

**RELATIONSHIP BETWEEN NONINTEREST INCOME AND BANK
VALUATION:
EVIDENCE FORM THE U.S. BANK HOLDING COMPANIES**

by

Mingqi Li

B.Comm., Saint Mary's University, 2015

and

Tiananqi Feng

B.Econ., Jinan University, 2015

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE IN FINANCE

of the

Faculty

of

Business Administration

© Mingqi Li and Tiananqi Feng

SIMON FRASER UNIVERSITY

Fall 2016

All rights reserved.

However, in accordance with the *Copyright Act of Canada*, this work may be reproduced, without authorization, under the conditions for Fair Dealing. Therefore, limited reproduction of this work for the purposes of private study, research, education, satire, parody, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.

Approval

Name: Mingqi Li and Tiananqi Feng
Degree: Master of Science in Finance
Title: Relationship between Noninterest Income and Bank Valuation: Evidence from the U.S. Bank Holding Companies

Supervisory Committee:

Jijun Niu
Senior Supervisor
Associate Professor, Finance

Ying Duan
Second Reader
Assistant Professor, Finance

Date Approved:

Abstract

This paper investigates the impact of noninterest income on bank valuation using 625 U.S. Bank Holding Companies over the period 2003-2015. We use two measures of valuation: Tobin's q and the market-to-book ratio. Using the whole sample, we find a positive relation between noninterest income and valuation. We then divide banks in our sample into three groups based on size, and the sample period into three sub-periods. We find that noninterest income is positively related to valuation (1) for large banks in each sub-period, (2) for medium-sized banks during and after the financial crisis of 2007-2009, and (3) for small banks after the financial crisis.

Keywords: Noninterest income; Bank valuation; Financial crisis; Bank size

Acknowledgements

We are heartily thankful to our senior supervisor, Dr. Jijun Niu, who encouraged and provided us with guidance and support throughout the project that enabled us to have better insights of the work. We appreciate our second reader, Professor Duan, for her valuable views on several issues. We also would like to show our regards and blessings to the faculty at the Beedie School of Business who led us to the success during the last 16 months. Thank all of those who gave us supports to the completion of this paper.

Table of Contents

| | |
|--------------------------------|----|
| Approval | 2 |
| Abstract | 3 |
| Acknowledgements | 4 |
| List of Figures | 6 |
| List of Tables | 7 |
| 1. Introduction | 8 |
| 2. Literature Overview | 12 |
| 3. Data and Methodology | 15 |
| 3.1 Sample and Variables | 15 |
| 3.2 Model Chosen | 8 |
| 4. Empirical Result | 18 |
| 4.1 Summary Statistics | 18 |
| 4.2 Regression Results | 20 |
| 5. Conclusion | 24 |
| Appendix | 25 |
| References | 36 |

List of Figures

| | |
|--|----|
| Figure 1: Noninterest Income as a Share of Net Operating Revenue | 8 |
| Figure 2: Trends in noninterest income vs interest income | 9 |
| Figure 3: Yearly Noninterest Income, % of Average Assets..... | 10 |

