, Brewer, Jackson, and Moser also point out the regulatory and accounting in initiatives affect hedging behavior and risk exposures may have negative implications for lending and banking organizations’ stock market valuation.

While there are quantity of explanations of the risk faced by the banks, there is little evidence consider the role of bank management in the decision of use derivative products. Anderson and Fraser (2000a) find managerial shareholding has influence on the bank’s exposure. From the empirical study, they find there are difference between the periods of 1987-1989 and 1992-1994, the total and firm specific risk are negatively and significantly related to managerial holdings between 1987 and 1989, while between 1992 and 1994, the relationship is negative, and the systemic risk is unrelated to the ownership in both of the periods. The interpretation of this is because the banks response to the changes of regulatory which is designed to reduce incentives for risk-taking and improvements in the financial health of the banking industry. Evidence from the empirical study also shows banks with more franchise values are less likely to take risk than banks with lower franchise value.

Sinkey and Carter (2000), focusing on the characteristic of banks that use derivatives and others that do not use, explore the reasons why banks use derivatives and the impaction on the risk management of the bank. They examine the motivations for bank using derivatives: as taking the large account of the derivatives market by banks, banks use derivatives as dealer or end user or both. For the end user of derivatives, banks use derivatives either to hedge against the uncertainty in interest rate, exchange rate, or liquidity and credit risk; only for large banks, they act as the dealer by providing over-the-counter (OTC) derivative products to small banks or nonfinancial
firms. The banks that use derivatives and nonusers have different characteristic.

The empirical study of the paper indicates the user of banks have substantially different capital structure, which is in the form of more notes and less equity capital. At the same time, the user of banks are engaging in coordinated management of credit risk and interest rate risk and shows a positive relationship between the use of derivatives and interest rate risk. The empirical results seem to related to a bank having the scale and scope of activities which is very necessary to justify the cost of resources to cover a derivatives program, which gives some interpretation that small banks can not afford the cost of participating in the derivative market. Compared to nonuser banks, the user banks have more risky capital structures, large maturity mismatches between on-balance sheet assets and liabilities, greater net loan charge-offs, and lower net interest margins. One surprising finding shows the smaller banks, who are members to bank holding company, will benefit from the derivative market. These finding, which are consistent with prior studies, do not support a regulatory hypothesis that banks must have stronger capital positions to participate in derivative market.

By examining the market risk capital amounts reported by BHCs to determine what new information they provided about the market risk exposure undertaken by the BHCs and how those exposure evolve over time, Hirtle (2003) studies the market risk capital, trading and derivatives from the quarterly financial report FR-Y9C of BHCs and the empirical result shows the market risk capital figures disclosed in bank holding companies’ regulatory reports are potentially an important source of new information about risks undertaken by large banking organizations subject to the market risk capital standards. More specifically, the capital figures seem to contain information about these exposures that is not reflected in other data in the regulatory reports.

The most recent research concerning about the purpose of the derivative usage are Mahieu and Xu (2007) and Deng, Elyasiani et al. (2010). In their study, Mahieu and Xu (2007) construct and apply a panel data set that comprises all U.S. bank holding companies (BHCs) that have used interest rate or credit derivatives during the period 1997 to 2005. They use a combination of BHC balance sheet items and macroeconomic factors to answer the question whether or not a BHC hedges with either interest rate or credit derivatives. The study shows banks are more likely to be hedgers with interest rate derivatives when loan commitment, demand deposit, ROE, size and credit spread are higher; higher interest rate and term spread reduce the likelihood of a BHC being a hedger with interest rate derivatives. Higher transaction deposit, larger size and the engagement in the trading of credit derivatives induce banks to become hedgers with credit derivatives.

Similar to Mahieu and Xu (2007), Deng, Elyasiani et al. (2010) also examine the association between derivatives usage by BHCs for hedging and trading (speculation)
purposes and their cost of debt, and the association between BHC derivatives-based hedging and loan shares, loan credit risk, and loan-spread. They find higher levels of derivatives used for hedging (speculation) are insignificantly (positively) associated with the cost of debt. Greater hedging is also associated with greater loan to asset ratio, commercial and real estate loan to total loan ratios, and non-performing loan ratios, suggesting hedged banks focus on areas of activity where they have monitoring advantages.

