Financial Derivatives at Community Banks

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Abstract: Recent financial regulation changes have brought many challenges to community banks. The Volcker Rule, section 619 of the Dodd-Frank Financial Reform Act of 2010, prohibits banks from engaging in proprietary trading in derivatives. Banning proprietary trading will deter smaller banks, especially community banks, from the permissible risk management derivative activities. This paper provides empirical evidence on how profitability at community banks was affected by derivatives before and after the 2008 crisis and estimates the potential effects of the Volcker Rule on profitability of these small banks if they had to operate under such rule. Contrary to the premises of the Volker Rule, we find derivatives helped reduce the sensitivity of profitability to credit risks and improve the profitability at community banks.

1. Introduction

Financial derivatives emerged as risk management tools. Hedging theory suggests that proper use of derivatives could remove uncertainty and balance future cash flows. Recently, however, numerous headlines of derivatives misuse, such as the trading losses of JPMorgan Chase and Union Bank of Switzerland, the collapse of Orange County in California, Barings Bank and Long-Term Capital Management have attracted much attention. Derivatives misuse is considered a major factor in the 2008 financial crisis and their impact on the financial stability of the U.S. banking industry has attracted the attentions of regulators.

Regulators created, Section 619 of Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, commonly known as Volcker Rule, to prohibit banks from engaging in

[1] The opinions expressed are those of the authors only. They do not represent the views of the Regions Financial Corporation.

proprietary trading in derivatives. However, permitted derivative activities, such as market making, underwriting and risk management, are similar to proprietary trading in many cases, which makes it difficult to distinguish proprietary trading from permissible activities. Therefore, the implementation of the Volcker Rule is extremely difficult and challenges banks to justify their permissible derivative activities. If it were implemented, banks, especially smaller banks such as community banks, may have to reduce and even stop using derivatives for risk management due to the increased regulatory costs. This paper analyzes how derivative activities affect community banks' profitability in the pre- and post-crisis periods.

Community banks are usually small banks and serve within a relatively closed area. Compared to large banks, they have more conservative capital structures, hold more liquid assets and are more cautious to risky investments. Although there has been a trend of diversifying services from traditional loans and savings to fee generating services due to the increased interest rate risk and bank deregulation since 1980s, community banks still maintain focus on providing traditional savings and loans. By 2012, over 88% of revenues at community banks came from interest income, while in large banks, over 30% of operating revenues came from non-interest income.

Gains from hedging are proportionally larger for small banks and small banks should be more likely to hedge due to the higher bankruptcy cost in small firms (Warner, 1977). The high cost of implementing hedging strategies, however, deterred community banks from derivative activities until the enactment of Gramm-Leach-Bliley Act in 2001. Call report data show that less than 1% of community banks used derivatives in 1999, mainly to manage interest rate risk. However, regulatory changes in the 1990s, the Riegle-Neal Interstate Banking and Branching Act of 1994 and the GLB Act of 1999, have made it possible for small banks to hedge through other derivatives. Call data show that derivative use by small banks surged since 2001. By 2012, around 18% of the community banks were active derivative users which included 10% of agricultural specialists, 23% of commercial real estate (CRE) specialists, 17% of mortgage specialists, 24% of multi-specialists, and 15% of non-specialty banks.

Little is known, however, about how derivatives affected these community banks. Previous empirical studies on derivatives at banks focused on exploring how these contracts affect the performance of large financial institutions, mainly because large financial institutions are the main players in the derivatives market with a longer history of derivatives use. Due to community banks' recent and limited exposure to derivatives, their impact on small banks performance is not well understood.

Published literature focuses mostly on evaluating how firm value and risk levels are affected by derivatives since derivatives are risk management contracts. There is limited literature on how bank profitability is affected even though trading losses from inappropriate derivative activities are usually large enough to cause financial difficulty and even bankruptcy. Community banks are usually small in size, use limited funding sources, and are more vulnerable to the inappropriate derivative activities. This paper attempts to fill the gap in the current literature and provides estimates on how derivatives affect profitability at community banks.

Unlike large banks which focus on transactional banking and serve as dealers in derivatives market, community banks are small in size, committed to serve local customers, and are end-users in derivatives. Community banks are also relatively new to the derivatives market. Their compliance cost and the cost to take derivative positions, either for risk management or for trading, are proportionally higher than those at large banks. Thus, it is less likely for community banks to speculate in derivatives than large banks and studying derivative activities at community banks has the potential to separate the benefits of hedging from that of trading activities.

Although credit derivatives were introduced to manage credit risk and the FED allows banks to use credit derivatives to substitute capital, such products are mainly used in large banks. Call report data show that community banks did not use such products to manage credit risks.

Banks are relatively heterogeneous and banks with different lending specialty may use and benefit differently from derivatives. Thus, we follow the classification of FDIC (2012) and group community banks as commercial real estate (CRE) specialists, mortgage specialists, agricultural specialists, multi-specialists and non-specialists. The next section discusses the current literature on derivatives at banks; section 3 discusses theoretical and empirical models used in this research; section 4 discusses data; and section 5 discusses the empirical results. Finally, section 5 summarizes and concludes this paper.

2. Literature Review

Previous literature on derivatives at commercial banks mainly focused on two areas: (1) the incentives of using derivatives and (2) how derivatives affect banks' risk level and investment.

2. 1 Why Banks Use Derivatives

Capital structure irrelevance theory developed by Modigliani and Miller (1958) suggests that in a perfect world, the equity value of a commercial bank is not affected by how the bank is financed as well as its hedging activities. However, market imperfections create incentives for firms to hedge: 1) increase the after-tax cash flow; 2) reduce the cost of financial distress; 3) reduce other costs such as cost of expensive external financing, agency cost and asymmetric information. As discussed by Smith and Stulz (1985) and Nance, Smith, and Smithson (1993), in a value-maximizing firm, with a convex expected corporate tax liability function, hedging can lead to a lower tax liability when the pretax income is relatively high. The benefits of hedging increase with an increase in pretax income if the tax function can make the after-tax cash flow function more concave. Meanwhile, Stulz (1984) and Smith and Stulz (1985) also argue that with the reduced variation in cash flow, the probability of financial distress is lowered as well, and thus hedging can reduce the expected cost of bankruptcy. Motivated by this argument, the model developed by Froot, Scharfstein, and Stein (1993) implies that, with increased cash flows from hedging, the demand for expensive external financing is reduced. Thus, banks' hedging behaviors are also motivated by the desire to reduce the expensive external financing for future investments.