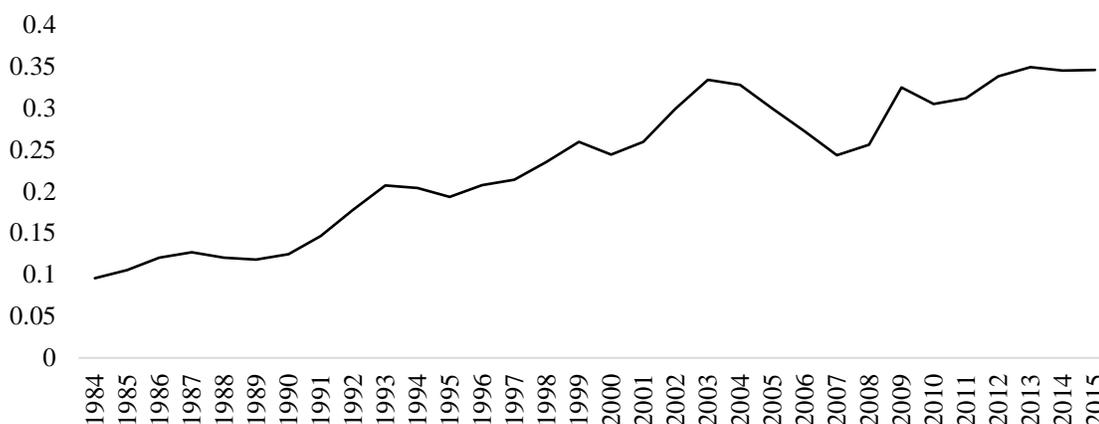
List of Tables

| | |
|---|----|
| Table 1: Definition of variables | 26 |
| Table 2: Number of banks by year..... | 27 |
| Table 3: Summary statistics | 28 |
| Table 4: Regression results of the whole sample,..... | 29 |
| Table 5: Regression results, Tobin's q is the dependent variable, large banks | 30 |
| Table 6: Regression results, Tobin's q is the dependent variable, medium-sized banks..... | 31 |
| Table 7: Regression results, Tobin's q is the dependent variable, small banks..... | 32 |
| Table 8: Regression results, Market-to-book ratio is the dependent variable, large banks | 33 |
| Table 9: Regression results, Market-to-book ratio is the dependent variable, medium-sized banks | 34 |
| Table 10: Regression results, Market-to-book ratio is the dependent variable, small banks..... | 35 |

1. Introduction

In the past three decades, U.S. banks have drifted from generating revenue through traditional loan-making activities to generating revenue through nontraditional activities such as fiduciary activities, service charges, and trading revenue. Figure 1 shows that noninterest income as a share of net operating revenue has increased dramatically from 10% in 1984 to 35% in 2015, indicating that noninterest income has become increasingly important for banks.

Figure 1: Noninterest Income as a Share of Net Operating Revenue

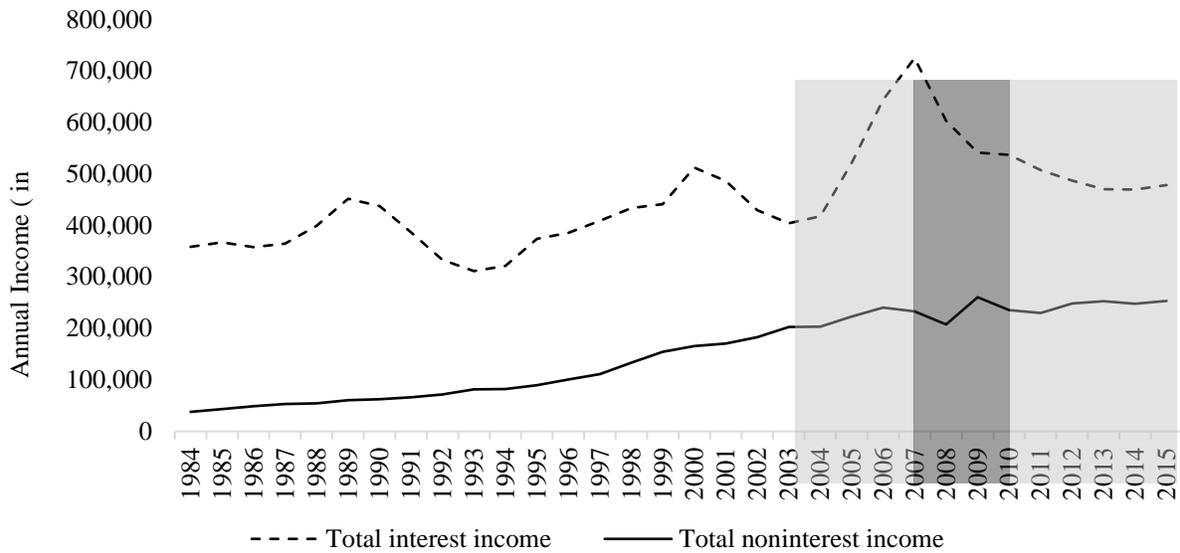


Source: FDIC

Note: Net operating revenue is the sum of noninterest income and net interest income.