3. Research Design

3.1 Multi-factor model

The multi-factor of model has been employed by several of papers (Flannery & James, 1984; BJ Hirtle, 1997), and provides a useful and significant approach to measure the relation between the use of derivative and the risks (market risk, interest rate risk, foreign risk and liquidity risk). A two-stage four-factor model is developed to analyze how the capital market reacts to the derivative market activity. In the first stage, market return, interest rate, exchange rate and liquidity betas are regressed using the quarterly stock return over the separate quarterly periods. In the second stage, cross-sectional regressions are estimated to determine how BHC derivative activity affects these four distinct measures of capital market risk.

The first-stage regression is as follows:

\[ R_i = \alpha_i + \beta_{im} R_m + \beta_{ir} R_r + \beta_{ix} R_x + \beta_{ib} R_b + \epsilon_i \]  

Where \( R_i \) = the return on BHC stock \( i \) during time period \( t \); \( \beta_{im}, \beta_{ir}, \beta_{ix}, \beta_{ib} \) = sensitivity of returns of each bank “\( i \)” to market risk, interest rate, exchange rate, and basis exposure, respectively; \( R_m \) = excess return on market portfolio at time “\( t \)” where the market portfolio value-weighted market index; \( R_r \) = interest rate risk factor, measured by the monthly percentage rate of changes of risk-free treasury bill; \( R_x \) = exchange rate risk factor, measured by monthly percentage rate of change in foreign exchange value of the hard currency; \( R_b \) = the default risk measure; \( \alpha_i, \epsilon_i \) = constant and random error terms, respectively.

The quarterly returns on each of BHC stocks and the market index get using the formula \( \left[ (P_t - P_{t-1}) / P_{t-1} \right] \), adjusted for dividends. The S&P 500 index is used to measure the market beta for BHCs. The interest rate index is measured by the quarterly changes in the 3-month Treasury bond in the sample, i.e., \( (q_t - q_{t-1}) / q_{t-1} \). The index of
U.S dollar against a basket of major currencies is used to measure foreign exchange risk, i.e., \( \frac{f_{t-1} - f_{t-1}}{f_{t-1}} \). The basis risk index is constructed by the change in spread between the prime rate and the average of the fed funds and 3-month LIBOR Rate, i.e., 
\[
\left[ \text{prime}_{t-1} - \left( \text{Fed funds}_{t-1} + \text{LIBOR}_{t-1} \right) / 2 \right] - \left[ \text{prime}_{t-1} - \left( \text{Fed funds}_{t-1} + \text{LIBOR}_{t-1} \right) / 2 \right].
\]

### 3.2 Derivative Regression Model

In the second step, the interest rate, foreign exchange rate and basis risk betas generated in the first stage are regressed against bank-specific on and off-balance sheet exposure variables. In order to adjust for possible bias due to cross-equation dependencies, the regress equation in each of the BHCs are estimated as a simultaneous equation system, using a modified Seemingly Unrelated Technique (SUR). The modified SUR technique, due to the use and develop by Choi & Elyasiani (1997), is a variation of the standard SUR method and produces asymptotically efficient estimates without imposing either conditional homoskedasticity or serial independence restrictions on disturbance term.

Consider that the BHCs have net basic balance-sheet exposure of \( B \), and net derivative off-balance sheet exposure of \( D \), with respect to interest rate, exchange rate and basis rate risk. The stock return \( R_n \), can be stated as:
\[
R_n = a_n B_n + b_n D_n + \epsilon_n
\]  

Where \( a_n \) and \( b_n \) are arbitrary parameters, and \( \epsilon_n \) is a component related to other risks as well as measurement errors. Note that the equation (2) is in vector form, summarizing the sensitivity of stock returns with respect to both basic balance sheet and derivative off-balance sheet exposure to interest rate, exchange rate and basis risk measures.