In addition, the financial intermediary theory developed by Diamond (1984) implies that banks should not assume risks that they could not control or have no advantage of monitoring, such as interest risk. Allowing banks to hedge uncontrollable risks or systematic risks can further reduce the delegation cost to monitor loan borrowers. Thus, hedging allows banks to obtain optimal benefits from diversification by reducing the delegation cost, which serves as an incentive for lending. His model implies that if the systematic risks are hedged completely, bank value and cash flow should not be sensitive to the variation of interest rate and bank should increase lending. Motivated by Diamond's idea (1984), Froot and Stein (1998) extend the analysis and decompose risks into tradable risks, such as interest risk, and non-tradable risks, such as credit risk. With the existence of non-tradable risks, banks must hold capital and decide their optimal level of exposure to such risks given the benefits and costs of hedging non-tradable risks. Thus, risk management, capital structure and capital budgeting decisions must be determined simultaneously in order to maximize bank value. In this case, allowing banks to hedge both tradable and non-tradable risks will not only affect bank lending and profitability but also have an impact on their capital structure. Empirical studies, such as Geczy, Minton, and Schrand (1997) and Sinkey and Carter (2000), support these arguments and document that banks with riskier capital structure and with less liquid assets are more likely to use derivatives.

Warner (1977) suggests that small banks should hedge more than large banks due to the cost of bankruptcy, which is proportionally higher at small banks. However, the cost of retaining qualified personnel and establishing hedging program is also proportionally higher at small banks, which serves as disincentives for banks to hedge. In addition, manager utility maximization by Stulz (1984), Smith and Stulz (1985) and Shapiro and Titman (1985) suggests that managers are more likely to hedge if their compensation is a concave function of firm value. This theory implies if a manager is compensated with stock option, whose value is positively correlated to the volatility of the firm value, he is more willing to take more risks and thus is less likely to hedge to maximize his own compensation.

Other factors that are not related to market imperfection also affect banks' risk management decisions. Alternative financial policies, such as conservative capital structure and low dividend payout ratio, serve as a substitute for hedging, and thus reduce the incentive to hedge (Shapiro and Titman, 1985; Nance et al., 1993; Pagano, 2001). As community banks are small and the cost of hedging is relatively high for small banks, rather than use derivatives, these banks are more inclined to maintain conservative capital structures and investment policies to reduce risk exposures.

2. 2 Derivatives Activities in Banks

The literature on derivatives and the general banking sector has identified mixed results. Some empirical studies support the theory by Diamond (1984) which indicates derivatives serve as a complement to banks' lending activities. Brewer, Jackson, and Moser (1996) find that, with derivatives, savings and loan institutions experience higher growth rate in fixed-rate mortgage loans and charge lower rates on large, partially insured certificates of deposit. Similarly, Zhao and Moser (2009a), Brewer, Minton, and Moser (2000) and Brewer, Jackson, and Moser (2001) detect a positive relationship between commercial and industrial (C&I) loan growth and derivative activities. In addition, by studying the effects of macroeconomic shocks on interest rate risk management at commercial banks, Purnanandam (2007) finds that derivative user banks make less or no adjustments to the on-balance sheet maturity gaps and do not cut lending when the FED tightens monetary supply, while the non-users reduce lending when facing the same situation.

In addition, some studies find that derivatives help reduce the banks' risk level. For example, Gorton and Rosen (1995) study derivative activities at commercial banks during 1985 and 1993. They find that the change in net incomes due to the change in interest rate is partially offset by the opposite change in net incomes from the interest rate risk hedge through swaps, and thus derivatives help mitigate most of the systematic risks at commercial banks. Zhao and Moser (2009b) find that with both on- and off-balance sheet risk management methods, BHCs effectively reduce the interest rate sensitivity of bank stocks. Similarly, Brewer et al. (1996) find that derivatives reduce the risk, which is measured by the volatility of the stock returns at savings and loan institutions. By extending the two-factor market model developed by Flannery and James (1984), Choi and Elyasiani (1996) detect a strong risk reduction effect of derivatives on the interest risk and foreign exchange risk for large banks when the risk is measured as sensitivity of stock returns to interest rate risk and to foreign exchange risk respectively. Shen and Hartarska (2013) find that derivatives help agricultural banks improve the profitability and reduce its sensitivity to credit risk and interest risk during the 2008 financial crisis.

Other work, however, finds that derivatives increase the riskiness at commercial banks. Using similar methods of Flannery and James (1984) and Choi and Elyasiani (1997), Hirtle (1997) examines the relationship between derivative activities and BHCs' interest rate sensitivity of stock returns between 1986 and 1994. He finds that interest rate derivatives increased the interest rate sensitivity of stock returns, and stock returns of large dealer BHCs were more sensitive to interest rate risk than the other BHCs. Based on the dealer model developed by Ho and Saunders (1981), Angbazo (1997) analyzes the effects of off-balance sheet activities on banks' profitability during 1989 and 1993. She finds that while off-balance sheet activities improved banks' profitability by allowing activities otherwise restricted with debt or equity financing, these activities increased banks' exposure to on-balance sheet liquidity risk and interest rate risk. Measuring risk with systematic risk (β), standard deviation of the stock returns, and implied volatility, Hassan and Khasawneh (2009a) find that while interest rate swaps are risk-reducing products across all the three risk measures, but the other derivative contracts (option, future and forward) are positively correlated to the systematic market risk (β).

The mixed results about the effects of derivatives on bank performance are likely due to the fact that speculating and hedging derivative activities are difficult to be distinguished in practice and that above studies are based on a sample with large banks which have extensive market making and speculating derivative activities. Therefore, the results from above studies are highly likely to be disrupted by the non-hedging activities, especially speculating activities. However, community banks have shorter history of using derivatives. Although there was a wave of consolidation of community banks, these banks remain small, have conservative capital structures, and are not likely to speculate in derivatives due to the costs of trading derivatives that are proportionally higher at small banks. Thus, studying the effect of derivatives at community banks, especially agricultural banks, allow to reduce, if not avoid, the disruptions of non-hedging derivative activities.

3. Empirical Model

Banks serve as the intermediary between the depositors and borrowers, profiting from the difference between the interest charged for loans and the interest paid to depositors. The interest rate spread between loans and deposits plays a dominant role in bank profitability. Based on the assumption that the bank serves as a risk-averse dealer and maximizes expected utility of wealth, Ho and Saunders (1981) developed a framework to explain bank pure interest rate spread. Such framework has been extended by Allen (1988), Angbazo (1997), and Saunders and Schumacher (2000) to study bank net interest margin (NIM). Following Ho and Saunders (1981) and Angbazo (1997), the pure interest rate spread is nested into the empirical model, and bank profitability or net interest margin (NIM) is modeled as a function of bank specific risk factors as follows:

$$NIM_{it} = F(S_{it}^{*}(.), X_{it}, \epsilon_{it}) \quad (1)$$

Where function $S_{it}^{*}(.)$ is the pure spread between loan rate and deposit rate, mainly determined by interest rate risk. X_{it} includes bank specific variables which control liquidity risk, credit risk, capital adequacy, management quality and other factors.