Noninterest income has not only increased bank revenue, but also reduced its volatility. Figure 2 shows that the growth of noninterest income was more steady than that of interest income over the last three decades. In particular, during the financial crisis of 2007-2009, noninterest income was more stable than interest income. While interest income dropped by 25%, noninterest income increased by 12% during the crisis period. After the crisis, noninterest income is negatively correlated with interest income. Therefore, noninterest income reduces the volatility of bank revenue, especially during the recent financial crisis.

Figure 2: Trends in noninterest income vs interest income

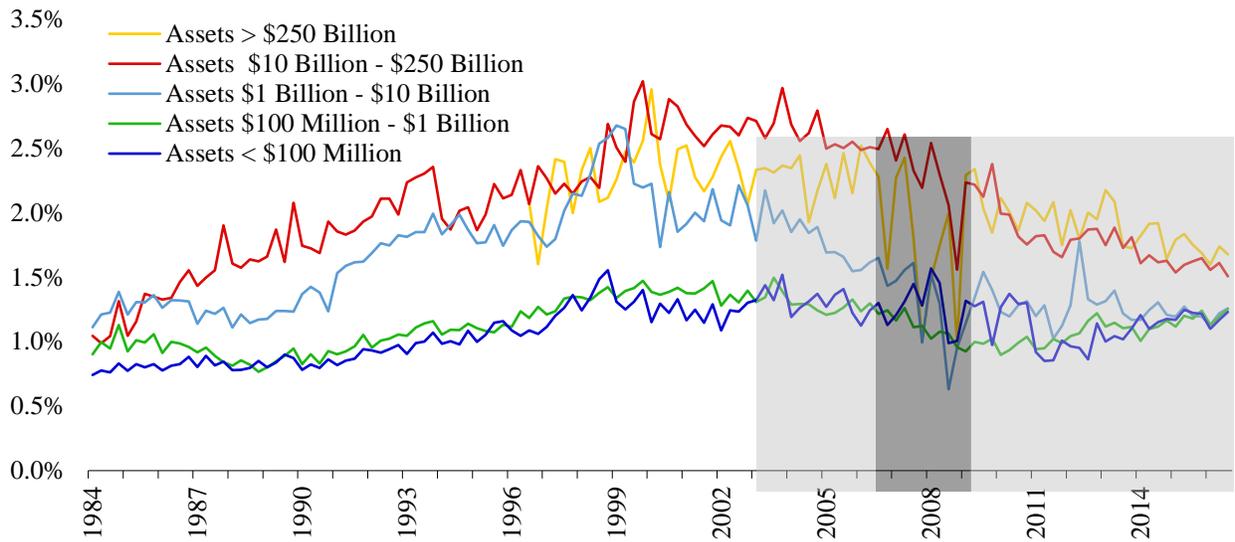


Source: FDIC

Note: Shaded areas are before, during and after the financial crisis

It is important for banks to reduce risk through noninterest income during a crisis. Indeed, because noninterest income reduces the volatility of bank revenue, it is reasonable for regulators to reduce capital requirements for banks which rely more on noninterest income. Banks would then have an incentive to reduce risk by generating more noninterest income because lower capital requirements usually mean lower cost of capital.

Figure 3: Yearly Noninterest Income, % of Average Assets



Source: FDIC

Note: Shaded areas are before, during and after the financial crisis

As for the impact of bank sizes on noninterest income, the trend shows that the ratio of noninterest income to the average assets in all banks is converging together after the recent financial crisis of 2007-2009. Large banks with assets more than \$10 billion show an increasing trend of noninterest income to the average assets before the crisis whereas the ratio decreases during and after the crisis. The possible reason could be that the increasing assets dilute the ratio. Medium-sized banks with assets between \$1 billion and \$10 billion show the same pattern as that at large banks. Small banks with assets up to \$1 billion, show an increasing trend after the crisis.