In equation (1), the standard definition of market risk beta is
\[
\beta_m = \frac{\text{cov}(R_t, R_m)}{\text{var}(R_m)}  \quad (3)
\]
By applying similar definitions for interest rate, exchange rate risk and basis risk and substituting (2) for \( R_n \), we get the following equations:
\[
\beta_{ir} = \frac{\text{cov}(R_t, R_{ir})}{\text{var}(R_t)} = \frac{a_t \text{cov}(B_t, R_t) + b_t \text{cov}(D_t, R_t)}{\text{var}(R_t)}  \quad (4)
\]
\[
\beta_{xr} = \frac{\text{cov}(R_t, R_{xr})}{\text{var}(R_t)} = \frac{a_t \text{cov}(B_t, R_t) + b_t \text{cov}(D_t, R_t)}{\text{var}(R_t)}  \quad (5)
\]
\[
\beta_{br} = \frac{\text{cov}(R_t, R_{br})}{\text{var}(R_t)} = \frac{a_t \text{cov}(B_t, R_t) + b_t \text{cov}(D_t, R_t)}{\text{var}(R_t)}  \quad (6)
\]

From the equations (4)—(6), we can find that the interest rate, exchange rate and basis risk betas are thus estimated as a simultaneous function of bank-specific basic balance...
sheet and derivative off-balance sheet exposure. The simultaneous estimation accounts for bias arising from interaction among interest rate, exchange rate and basis risk, as well as the dependence between bank-specific variables. The estimable equation system can be specified as

\[
\begin{bmatrix}
\beta_{12} \\
\beta_{13} \\
\beta_{14}
\end{bmatrix} =
\begin{bmatrix}
a_2 \\
a_3 \\
a_4
\end{bmatrix}
\begin{bmatrix}
B_{12} & B_{13} & B_{14} \\
B_{21} & B_{22} & B_{23} \\
B_{31} & B_{32} & B_{33} \\
B_{41} & B_{42} & B_{43}
\end{bmatrix} +
\begin{bmatrix}
b_2 \\
b_3 \\
b_4
\end{bmatrix}
\begin{bmatrix}
D_{12} & D_{13} & D_{14} \\
D_{22} & D_{23} & D_{24} \\
D_{32} & D_{33} & D_{34} \\
D_{42} & D_{43} & D_{44}
\end{bmatrix}
\]

(7)

As the estimation of betas in the first step, the equation (7) is simultaneous because the balance sheet and derivative exposure variables affect all of the interest rate, exchange rate and basis risk betas. The modified SUR procedure enables us to incorporate the interaction of the three exposure equations as a system.

4. Measurement Issues

The data and variables obtained from the Schedule RC-L of the quarterly Call Reports and support it by other sources such as FR Y-9C. The U.S. commercial banks are required to report the usage of derivatives separately by the purpose of trading and non-trading from the March, 1995. As we discussed before, banks use derivatives as end-user, trader, or both. As trader, the role of derivative contacts are used for trading and making profit from the transaction; while as end-user, the derivatives are used for hedging risk. In the Call Report, the banks report the derivative activities in the case of trading as” contract held for trading purpose”. The derivatives contract used for hedging purpose are reported as” contract held for non-trading purpose”. Considering the characteristic of the banks activities, the variables are constructed from the two following standards:

4.1 Basic (On Balance Sheet) Variables

Interest Rate Exposure:
Net interest sensitive assets repricing in less than one year (GAP12) will affect the interest rate exposure. The exact impact will depend on the repricing or funding gap and whether the rate sensitive assets are more or less than the rate sensitive liability. In the period of rising interest rate, the ABSGAP variable will be positively related to the interest rate exposure. ABSGAP is the net assets repricing or maturing within one year.

Commercial and Industrial loans (CIL) are important measure of lending activities and consequently have a direct impact on interest sensitivities and interest rate exposure. It is expected that this variable will be similarly positively related to interest rate exposure.CIL is the commercial and industrial loans expressed as a fraction of total asset of the BHC.
Mortgage loans and similar resource exposure to real estate and agriculture products (MORT) are found to significantly relate to the interest rate exposure by the literature.

Loans other than CIL and MORT (i.e., LOANS) will have significantly relationship to the interest rate exposure in times of rising interest rate. LOANS represent the total loans less CIL and MORT.