Although banks have been deviating from the traditional savings and loans since 1980s and over 30% of the total revenues at commercial banks came from noninterest income in 2010, the traditional savings and loans are still the main business for community banks and only 12% of the revenues at these banks came from noninterest income. Thus, NIM still plays a dominant role on bank profitability at community banks. However, NIM only includes the unhedged operating income from banks' investments, and gains or losses from derivatives are recorded in the trading revenues which are part of noninterest income. In order to capture the full effects of derivatives on bank profitability, rather than NIM, return on assets (ROA) is used to measure bank profitability in this research. The empirical model is adjusted accordingly as

$$ROA_{it} = F(S_{it}^{*}(.), X_{it}, \epsilon_{it}) \quad (2)$$

The final empirical model for profitability is:

$$ROA_{it} = F(Interest\ rate\ risk, Credit\ risk, Liquidity\ risk, Capital\ adequacy, Management, Other\ control\ variables) \quad (3)$$

To detect the effects of derivative activities, a common method is to include a dummy variable which identifies the banks which participate in the derivative market in the above equation:

$$ROA_{it} = X_{it}\beta + I\zeta + \varepsilon \quad (4)$$

Where X is a vector of risk factors and other control variables in equation (3), and I is the dummy variable which identifies derivative users. This model assumes that the bank decision to use derivatives is exogenous to its profitability and that derivative activities only affect the average profitability (intercept effect) rather than the sensitivities of profitability (β) to various risk factors. However, such assumption is too strong and unrealistic in the real world. First, the decision to use derivatives is affected by unobserved factors such as manager's knowledge of derivatives, banks' risk management policy, and manager's risk preference, which are likely to affect profitability through asset-liability management as well. Derivative users, in turn, are systematically different from non-users and have self-selected themselves to use derivatives. Secondly, bank profitability for user and non-user tends to react differently to risk factors due to derivatives. Thus, the bank decision to use derivatives and its profitability are not independent, and profitability for derivative users and non-users should be estimated separately.

In this case, the endogenous switching model, developed by Maddala and Nelso (1975) and Maddala (1986), not only controls for the endogenous selection problems, but also allows the user and non-user banks to react differently to the risk factors. The model is adjusted to fit panel data by the method suggested by Wooldridge (1995, 2002):

(5) $Y_{1it} = X_{1it}\beta_1 + c_{1i}^* + \mu_{1it} \ \ if \ I_{it} = 1$

(6) $Y_{2it} = X_{2it}\beta_2 + c_{2i}^* + \mu_{2it} \ \ if \ I_{it} = 0$

(7) $I_{it}{}^* = X_{it}\beta_3 + Z_{it}\gamma + \varepsilon_{\varepsilon_i} + a_{it}$

(8) $I_{it} = 1 \ iff \ I_{it}{}^* \geq 0$

(9) $I_{it} = 0 \ iff \ I_{it}{}^* < 0$

Where equation (5) and (6) are the models of interest which model bank profitability as a function of risk factors; X_{1it} and X_{2it} is the vectors of variables which affect profitability for user and non-user banks; and Z_{it} is a vector of variables which affect decision to use derivatives. c_{1i}^* and c_{2i}^* contain unobserved individual effects which also determine the profitability for users and non-user banks. To control the correlation between ε_i and $I_{it,}$ with panel data, it is assumed that the correlation follows the form proposed by Mundlak (1978):

(10) $$\varepsilon_i^* = \overline{x_\imath}\theta_1 + \xi_i$$

Where $\varepsilon_i \mid x_{i,} \ z_i \sim$ Normal$(0,\sigma_\varepsilon^2)$; $\overline{x_\imath} = T^{-1}\sum_{t=1}^{T} z_{it}$

Thus, the selection function becomes:

(11) $$I_{it}{}^* = X_{it}\beta_3 + Z_{it}\gamma + \overline{x_\imath}\theta_3 + \xi_i + a_{it}$$

It is further assumed that:

(12) $$c_{1i}^* = \overline{x_\imath}\theta_1 + c_{1i}$$

(13) $$c_{2i}^* = \overline{x_\imath}\theta_2 + c_{2i}$$

Thus, equation (2) to (3) becomes:

(14) $$Y_{1it} = X_{1it}\beta_1 + \overline{x_\imath}\theta_1 + c_{1i} + \mu_{1it} \ \ if \ I_{it} = 1$$

(15) $$Y_{2it} = X_{1it}\beta_2 + \overline{x_\imath}\theta_2 + c_{2i} + \mu_{2it} \ \ if \ I_{it} = 0$$

Under the above settings, c_{1i} and c_{2i} are independent of explanatory variables as well as μ_{1it} and μ_{2it} with normal distribution with zero mean and variance σ^2. β_1 and β_2 are the coefficients which capture the sensitivities of bank profitability to risk factors. θ_1 and θ_2 capture the fixed effects factors in the error terms. Following the method suggested by Wooldridge (1995, 2002), the two-step method is used to adjust for the sample selection problems. In the first step, probit regression on banks' choice of whether to use derivatives, as expressed in equation (7), is estimated for each period and then the inverse Mills ratios for users and non-users are calculated as follows:

(16) $$\lambda_{1it} = \frac{f(X_{it}\beta_3 + Z_{it}\gamma + \bar{x}_i\theta_3)}{F(X_{it}\beta_3 + Z_{it}\gamma + \bar{x}_i\theta_3)} \; if \; I_{it} = 1$$

(17) $$\lambda_{2it} = -\frac{f(X_{it}\beta_3 + Z_{it}\gamma + \bar{x}_i\theta_3)}{1 - F(X_{it}\beta_3 + Z_{it}\gamma + \bar{x}_i\theta_3)} \, if \; I_{it} = 0$$

In the second step, the inverse Mills ratios are plugged into the main equations (9) and (10). The coefficients vectors β_1, β_2 and β_3 include the effects of risk factors on profitability for user and non-user banks and on the decision to use derivatives. Bootstrapped standard errors are calculated for both steps to correct for the heteroskedasticity and serial correlation. After estimating the models, conditional expectation can be calculated:

(18) $$E(Y_{1it} | I_i = 1, x_{1i}) = x_{1it}\beta_1 + \bar{x}_i\theta_1 + \alpha_1\lambda_{1it}$$

(19) $$E(Y_{2it} | I_i = 1, x_{2i}) = x_{2i}\beta_1 + \bar{x}_i\theta_1 + \alpha_1\lambda_{2it}$$

(20) $$E(Y_{1it} | I_i = 0, x_{1i}) = x_{1i}\beta_2 + \bar{x}_i\theta_2 + \alpha_2\lambda_{1it}$$

(21) $$E(Y_{2it} | I_i = 0, x_{2i}) = x_{2i}\beta_2 + \bar{x}_i\theta_2 + \alpha_2\lambda_{2it}$$

The effects of derivative activities are represented by the difference in outcomes when the profitability at user banks is predicted with non-user parameters and the prediction with its own parameters, and vice versa.