In this paper, we study the impact of noninterest income on bank valuation. Because noninterest income reduces the volatility of bank revenue, we hypothesize that banks with higher noninterest income have a higher valuation. By focusing on valuation rather than profitability, we avoid some of the problems of measuring bank performance using profitability. Following previous

studies such as Gambacorta, Scatigna, and Yang (2014), we use the ratio of noninterest income to total operating income to measure the importance of noninterest income for a given bank. We use Tobin's q and the market-to-book ratio as measures of valuation. Our sample consists of U.S. bank holding companies from 2003 to 2015. We include a variety of control variables such as bank size, capital ratio, loans to assets ratio, deposits to assets ratio and return on equity in the regressions.

To take a close look at the impact of noninterest income on bank valuation under different market conditions, we divide the sample period into three sub-periods: before, during, and after the financial crisis of 2007-2009. We also divide banks in our sample into three groups based on size. We find that noninterest income is positively related to valuation (1) for large banks in each sub-period, (2) for medium-sized banks during and after the financial crisis of 2007-2009, and (3) for small banks after the financial crisis.

The rest of this paper is organized as follows. Section 2 provides a literature review. Section 3 presents data and methodology. Section 4 presents empirical results. Section 5 concludes the work.

2. Literature Overview

A few literature has studied the relation between bank diversification and valuation. We mainly summarized the empirical results from studies of the relationship between income diversification and bank valuation in U.S. and international wise. Early studies mostly find a negative relationship between the banks' income diversification and bank value; while the recent studies show positive relationship between banks' income diversification and bank value. Lastly, a latest study has been studied in 2014 based on bank sizes and geographical locations, which adds new findings to the empirical studies.

In the earlier studies, Lang and Stulz (1994) find that Tobin's q and firm diversification have a negative relation based on the data from the 1980s in U.S. Firms that choose to diversify have poor performance compared to the firms that do not diversify, but there is no significant evidence that they have lower Tobin's q than the average firm in their industry. The reason is that large financial firms may be inefficient in establishing managerial incentive contracts and it may also be difficult to align the incentives of outsiders and insiders for large financial firms (Rotemberg and Saloner, 1994). With the same result, Berger and Ofek (1995) and Servaes (1996) find a diversification discount that Tobin's q of diversified firms is lower than that of specialized firms. Meanwhile, works by Jensen (1996) suggest that diversification of activities within a single bank may intensify agency problems. Interestingly, Berger and Humphrey (1997) argue that since it is difficult to price different activities, it is very difficult to identify the presence of economies of scale in financial services.

However, Maksimovic and Phillips (2002) find that less productive firms tend to diversify, but

diversification does not induce lower productivity based on the plant-level data from US manufacturing firms. Campa and Kedia (2002) find that the failure to control firms' endogenous characteristics that lead firm's diversification will induce discount in firm values. For example, a poor performing firm will trade at a discount to compete with other firms in the industry. Since they have lower opportunity costs than the other competitors of allocating its resources in other industries, they will generate diversification. Graham et al. (2002) argue that firms tend to purchase the target firms with discount, resulting in producing the diversification discount. Thus, they argue that no evidence shows that diversification exaggerates agency problems and destroys bank value.

Villalonga (2004a) argues that the main drivers of the entire diversification literature are data problems. After identifying shortcomings with the industrial segment data from Compustat arising from the fact that firms self-report their activities, she argues that self-reporting biases the results toward finding a diversification discount. Most importantly, she highlights the problem that each firm can manipulate the way to aggregate specific activities into the broad segments in Compustat. About 25% of the changes in firms' number of segments over time are purely due to reporting changes rather than real changes in diversification. She finds a diversification premium by applying data at the establishment level. Consequently, a proper examination of the impact of diversification must attribute to mergers and acquisitions (M&As) and problems associated with self-reported data.

Based on Lang and Stulz (1994)'s 'chop shop' method, Laeven and Levine (2007) modify their model to examine the impact of diversification on bank value based on the data of 836 banks in

43 countries from 1998-2002. They compare the market-to-book ratio of a diversified financial institution with that of a corresponding portfolio of selected banks focusing on either interest-based or fee-based business. Based on the assumption of a linear relationship between diversification and market value, they find that diversification decreases market-to-book ratio by up to 10 percentage points. Their results are consistent with the earlier studies that diversification magnifies agency problems in financial firms with adverse implications for market valuations. Schmid and Walter (2009) report findings similar to those of Laeven and Levine (2007) after applying the same approach to a large sample of US financial firms including shadow banks.