The domestic deposits (DEPOSITS) should be negatively correlated to interest rate, and might well be dependent upon interest rate sensitive deposits.

**Exchange Rate Exposure:**

Assets in foreign offices (FOA) indicate whether the bank is susceptible to exchange rate movements.

Deposits denominated in foreign currencies and in foreign offices (FxDEP) will have a negative relationship to the exchange rate exposure, as increase in the value of U.S dollar will reduce the exposure to exchange rate risk.

The variable FxLIQ is used to reflect the impact of short term (liquid) foreign currency asset. This variable is similar to the ABSGAP variable and is expected to be positively related to the foreign exchange rate variable.

**Basis exposure:**

Sum of cash, securities (both held-to-maturity and available for sale), and fed funds lent, represents the market liquidity exposure (MLIQ), and the sum of fed funds purchased and borrowed money less core deposits, represents the funding liquidity exposure (FLIQ). MLIQ and FLIQ effectively represent the liquidity exposure component of the basis risk, and are positively and negatively related to basis exposure of BHC.

Basis exposure is also affected by the extent of non-performing loans. The NPL variable, which represents the total amount of loans classified as part due for more than 30 days and/or as non-performing is used in the estimation process.

Loan charge-offs (LCO), and loans loss provision (LLP) were found to result from basis exposure undertaken by the BHCs in previous studies.

Anderson and Fraser (2000b) modified Tobin’s Q, based on Keeley’s adaptation to indicate the health of the individual banking firm. In this research, KQ represents the Keeley’s Q, and expected to be a significant explanatory variable in the model.

In addition, SIZE, which is the log of total assets scaled by 1000, is used as the control variables. Risk capital is used to control for unique features in estimation the
exposures in the BHCs. The total risk based capital ratio (TRBCAP) would be positively related to increased derivatives usage.

4.2 Derivatives (Off-Balance-Sheet) Variables

Interest Rate Derivatives:
Interest rate options bought (IOPTB) will be negatively correlated, and the interest rate options written (IOPTW) will be positively correlated with interest rate changes. Interest rate futures and forwards (IFF) and interest rate swaps (ISWAP) will enable the BHC to reduce or increase its exposure to interest rate changes.

Foreign Exchange Derivatives:
Currency options bought (XOPTB) and currency options written (XOPTW) have a negative and positive relationship with exchange rate sensitivity, respectively.

Both currency futures and forwards (XFF) and currency swaps (XSWAP) variables are expected to have a negative and positive relationship with respect to exchange rate sensitivity as in the case of interest rate forwards and futures.

The amount foreign currencies held for immediate delivery, SpotEX, is the final exchange rate sensitive, off-balance-sheet independent variables. The relationship of the variable to exchange rate exposure depends on the whether a specific currency is appreciating or depreciation, with respect to the U.S dollar and other currencies in the index.

Basis Exposures and related Derivatives:
Credit Derivatives, for which the BHC is the guarantor (CDG) will increase the exposure of the BHC to possible basis risk, and should therefore be positively related to BASIS.

BHC use credit derivatives, for which the BHC is the beneficiary (CDB), to reduce the basis risk exposure, and hence there should be an inverse relationship between this variable and basis risk exposure.

The sum of unused commitments, letters of credit (financial performance and commercial), and acceptances (UNCOM) should be positively related to basis risk, and this variable is also expected to be significant.

4.3 Data Source

The data used in this study are obtained from two sources: (1) Call Report data from the bank holding company database at the Federal Reserve Bank of Chicago which has the FR Y-9C financial data; (2) Historical bank holding company stock price from the Center of Research of Security Price (CRSP) at the University of Chicago.
Besides the firm-level specific data, the macroeconomic data also obtained from the Federal Reserve Board of Governor. The specific information goes as follows:

4.3.1 Derivatives Data Source
Derivatives information comes from quarterly Bank Holding Company performance reports from the Federal Deposit Insurance Corporation (FDIC). For banks in the U.S, they are required to report the financial data regarding a bank’s financial condition and its operation. The information is extensively used by the bank regulatory agencies in the daily bank monitoring activities. The Federal Financial Institution Examination Council (FFIEC) is fully responsible for maintaining an accurate and up-to-data Call Data base available to all users. Call Reports data are critical publicly available source of information regarding the status of U.S. banking system1.