(22) $$Diff_{1it} = E(Y_{1it} | I_{it} = 1, x_{1it}) - E(Y_{1it} | I_{it} = 0, x_{1it}) \; for \; I_{it} = 1$$

(23) $$Diff_{2it} = E(Y_{2it} | I_{it} = 1, x_{2it}) - E(Y_{2it} | I_{it} = 0, x_{2it}) \; for \; I_{it} = 0$$

Previous research shows that participation in the derivatives market has high fixed costs with establishing and implementing efficient hedging strategies, and these costs serve as a barrier for small banks to hedge (Brewer et al. 1996, 2000, 2001; Carter and Sinkey, 1998; Sinkey and Carter, 2000; Koppenhaver, 1990; Kim and Koppenhaver, 1993). Therefore, large community banks or small banks which are part of BHCs may have access to the sophisticated hedging techniques. Apart from the risk factors in the profitability model, a dummy variable which identifies the bank that is affiliated to BHCs and size of banks are also included in the decision model to improve identification.

4. Data

Quarterly bank data between 1995 and 2012 (Q3) come from Call Report from Federal Reserve Bank of Chicago and FDIC. Following the definition by FDIC (2012), banks are excluded from sample for the community banks if they specialize in providing services other than savings and loans, hold more than 10% of total assets as foreign assets, or fall in certain specialty groups, such as credit card specialists, industrial loan companies, banker's banks, trust companies, and consumer nonbank banks. In the remaining banks, banks with total assets larger than $10 billion for majority of the sample's periods are also excluded because they tend to operate nationwide rather than in a relatively small geographic area. Meanwhile, banks with total assets between $1 billion and $10 billion are also excluded if they hold less than 33% of total assets in loans or with less than 50% of assets financed by core deposits in majority of the sample period. Banks merged with, or acquired by, other banks during the sample period are also excluded. As banks manage their loan portfolios actively, they can move frequently among lending groups if the strict numerical classification is imposed. Thus, if a bank can be classified into a lending specialty group in majority of the sample period, the bank will be classified in that group. The final dataset includes 6,921 community banks with 1,021 agricultural specialists, 1,310 CRE specialists, 1,134 mortgage specialists, 650 multi-specialists and 2,471 non-specialists.[2]

Risk factors which capture banks' capital adequacy, asset quality, management quality, earnings, liquidity and sensitivity to market risks are included in the model. Default risk (or credit risk) is measured by loan charge-offs which is scaled by total loans. An increase in loan charge-offs decreases bank profitability. Interest risk is measured by the short-term maturity gap (Gap), constructed similarly to that by Flannery and James (1984), with the absolute difference between banks' short-term assets and liabilities scaled by earning assets. An increase in the gap is expected to decrease bank profitability in unfavorable market conditions and to increase the profitability in favorable market conditions. Thus, the signs for interest rate risk are non-defined. With perfect hedge, interest rate risk should place no effect on bank profitability.

Liquidity risk is measured by the proportion of the banks' liquid assets scaled by total assets. Because liquid assets usually have a lower return, an increase in liquid assets or a decrease in liquidity risk will result in lower operating revenues and thus lower ROA, but the probability of financial distress is lowered as well. Capital adequacy is measured by the asset-to-equity ratio (Leverage). An increase in leverage signals increased interest expense, which lead to an increased insolvency risk. Thus, leverage is associated with lower ROA. In addition, volume of agricultural loans, scaled by total loan portfolio, is also included in the model to measure diversification.

Following the method used by Angbazo (1997), management efficiency is measured by the banks' earning assets scaled by total assets. Because management affects the allocation of assets which earn high interests (or liabilities which in turn pay low interests), this variable is

[2] Appendix 1 includes detailed classification criteria of lending specialty groups used in this research. The performance of C&I specialists and consumer specialists is not analyzed because the first step probit regressions are not converged for these two groups, which prevent us from correcting sample selections.

expected to be positively correlated to bank profitability. The logarithm of bank total assets and a dummy variable BHC which identifies the banks which are affiliated to BHCs are included in the selection model to improve identification. The variable number of employees is used in the profitability functions to control for the efficiency and the scale of the bank.

5. Empirical Results

5. 1 Characteristics of Derivative User and Non-user Banks by Lending Specialty

Most user banks enter derivatives market after the deregulation of 1999. By 2012, over 18% of community banks used derivatives, which include 10% of agricultural specialists, 17% of mortgage specialists and 23% CRE specialists, 24% multiple specialists and 15% non-specialists. However, among the three single specialty groups, no agricultural specialists, and only 24 mortgage specialists and 19 CRE specialists were derivative users in 1999. The sample period studied included data from 2003-2012.

The 2008 financial crisis and the Dodd-Frank Act have brought about significant changes in the banking system. Empirically, Chow test shows structural change in the data and we analyze separately two sub-sample periods: 2003-2007 and 2008-2012. Table 1a contains the summary statistics of key variables for the specialty groups for the period before the 2008 financial crisis. Table 1b contains summary statistics of key variables for the specialty groups for the period after 2008.

By specialty group, agricultural banks were the smallest institutions by size with average $99 million total assets for 1,021 banks, while the CRE specialists were the largest group with average $373 million of assets for 1,310 banks. While residential mortgage were at the center of the 2008 financial crisis, mortgage specialists charged off least loans (0.3%) during the whole sample period because they were able to remove these loans from balance sheet through securitization and loan sales. However, each CRE loan is unique and such loan portfolio is less liquid than the residential RE loans due to the fact that there is no securitization system for CRE loans. Thus, when the economy is in recession and when the owners of CRE loans experience a financial difficulty which leads to defaults, it is much more difficult for banks to recover these investments and liquidate these CRE loans. The CRE specialists suffered most from loan charge-offs with average 0.7% of loans charged off for the whole sample period but over 1% after 2008. In turn, CRE specialists were the least profitable group in the post-crisis period with on average 0.2% ROA. Banks who did not use derivatives suffered a loss of 0.09% in ROA on average after 2008 but the derivative users gained 0.57% on ROA during the same period.

Grouped by derivative activities, derivative user banks were larger with a size around three times that of non-users. Higher portion of the derivative users were part of BHCs than the non-user banks across the specialty group. On average, 89% of derivative users were part of BHCs, compared to 82% for non-users. They were also more leveraged (held less capital), were subject to less interest rate risk with more balanced short-term assets and liabilities, held less liquid assets or higher liquidity risk, and invested higher portion of their assets in loans. Derivative users had a more diversified loan portfolio with a smaller portion of total assets distributed to their specialty loans in general. Although derivative users charged off more loans than non-users after 2008, they were still more profitable than the non-users.