On the contrary, by applying a longer time period than studies from 1998-2008 and more concentration on 2/3 banks in the U.S., Elsas et al. (2010) find that revenue diversification increases bank profitability and consequently also market valuations. Revenue diversification boosts bank profitability via the higher margins from non-interest businesses and lower cost-income ratios. A higher bank profitability translates into a higher market valuation, which suggests that diversification has an indirect positive impact on bank value, and thus generates a diversification premium in banking. Rather than reducing shareholder value, diversification improves bank profitability and thus indirectly enhances value. They show that the discrepancy of their results with those of Laeven and Levine (2007) is primarily driven by the fact that Laeven and Levine (2007) use different measures for bank value and revenue diversification, and fail to control for profitability in their major regressions. Moreover, they also find supporting evidence that diversification in principle can help banks to better resist shocks during the financial crisis. In addition, in the context of international evidence Chen and Lin (2009) find that income diversification enhances the bank's valuation by using market valuation of the bank

based on the Laeven and Levine (2007) methodology from the data on 864 banks from 54 countries during 1992-2006. They also indicate that different samples of banks and changing time horizons affect diversification discount.

Since previous studies have shown that it is very difficult to identify the causal impact of diversity on the valuation of banks, Armstrong and Fic (2014) conduct an analysis based on bank size and geographical locations. After dividing banks into small, medium and large banks, the authors find that diversification may add value in small banks but probably destroys it in the largest banks. After allocating the banks based on the geographical locations, the authors find that European, Asian and North American banks may not gain as much benefit as South American and Australian banks at greater diversification of their operations.

3. Data and Methodology

3.1 Sample and Variables

This paper uses panel data from 625 U.S. Bank Holding Companies (BHCs) over the period of 2003 to 2015. We draw the stock data from the Center for Research in Security Pries (CRSP) derived from the Wharton Research Data Services (WRDS). The Federal Reserve's Y-9C reports provide the yearly accounting data of U.S. BHCs. We eliminate bank-years that have missing data and winsorize all of the variables at the first and ninety-ninth percentile to alleviate the effect of extreme outliers. We include year fixed effect in the regression models to control for common factors that affect the valuations of all the banks in a given year.

To measure the importance of revenue from nontraditional activities, we use the ratio of noninterest income to total operating income. We use Tobin's q and the market-to-book ratio as measures of valuation. We include a variety of control variables such as bank size, capital ratio, loans to assets ratio, deposits to assets ratio and return on equity, which are used by shareholders and investors to assess the values of banks.

Table 1 presents the definition of each variable we use in this paper. Table 2 lists the total number of banks in each year in our sample.

As shown by Lang and Stulz (1994), Tobin's q measures the present value of future cash flow divided by the replacement cost of tangible assets and is regarded as a measure of firm valuation. We calculate Tobin's q as the ratio of the market value of equity plus the book value of liabilities to the book value of assets. A similar measure we use is the market-to-book ratio (Caprio, Laeven, and Levine, 2007), which is expressed as the ratio of the market value of equity to the book value of equity and is used to contrast the market value of a stock to its book value.

We use the ratio of noninterest income to total operating income as the independent variable to test its impact on bank valuation.¹ Following Stiroh (2004a) and Lepetit et al. (2008), total operating income is the sum of interest income and noninterest income. Interest income mainly comes from loans and leases and investment securities. Noninterest income mainly comes from

¹ Lang and Stulz (1994) use Herfindahl-Hirschman Index as a measure of diversification. Laeven and Levine (2007) and Chen and Lin (2009) use the difference between net interest income and other operating income as a percentage of total operating income to measure the importance of noninterest income. Gambacorta, Scatigna, and Yang (2014) use noninterest income (trading income, fees and commissions for services) to total income.

fees of fiduciary activities, service charges, and trading revenue.