Call Report data, in contrast to certain other studies that used annual reports or data of the banks’ websites, which may not have been as standardized and consistent. Reporting of derivatives and other off-balance sheet data is hardly consistent or comprehensive across BHCs. Interpreting and converting such data to standardized, comparable data might well have introduced errors across BHCs, in addition to subjectivity. Call Report, though, preliminary and un-audited, contain data in standardized formats using fairly precise definitions and measurement guidelines (set forth by the bank regulators).

The specific information that will be used in this study come from the bank holding company database at the Federal Reserve Bank of Chicago which has the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) financial data. This report collect basic financial information from the U.S. domestic bank holding company (BHC) with total consolidated assets of $500 million in the form of a balance sheet, an income statement, and detailed supporting schedules, including a schedule of off-balance sheet items. Since March 1995, bank holding companies are required to report whether their derivatives activity is for trading purpose or for purpose other than trading.

Off-Balance Sheet Derivatives Variables include four items chosen from the report of income and report of condition schedule L. The four items are swaps, options, forwards and futures. Derivative items are calculated as the ratio of the notional amount of each derivatives item to the total assets. The On-Balance Sheet Variables are also collected from the call reports of the banks.

4.3.2 Stock Price Data Source
Stock returns from the Center of Research of Security Price (CRSP) at the University of Chicago will be used for the individual bank holding company daily stock returns and the market index. Stock returns, market model betas, and returns variance will computed using the CRSP daily return data.

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1 See [http://www2.fdic.gov/Call_TFR_Rpts/inform.asp](http://www2.fdic.gov/Call_TFR_Rpts/inform.asp) for specific information.
4.3.3 Macroeconomic Data Source
The macroeconomic data are used to evaluate the stock return sensitivity. First, the interest rate is introduced as the control variables in the economy as an indicator for the tightness of money supply, and it is measured by the annualized yield on 6-month treasury rate during the quarter, which is reported in the H.15 Release from the Federal Reserve Board of Governors. The exchange rate, as the second macroeconomic variables, measures the exchange rate risk factor. The data is measured by the monthly percentage rate of change in foreign exchange value of the U.S dollar versus a subset of the broad index currencies that circulate widely outside the country of issue. This information is reported in the G.5 Release from the Federal Reserve Board of Governors. Both sets of information above are obtained from the Federal Reserve Economic Data (FRED) database maintained by the Federal Reserve Bank. The market index used in this study is the market return on the equally weighted NYSE/AMEX/NASDAQ market index with dividends, while the Basis spread (which reflects both credit and liquidity exposures) is defined the yield difference between the Aaa-Bbb corporate debt.

5. Scientific Contribution

Previous theories of banking and risk management have predominantly focused on the traditional role of banking and similarly traditional methods of risk management. However, both the role of banking and the tools available for managing risks have changed substantially during the last decade, with a significant part of the change occurring in just the past few years. The move from traditional, time-tested banking to newer, and untested, banking has been documented in both academic and regulatory publications. Initial measurement and subsequent control of various exposures facing financial companies are important issues for regulators, bank customers, and the general public. They are also important for the banks themselves, as exposures have a potential to adversely affect a bank by turning from mere exposures to actual risks. These exposures may be advantageous or disadvantageous for a bank, depending on various factors that are unique to each bank and to the specific point in time. Unfavorable exposure arises when the financial success of the BHC might be adversely impacted by changes in the underlying factors such as interest rates, exchange rates, quality of bank loans, and the bank's liquidity position.

It is expected that after the employ of the recent data sample and analysis of the macroeconomic factors, on-and off-balance sheet variables, this research will give some conclusions about the relation between the usage of derivatives by bank holding companies and the sensitivity of interest rate exposure, exchange rate exposure and basis exposures over the studied period; find out the bank specific motivations, financial factors and macro economic factors which determine the extend of banking holding companies use of derivatives; provide insight to the purpose, benefit and risk of derivative usage by banks and the propensity for derivatives trading activity as opposed to derivatives trading for purposes other than trading.
References