Simple mean comparison suggests that the profitability at derivative user banks is as same as that at non-user banks for the whole sample period. Before 2008, derivative users in most lending specialty groups were less profitable than non-users. However direct comparison of profitability at user banks to that at non-user banks is not appropriate because banks are heterogeneous, balance sheet structures are significantly different between user and non-user banks, and the decision to use derivatives is endogenous. In the next section, we construct the counterfactual analyses through the endogenous switching models which allow to estimate the profitability of derivative user banks had they not used derivatives, and vice versa.

5. 2 Effects of Risk Factors on Derivatives User and Non-user Community Banks

The 2008 financial turmoil have brought huge changes to the financial institutions. Empirically, using a Chow test we confirm that bank profitability reacted differently to risk factors during and after the financial crisis. We analyze separately performance during the sub-sample period of 2003-2007 and 2008-2012 separately. We estimate two separate probit regression on banks' decision to use derivatives to calculate the appropriate inverse Mills ratios and results are reported in Table 2 for the period of 2003-2007 and 2008-2012.

The results are consistent with previous findings that larger banks were more likely to use derivatives. As expected, banks which are affiliated to BHCs are more likely to use derivatives, especially in the post-crisis period. Agricultural banks' decision to use derivatives were not affected by the affiliation of BHCs for the whole sample period and mortgage specialists were less likely to use derivatives before 2008. This result implies that mortgage specialists may have moved the risk management upstream to BHC level to avoid the regulation at bank level.

When it comes to how risk factors affect bank decision to use derivatives, interest risk is the main factor affecting bank decision to use derivatives. Banks were more likely to use derivatives before 2008 but less likely to hedge after 2008. Agricultural specialists and mortgage specialists were more likely to hedge with an increase in liquidity risk (a decrease in liquidity assets).

5. 3 Effects of Risk Factors on Bank Profitability

Sensitivities of bank profitability to risk factors for the period 2003-2007 and 2008-2012 are presented in Table 3a and Table 3b respectively. As expected, loan charge-offs are associated with lower bank profitability. However, compared to the period before the crisis, the profitability at agricultural specialists and mortgage specialists was less sensitive to the credit risk during and after the crisis, while profitability of banks not using derivatives in these two groups was more sensitive to credit risk during the same period. It is hard to securitize CRE loans due to the uniqueness of each loan and these loans are much less liquid than residential mortgage. Banks with large CRE exposures, i.e. CRE and multiple specialists, were more sensitive to credit risk during and after the crisis due to the increased CRE related credit risks. As expected, sensitivities of bank profitability to credit risk for CRE and multiple specialists increased by 25% for both derivative users and non-users after 2008.

In most banks, profitability was negatively affected by interest rate risk. However, compared to non-user banks, user banks were less affected and in some banks such as mortgage, specialists, multiple specialists and non-specialists the interest rate risk did not affect profitability before 2008.

As expected, an increase in leverage (or a decrease in equity capital) is associated with a decrease in bank profitability for most banks due to the increased interest expenses from the increased debt level. However, compared to the period before the 2008 crisis, profitability in CRE specialists, multiple specialists and non-specialists, was less sensitive to an increase in leverage after 2008. In agricultural specialists and mortgage specialists, profitability for both derivative users and non-users, was more sensitive to leverage in the post-crisis period. For example, a 1x increase in leverage at CRE specialists resulted in a decrease of 0.1% in ROA before 2008 but a decrease of 0.06% in ROA after 2008, while the profitability at agricultural specialists were reduced 0.3% after 2008 although their profitability was only supposed to be reduced by 0.2% before 2008.

5. 4 Counterfactual Effects of Derivatives on Bank Profitability

After estimating the profitability equation for derivative user and non-user banks, the effects of derivative activities are estimated in accordance with equation (22) and (23), which measure the difference between expected profits for user banks and hypothetical expected profits had they not used derivatives, and vice versa. These effects for user banks and non-user banks are presented in Table 4a for sample period 2003-2007 and in Table 4b for the sample period 2008-2012.

Contrary to the premise of Volcker Rule, we find that derivative activities help improve bank profitability of most lending specialty groups. As the U.S. economy had suffered 18 month recession due to the problem in housing markets, the loan charge-offs have been increasing during and after the financial crisis especially for lenders which had large exposure to the problematic RE loans. Results suggest that user agricultural and CRE specialists could have lost 0.26% and 0.50% in ROA respectively before 2008 had they not used derivatives, and they could have lost up to 0.95% and 3.65% in ROA after the financial crisis had they not used derivatives.

Mortgage specialists are the only group where derivative activities could have the potential to hurt their profitability had nonusers used derivatives before 2008. For user mortgage specialists, estimated hypothetical profitability had they not used derivatives is higher than the realized level. However, the negative effect is decreasing over time with negative effects of 0.92% before the financial crisis reduced to 0.17% in the post-crisis period. At the same time the benefits of derivatives are increasing over time for other specialty groups. In particular, the benefits for CRE users are expected to be more than doubled after the financial crisis, with the expected increase of 3.7% in ROA after 2008 compared to the increase of 1.64% in ROA for the period before 2008.

Results also show benefits from potential use of derivatives for most banks which did not use derivatives. In particular, CRE non-users could have gained 0.56% in ROA had they used derivatives in the period after 2008, when they suffered a loss of 0.32% in ROA. Non-user mortgage specialists could also have benefited from derivative in the post-crisis period, although results show that they could have been hurt by derivatives use before 2007. However, the profitability of non-users non-specialists could have suffered 0.06% loss after 2008 had they used derivatives although these banks could have gained 0.12% higher ROA than what they had before 2008.

6. Conclusion

Financial derivatives have been blamed for the 2008 financial crisis. This research provides empirical evidence on how the profitability of community banks was affected by derivatives and estimates the potential effects that a rule like the Volcker Rule could have had on these small banks that mainly participate in the end-user derivatives market to manage their risks and maintain a focus on serving the local community.

Contrary to the premise of Volcker Rule, this chapter finds that derivative activities at community banks, such as agricultural and mortgage specialists, successfully reduce the sensitivity of their profitability to on-balance sheet credit risk and interest rate risk. In addition, derivatives have improved profitability at majority of user community banks, especially at CRE lenders. We find that with a few exceptions, most banks that did not use derivative could have had higher profits had they used derivatives.

Since it is expected that the Volcker Rule will impose proportionally higher regulatory cost on community banks than on large banks, community banks will have to reduce their use of derivatives and substitute the cheap off-balance sheet risk management for costly on-balance sheet asset-liability management. The results from this research suggest that the Volcker Rule will not be neutral to community banks' profitability. It will likely increase the sensitivity of bank profitability to a number of risk factors, including credit risk and interest rate risk which are the main risks built into the traditional saving and loans. In the absence of cheap risk management tools, community banks may reduce lending to finance local economic development which could have negative consequences for the local economies.