We include a variety of control variables. Firstly, we take the logarithm of total assets of each bank in thousands of U.S. dollars to control for the size, which is regarded to affect valuations through the economies of scope by Lang and Stulz (1994). Secondly, we include the ratio of equity to total assets as a measure of bank leverage level and we use the ratio of pre-tax profit to equity as a measure of profitability. Thirdly, we control for the ratio of total deposits to total assets to examine whether a higher ratio signals a higher value because deposits are regarded as a cheaper source of funding. Fourthly, we also control for the ratio of net loans to total assets.

3.2 Model Chosen

The following equations describe the models that we apply in our analysis. The definitions of variables we use in the regressions are listed in Table 1:

- Dependent variables: Tobin's q (q) and the market-to-book (mb) ratio
- Independent variable: The ratio of noninterest income to total operating income (Nii)
- Control variables: Size, Capital, Loans, Deposits and Return on equity (ROE)

$$q_{i,t} = \alpha + \beta_1 Nii_{i,t} + \beta_2 Size_{i,t} + \beta_3 Capital_{i,t} + \beta_4 Loans_{i,t} + \beta_5 Deposits_{i,t} + \beta_6 ROE_{i,t} + \varepsilon_i$$

$$mb_{i,t} = \alpha + \beta_1 Nii_{i,t} + \beta_2 Size_{i,t} + \beta_3 Capital_{i,t} + \beta_4 Loans_{i,t} + \beta_5 Deposits_{i,t} + \beta_6 ROE_{i,t} + \varepsilon_{i,t}$$

where i indicates a bank (i = 1, 2, 3,, 625); t indicates a year (t = 2003,, 2015); β is a coefficient to be estimated; α is constant term and ε is the error term.

4. Empirical Result

4.1 Summary Statistics

As shown in Table 3, we give summary statistics for the variables after dividing banks in our sample into three groups based on total assets: large banks with total assets exceeding \$10 billion, medium-sized banks with total assets between \$1 billion and \$10 billion and small banks with total assets up to \$1 billion. The number of observations is 687 for large banks, 2,257 for medium-sized banks, and 1,364 for small banks.

Both Tobin's q and the market-to-book ratio measure the market value of a firm relative to its accounting value, in terms of assets and equity, respectively. Generally, a firm's market value diverges from its book value. One main reason is that the market value is a forward-looking metric and book value is primarily based on historical performance of a company. The value of a bank changes as time varies. Many factors can affect the value of a company including macroeconomic and microeconomic factors, and noninterest income is a contribution to the changes in the bank value. In this paper, we investigate how changes in the noninterest income impact bank valuation.

We find that large banks have a higher average Tobin's q of 1.05 and a higher market-to-book ratio of 1.552, whereas medium-sized and small banks have a lower average Tobin's q of 1.044 and 1.036, and a lower market-to-book ratio of 1.468 and 1.405, respectively. In our sample, all the value measures are greater than one on average, indicating that the bank's market value exceeds its book value. The standard deviation of the market-to-book ratio is around 70% - 80%,

which means that the market-to-book ratio of banks varies considerably across banks and time as compared with that of about 6% - 8% for Tobin's q. Generally, the standard deviation of the value measures increases as bank size increases. Indeed, small banks have the lowest standard deviations of Tobin's q and the market-to-book ratio indicating that they have more stable valuations.

We use the ratio of noninterest income to total operating income, denoted by Nii, to investigate how noninterest income affects bank valuation. We find that large banks have the largest Nii of 0.315, which is almost twice as much as that of medium-sized banks of 0.176 and small banks of 0.149. This ratio indicates that large banks have the highest noninterest income ratio over the period of 2003 – 2015 because large banks have the economies of scale and the expertise and experience of generating noninterest income through nontraditional activities. The standard deviation of Nii for large banks is 18%, approximately twice as much as that of small banks, showing that Nii varies wider across large banks.

We find that large banks use more leverage, expressed as the ratio of equity to total assets, and their profitability in terms of ROE are higher than that of medium-sized and small banks. In comparison to medium-sized and small banks, the results of our studies show that large banks have lower ratios of net loans to total assets and deposits to total assets. This is consistent with that large banks have higher Nii, which comprises of more nontraditional activities.

We summarize how the importance of noninterest income has increased over time for banks of different sizes. All banks lose some noninterest income when the market faces with the financial

crisis and then gain back the noninterest income after the crisis regardless of bank sizes. Before the crisis, large banks have the largest ratio of noninterest income to total operating income with 0.314, whereas the ratio at medium-sized and small banks is 0.173 and 0.154 respectively. During the crisis, the ratio at small and large banks drops by 18% and 17% respectively, while the ratio drops only by 10% at medium-sized banks. This could be explained by the truth that the small banks are most vulnerable to the crisis and large banks have much more exposure to risks due to the large amount of assets. After the crisis, the ratio increases by 24% at both small and medium-sized banks and increases by 32% at large banks. Therefore, the ratio at medium-sized banks has less volatility than small and large banks in three sub-periods and the ratio at large banks is the most sensitive to the changes of the market condition.

4.2 Regression Results

Our model uses linear regression method. For robustness, we divide our sample into three sub-periods: before the financial crisis (2003 – 2006), during the financial crisis (2007 – 2009) and after the financial crisis (2010 – 2015), based on Berger and Bouwman (2013) definition of the financial crisis period. We are then able to examine how different market conditions affect the relation between noninterest income and bank valuation. Laeven and Levine (2007) indicate that size often impacts valuation through the economies of scope. Thus, we divide banks in our sample into three groups as stated above. This gives us a picture on how bank size influences the relation between noninterest income and bank valuation.

Our regression results are shown in Table 4 to Table 10. In each table, we report the standard errors in parentheses and use the 1%, 5% or 10% significance levels, respectively.

In Table 4, we regress Tobin's q and the market-to-book ratio, respectively, on noninterest income using the whole sample. The results indicate a positive relation between noninterest income and valuation. This finding shows that an increase in noninterest income is associated with a higher bank valuation.

When analyzing control variables, we find that the coefficient on bank size is significant and positive at the 1% significance level. This result is consistent with Laeven and Levin's (2007) finding that the size of banks often impacts bank valuations through their economies of scale. Deposits and return on equity are positively associated with both Tobin's q and the market-to-book ratio. The coefficient on capital is positive on the market-to-book valuation. The loans are insignificant for both market value measures.

Following Armstrong and Fic (2014), we divide banks into different size groups and sample period into sub-periods as noted above. We do so to check whether the positive relation between noninterest income and bank valuation exists under different market conditions.

Using Tobin's q as the dependent variable, Table 5, 6 and 7 present the regression results for large, medium-sized and small banks under three sub-periods, respectively. We find that noninterest income is always positively associated with valuation at large banks; this relation also holds for the period during and after the financial crisis at medium-sized banks; and for the period after the financial crisis at small banks. As suggested by the summary statistics presented in table 3, noninterest income at large banks accounts for approximately twice as much as that of

medium-sized and small banks. This is because medium-sized and small banks do not have much experience in producing noninterest income. In contrast, the economies of scale at large banks allow them to enjoy their experience, expertise and technology capabilities of generating noninterest income. Additionally, large banks have a higher portion of noninterest income indicating that noninterest income is relatively more important for their businesses in comparison to medium-sized and small banks. This leads to the result that noninterest income is always positively associated with valuations at large banks.

Looking at bank size, the results indicate a negative relation with valuation at large banks for the three sub-periods but demonstrate a positive association at medium-sized banks before and after the financial crisis. Size is always insignificantly associated with valuation at small banks. The complexity to manage large banks is one possible reason. This result is consistent with Laeven and Levin (2007) finding that economies of scale are not sufficient enough to yield higher values.

In our paper, return on equity (ROE) is always positively associated with bank valuations regardless of the market conditions and bank sizes. As ROE is a performance measurement, the higher ROE signals better performance, resulting in higher values. Capital has a positive association with bank valuation before the crisis and a negative relation during the crisis for each group. After the crisis, there is an insignificant relation at medium-sized and small banks, but a negative relation at large banks.