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Table 1a. Summary Statistics, 2003 – 2007

	AG		Mortgage		CRE		Multiple		Non-Specialist	
Variables	User	Non-User	User	Non-User	User	Non-User	User	Non-User	User	Non-User
ROA	1.16	1.19	0.76	0.83	1.15	0.75	1.15	0.85	1.19	1.09
	(0.81)	(0.99)	(0.60)	(1.18)	(0.94)	(1.88)	(1.32)	(1.70)	(1.25)	(1.22)
Charge-off (%)	0.31	0.29	0.15	0.19	0.22	0.23	0.24	0.32	0.31	1.21
	(0.77)	(0.98)	(0.48)	(0.70)	(0.56)	(0.74)	(0.44)	(1.07)	(0.77)	(172.60)
Manage (%)	97.66	98.30	97.70	97.72	96.79	97.30	97.08	97.37	97.03	97.64
	(1.48)	(1.37)	(1.21)	(1.55)	(2.15)	(2.08)	(1.89)	(2.03)	(2.42)	(2.40)
Leverage	10.45	9.71	10.86	10.10	11.06	9.98	11.03	10.10	10.82	9.65
	(2.22)	(2.46)	(2.31)	(2.71)	(2.14)	(2.92)	(1.86)	(2.72)	(2.49)	(2.73)
Gap (%)	26.47	28.59	31.44	30.78	24.94	25.78	25.36	27.09	25.13	28.96
	(16.15)	(62.34)	(20.17)	(20.29)	(20.78)	(20.59)	(18.78)	(20.07)	(17.94)	(19.35)
Liquidity (%)	23.73	27.61	22.75	25.20	18.35	18.37	17.64	18.52	31.64	37.85
	(10.49)	(12.09)	(10.03)	(12.09)	(8.93)	(10.01)	(7.79)	(9.84)	(11.79)	(15.51)
BHC	96.2	86.3	51.3	59.5	92.3	73.5	87.5	77.9	93	80.7
	(19.2)	(34.4)	(50)	(49).1	(26.6)	(44.1)	(33.1)	(41.5)	(25.6)	(39.4)
Loan Ratio (%)	70.36	65.64	71.18	68.17	74.97	72.61	76.16	73.11	61.05	53.85
	(10.63)	(12.28)	(10.00)	(12.33)	(9.50)	(12.33)	(8.57)	(11.51)	(12.36)	(15.44)
CRE loans (%)	11.00	7.18	18.29	13.48	42.85	42.11	32.79	26.30	21.62	13.71
	(8.51)	(7.16)	(8.32)	(9.43)	(9.18)	(14.82)	(9.05)	(13.63)	(9.12)	(10.36)
CI loans (%)	10.06	8.77	4.91	5.10	10.66	10.78	14.66	14.46	9.38	8.25
	(4.45)	(4.67)	(3.83)	(4.96)	(5.28)	(6.27)	(8.85)	(9.34)	(4.78)	(5.45)
Mortgage Loans (%)	11.21	10.05	42.91	41.15	16.07	13.34	19.15	19.05	17.82	16.36
	(6.54)	(6.82)	(11.18)	(11.31)	(7.14)	(7.83)	(11.35)	(11.39)	(7.34)	(8.00)
AG Loans (%)	31.47	32.66	0.75	2.11	1.68	1.48	4.23	5.19	5.18	7.01
	(10.37)	(11.03)	(1.82)	(3.59)	(2.63)	(2.93)	(5.96)	(7.59)	(5.92)	(6.52)
Employee	55	25	172	67	216	75	246	71	214	55
	(55.)	(28)	(229)	(513)	(217)	(108)	(568)	(142)	(257)	(102)
Total Assets	185.87	76.84	718.35	222.01	846.05	260.30	788.69	233.07	718.99	165.49
(US$ Millions)	(168.84)	(84.70)	(942.57)	(341.55)	(972.75)	(365.31)	(804.54)	(321.82)	(934.32)	(330.41)
Number of Institutions (2003)	29	976	37	667	56	833	44	446	112	2,178

Table 1b. Summary Statistics, 2008 – 2012

	AG		Mortgage		CRE		Multiple Specialists		Non-Specialists	
	User	Non-User	User	Non-User	User	Non-User	User	Non-User	User	Non-User
ROA (%)	1.05	0.98	0.56	0.47	0.05	-0.32	0.46	0.21	0.77	0.70
	(1.02)	(1.20)	(1.01)	(1.49)	(2.51)	(2.57)	(1.71)	(2.13)	(1.48)	(1.82)
Charge-off (%)	0.46	0.43	0.50	0.43	1.25	1.08	0.93	0.86	0.77	0.70
	(1.04)	(1.25)	(0.94)	(1.01)	(2.04)	(2.18)	(1.49)	(1.76)	(1.54)	(14.55)
Manage (%)	97.11	98.14	97.03	97.34	95.91	96.09	96.49	96.85	96.58	97.17
	(1.67)	(1.64)	(1.76)	(1.95)	(2.53)	(3.06)	(2.22)	(2.38)	(2.06)	(2.73)
Leverage	10.22	9.66	10.73	9.98	10.76	10.54	10.37	10.32	10.35	9.46
	(1.73)	(2.31)	(3.01)	(2.98)	(4.03)	(22.97)	(2.56)	(3.72)	(4.56)	(3.14)
Gap (%)	29.48	30.65	29.53	37.13	33.12	37.06	28.07	35.06	28.37	35.08
	(15.99)	(17.78)	(17.45)	(21.45)	(23.58)	(25.16)	(21.63)	(22.75)	(17.58)	(20.45)
Liquidity (%)	25.61	30.26	22.42	25.32	20.62	21.33	20.48	20.28	32.90	39.14
	(10.96)	(13.73)	(9.90)	(11.81)	(9.37)	(10.87)	(9.00)	(10.79)	(12.90)	(16.73)
BHC (%)	96.0	87.4	66.0	58.2	87.6	70.7	91.4	74.9	92.6	81.9
	(19.7)	(33.2)	(47.4)	(49.3)	(33.0)	(45.5)	(28.1)	(43.4)	(26.2)	(38.5)
Loan Ratio (%)	68.61	62.98	71.03	68.30	72.66	71.31	73.22	72.89	60.21	53.26
	(10.96)	(13.39)	(9.81)	(11.45)	(9.77)	(11.29)	(9.40)	(10.81)	(12.27)	(16.10)
CRE Loans (%)	14.63	8.59	21.00	16.13	42.01	44.34	32.00	30.76	22.75	16.59
	(8.14)	(7.40)	(8.18)	(9.65)	(9.33)	(11.79)	(9.38)	(12.41)	(8.94)	(10.74)
CI Loans	9.49	8.31	5.21	4.40	9.76	9.20	13.42	13.08	8.71	7.42
	(4.23)	(4.68)	(3.51)	(4.23)	(4.95)	(5.40)	(8.12)	(8.93)	(4.83)	(5.07)
Mortgage Loans (%)	11.97	9.38	39.98	41.58	16.60	13.95	18.78	19.18	17.72	16.35
	(6.01)	(6.50)	(11.46)	(12.06)	(7.63)	(7.59)	(10.95)	(11.52)	(7.53)	(8.44)
AG Loans (%)	27.98	31.89	1.34	2.33	1.55	1.48	4.92	4.98	5.86	6.94
	(9.73)	(12.03)	(2.81)	(4.00)	(2.48)	(2.65)	(7.16)	(7.73)	(6.08)	(6.67)
Number of Employee	75	25	199	62	191	73	223	64	224	54
	(72)	(29)	(319)	(73)	(210)	(157)	(260)	(77)	(295)	(100)
Total Assets	296.42	99.34	912.48	262.99	847.89	314.29	939.97	276.39	917.83	196.71
(US$ Millions)	(277.87)	(116.53)	(1684.67)	(469.80)	(1007.94)	(434.76)	(1456.45)	(351.77)	(1621.07)	(378.57)
Number of Banks (2012)	119	902	193	941	296	1,014	157	493	375	2,096

Table 2. Probit Regression on Probability of Using Derivatives

VARIABLES	AG		Mortgage		CRE		Multiple Specialists		Non-Specialists	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Before 2008	After 2008	Before 2008	After 2008	Before 2008	After 2008	Before 2008	After 2008	Before 2008	After 2008
Log(asset)	0.922***	0.571***	0.562***	0.987***	1.148***	0.435***	1.062***	0.488***	0.965***	0.517***
	(0.178)	(0.162)	(0.214)	(0.233)	(0.125)	(0.079)	(0.153)	(0.093)	(0.144)	(0.095)
Charge-off	0.010	-0.003	0.022	-0.001	-0.007	0.003	-0.017	-0.006	-0.009	<-0.001
	(0.008)	(0.008)	(0.026)	(0.012)	(0.021)	(0.004)	(0.024)	(0.005)	(0.017)	(0.009)
Manage	-0.034	-0.015	0.009	0.002	0.011	-0.002	-0.066*	-0.007	-0.018	-0.020
	(0.050)	(0.028)	(0.038)	(0.018)	(0.021)	(0.010)	(0.035)	(0.012)	(0.020)	(0.014)
Leverage	-0.018	-0.018	-0.001	-0.007	-0.015	-0.001	-0.040	-0.005	-0.001	-0.005**
	(0.019)	(0.011)	(0.023)	(0.011)	(0.017)	(0.002)	(0.028)	(0.006)	(0.016)	(0.002)
Gap	0.001***	-0.003*	0.005***	-0.003*	0.002	-0.002**	0.002	-0.003**	0.003**	-0.002**
	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Liquidity	-0.015**	0.001	-0.017***	-0.002	-0.005	0.001	0.008	0.004	-0.005	0.003
	(0.007)	(0.003)	(0.006)	(0.005)	(0.005)	(0.002)	(0.009)	(0.003)	(0.003)	(0.002)
BHC	0.163	-0.032	-0.345***	0.023	0.207*	0.239**	0.017	0.519***	0.165	0.172*
	(0.242)	(0.247)	(0.126)	(0.104)	(0.121)	(0.099)	(0.181)	(0.164)	(0.118)	(0.101)
Constant	-4.210	-0.040	-9.295*	-4.444	-0.445	-6.027***	-4.691	-2.833	-6.745***	-8.516***
	(5.050)	(3.802)	(5.401)	(2.843)	(2.483)	(1.615)	(3.736)	(2.797)	(1.410)	(1.458)
Observations	20,111	19,200	14,199	15,007	19,910	23,885	10,465	11,506	46,076	45,150
χ^2	79.72	136.0	154.6	150.5	248.6	257.5	175.8	195.6	410.3	484.1
Log Likelihood	-3,302	-4,497	-3,256	-5,269	-5,464	-9,820	-3,228	-4,799	-8591	-12,463
#of Institutions	1009	1,022	734	1,136	1,171	1,321	582	651	2354	2,480

Note: coefficients θs are not reported and available upon request. Robust standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3a. Effects of Risk Factors on Bank Profitability, 2003 – 2007

VARIABLES	AG		Mortgage		CRE		Multiple Specialists		Non-Specialists	
	(1) User	(2) Non-User	(3) User	(4) Non-User	(5) User	(6) Non-User	(7) User	(8) Non-User	(9) User	(10) Non-User
Employee	-0.008*	-0.004***	<-0.001	<0.001	-0.002**	0.001	-0.001	<0.001	-0.001	-0.001
	(0.005)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(<0.001)	(0.002)	(0.001)	(0.001)
Charge-off	-0.451***	-0.357***	-0.411***	-0.116*	-0.403***	-0.362***	-0.414***	-0.420***	-0.082	-0.001
	(0.167)	(0.028)	(0.074)	(0.064)	(0.067)	(0.045)	(0.063)	(0.047)	(0.074)	(0.097)
Manage	0.074**	0.148***	0.001	0.132***	0.045	0.145***	0.439*	0.157***	0.188**	0.043
	(0.037)	(0.035)	(0.115)	(0.029)	(0.037)	(0.031)	(0.245)	(0.045)	(0.077)	(0.055)
Leverage	-0.195***	-0.113***	0.012	-0.016	-0.095***	0.194***	-0.246**	0.224***	-0.180**	-0.086***
	(0.040)	(0.035)	(0.037)	(0.045)	(0.024)	(0.024)	(0.102)	(0.041)	(0.089)	(0.025)
Gap	-0.001	-0.001	-0.001	-0.005***	-0.007***	-0.010***	-0.003	-0.010***	-0.001	-0.003***
	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)
Liquidity	0.011	-0.001	0.011	-0.007	0.018***	-0.027***	0.008	-0.040***	0.004	0.003
	(0.009)	(0.002)	(0.007)	(0.006)	(0.006)	(0.004)	(0.010)	(0.010)	(0.005)	(0.002)
IMR	-0.079	-0.760***	0.062	0.490*	-0.459***	-1.021***	-0.127	-0.551***	0.063	-0.457
	(0.157)	(0.206)	(0.107)	(0.256)	(0.124)	(0.228)	(0.156)	(0.207)	(0.099)	(0.278)
Constant	-5.289	-9.923***	-4.086	-8.406***	2.113	-11.137***	7.400	-11.101***	3.862	4.338
	(3.578)	(2.460)	(4.614)	(2.462)	(4.095)	(1.991)	(7.083)	(3.184)	(5.084)	(5.938)
Observations	945	19,166	1,192	13,007	2,191	17,719	1,478	8,987	3,157	42,919
R^2	0.352	0.189	0.187	0.055	0.155	0.226	0.124	0.234	0.054	0.065
$\chi^2(13)$	87.62	609.9	87.97	150.4	169.1	913.4	104.6	186.1	78.28	246.2

Note: coefficients *θs* are not reported and available upon request. Robust standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3b. Effects of Risk Factors on Bank Profitability, 2008 – 2012

VARIABLES	AG		Mortgage		CRE		Multiple Specialists		Non-Specialists	
	(1) User	(2) Non-User	(3) User	(4) Non-User	(5) User	(6) Non-User	7) User	(8) Non-User	(9) User	(10) Non-User
employee	0.002	-0.002	0.001	0.005**	<0.001	0.002*	0.002*	0.007*	<0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)
Charge-off	-0.412***	-0.379***	-0.368***	-0.651***	-0.578***	-0.499***	-0.518***	-0.532***	-0.339***	-0.010
	(0.075)	(0.021)	(0.068)	(0.131)	(0.045)	(0.018)	(0.032)	(0.027)	(0.046)	(0.163)
Manage	0.073	0.162***	0.003	0.036	-0.073**	0.099***	0.118	0.054**	0.057	0.179***
	(0.048)	(0.029)	(0.057)	(0.063)	(0.033)	(0.021)	(0.077)	(0.023)	(0.054)	(0.054)
Leverage	-0.273***	-0.150***	-0.071**	-0.034	-0.059***	0.001	-0.056	-0.002	-0.123**	-0.041*
	(0.046)	(0.021)	(0.034)	(0.048)	(0.021)	(0.007)	(0.055)	(0.018)	(0.054)	(0.021)
Gap	0.001	-0.001	-0.011***	-0.006***	0.004	-0.012***	-0.010***	-0.006***	-0.008**	-0.008***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.006)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Liquidity	0.004	-0.004***	-0.002	-0.001	0.025***	0.004	0.013*	0.009	0.010*	-0.001
	(0.004)	(0.001)	(0.005)	(0.003)	(0.008)	(0.005)	(0.007)	(0.006)	(0.006)	(0.003)
IMR	-0.215	-1.134***	-0.043	0.153	-0.267	-2.187***	-0.380***	-1.444***	0.140	-0.266
	(0.134)	(0.272)	(0.099)	(0.219)	(0.233)	(0.468)	(0.112)	(0.235)	(0.119)	(0.359)
Constant	-14.679***	-11.144***	-1.611	-4.311***	2.129	-6.094***	-2.297	-6.028***	-6.661***	5.166
	(3.064)	(1.616)	(4.537)	(1.581)	(1.934)	(1.327)	(1.946)	(1.989)	(1.851)	(9.553)
Observations	1,751	17,965	2,299	12,708	4,456	19,429	2,568	8,938	5,557	39,593
R^2	0.392	0.278	0.247	0.229	0.323	0.271	0.381	0.315	0.302	0.075
$\chi^2(13)$	310.9	1081	263.0	345.4	1022	1651	684.7	868.4	202.1	139.0

Note: coefficients *θs* are not reported and available upon request. Robust standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4a. Counterfactual Analysis, 2003 – 2007

	Predicted ROA for Derivatives User			Predicted ROA for Derivatives Non-User		
Specialty Groups	E(ROA|Duser=1)	E(ROA|Duser=0)	Difference	E(ROA|Duser=1)	E(ROA|Duser=0)	Difference
AG Specialists	1.16	-0.26	1.42***	1.39	1.18	0.21***
	(0.60)	(0.51)	(0.45)	(0.60)	(0.43)	(0.30)
Mortgage Specialists	0.76	1.69	-0.92***	0.64	0.83	-0.18**
	(0.26)	(0.27)	(0.28)	(0.42)	(0.28)	(0.38)
CRE Specialists	1.15	-0.50	1.64***	1.97	0.75	1.22***
	(0.37)	(0.93)	(0.87)	(0.44)	(0.90)	(0.99)
Multiple Specialists	1.15	0.23	0.92***	1.42	0.85	0.57***
	(0.46)	(0.62)	(0.81)	(0.75)	(0.82)	(1.0)
Non-Specialty banks	1.19	0.39	0.81***	1.21	1.09	0.12**
	(0.29)	(0.32)	(0.34)	(14.1)	(0.31)	(13.9)

Standard deviation in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4b. Counterfactual Analysis, 2008 – 2012

	Predicted ROA for Derivatives User			Predicted ROA for Derivatives Non-User		
Specialty Groups	E(ROA|Duser=1)	E(ROA|Duser=0)	Difference	E(ROA|Duser=1)	E(ROA|Duser=0)	Difference
AG Specialists	1.04	-0.95	1.99***	1.57	0.98	0.60***
	(0.65)	(0.71)	(0.48)	(0.76)	(0.64)	(0.30)
Mortgage Specialists	0.56	0.74	-0.17***	0.62	0.47	0.16***
	(0.50)	(0.69)	(0.29)	(0.50)	(0.71)	(0.29)
CRE Specialists	0.05	-3.65	3.70***	0.56	-0.32	0.88***
	(1.43)	(1.45)	(0.93)	(2.02)	(1.34)	(1.47)
Multiple Specialists	0.46	-2.02	2.48***	0.96	0.21	0.75***
	(1.06)	(1.17)	(0.48)	(1.19)	(1.19)	(0.28)
Non-Specialists	0.77	0.31	0.47***	0.64	0.70	-0.06**
	(0.81)	(0.41)	(0.76)	(5.38)	(0.50)	(5.07)

Standard deviation in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 1: Definition of Lending Specialty Groups for Chapter 4

Lending Specialty Group	**Definition**
Agricultural Specialists	Agricultural production loan plus loans secured by farmland greater than 20% of total assets
Mortgage Specialists	Residential Mortgage loans greater than 30% of total assets
Consumer Specialists	Credit card lines and other loans to individuals greater than 20% of total assets
Commercial Real Estate (CRE) Specialists	construction and development (C&D) loans greater than 10% of total assets OR total CRE loans (C&D, multifamily, and secured by other commercial properties) greater than 30% of total assets
Commercial &Industrial (C&I) Specialists	C&I loans greater than 20% total assets
Multi-Specialists	Meets more than one of the single-specialty definition above OR holds either retail loans* or commercial loans** greater than 40% of total assets
No Specialty	All other institutions

Source: FDIC, 2012

Note: All specialty groups require the bank to hold loans greater than 33% of total assets. *retail loans include 1-4 family residential real estate loans and loans to individual. **commercial loans include CRE loans, C&I loans, and RE loans secured by farmland.