Loans are positively associated with valuations after the crisis at large banks, and are negatively associated with valuations during and after the crisis at medium-sized banks and during the crisis

at small banks. The possible reason is that large banks enjoy the economies of scale, so they are able to recover faster and have a higher capacity to absorb losses; whereas medium-sized and small banks much more severely suffer from default and credit risks at the time of the sub-prime financial crisis. Deposits are negatively related to valuation after the crisis for large banks, but positively related to valuation before the crisis for both medium-sized and small banks. As Laeven and Levin (2007) point out, a higher level of deposits allows banks to access to the lower-cost funding, because deposits are regarded as a cheaper source of funding and are entitled to the government-subsidized insurance. In particular, as the summary statistics in table 3 suggest, medium-sized and small banks have higher means of deposits to total assets compared with large banks, thus these banks benefit more from deposits.

In the Table 8, 9 and 10, we perform robustness checks and use the market-to-book ratio as an alternative measure of valuation in order to test the association between noninterest income and bank valuations. The results of our regressions are also based on three different market conditions and bank sizes.

We find that, for large and small banks, the relation between noninterest income and bank valuations is the same as that when we use Tobin's q as the dependent variable. Capital is insignificant before the crisis at large banks, whereas it is positive when we use Tobin's q as the dependent variable. Loans are always insignificant. For the control variable of bank size, the results show that small and medium-sized banks benefit from the economies of scale during the crisis while there is no such relation when we use Tobin's q as the dependent variable.

For medium-sized banks, the relation between noninterest income and bank valuations is insignificant after the financial crisis. Capital is negatively related to valuations before the crisis, and loans are negatively associated with valuations before the crisis.

5. Conclusion

This paper examines the impact of noninterest income on bank valuations. We perform analyses using yearly data on 625 U.S. Bank Holding Companies over the period of 2003 – 2015.

Looking at the whole sample, we find a positive relation between noninterest income and bank valuations.

We perform robustness exams to take a close look at the impact of noninterest income on bank valuation under different market conditions. We divide banks into three sub-periods: before, during and after the financial crisis of 2007 – 2009. We also divide banks in our sample into three groups based on size: large, medium-sized and small banks. We find that noninterest income is positively related to valuation (1) for large banks in each sub-period, (2) for medium-sized banks during and after the financial crisis of 2007-2009, and (3) for small banks after the financial crisis.

One of the underlying reasons is that medium-sized and small banks do not have much experience in generating noninterest income. In contrast, the economies of scale at large banks allow them to enjoy their experience, expertise and technology capabilities of generating noninterest income. Large banks have a higher portion of noninterest income indicating that noninterest income is relatively more important in their business compared with medium-sized

and small banks. Additionally, regulatory changes are one possible reason that affect banks' ability to generate noninterest income. The implementation of Dodd-Frank Act in 2010 makes banks more difficult and more expensive to service mortgage loans. The Volcker Rule included in the Dodd-Frank Act prohibits banks from generating revenue from proprietary trading and limits investment in hedge funds and private equity.

Appendix

Table 1: Definition of variables

| Variables | Definition |
|-------------------------|--|
| Tobin's Q, q | The ratio of the market value of equity plus the book value of liabilities to the book value of assets |
| Market-to-book, mb | The ratio of the market value of equity to the book value of equity |
| Noninterest income, Nii | The ratio of noninterest income to total operating income |
| Size | The natural logarithm of total assets in thousands of dollars |
| Capital | The ratio of equity to total assets |
| Loans | The ratio of net loans to total assets |
| Deposits | The ratio of total deposits to total assets |
| Return on equity, ROE | The ratio of pre-tax profit to equity |

Table 2: Number of banks by year

| Year | N |
|----------------------|-------|
| 2003 | 454 |
| 2004 | 438 |
| 2005 | 448 |
| 2006 | 376 |
| 2007 | 355 |
| 2008 | 339 |
| 2009 | 345 |
| 2010 | 329 |
| 2011 | 290 |
| 2012 | 279 |
| 2013 | 226 |
| 2014 | 234 |
| 2015 | 195 |
| Total observations | 4,308 |
| Total number of BHCs | 625 |

Table 3: Summary statistics

Panel A: Summary statistics for large banks

| | N | Mean | Median | Std. Dev. | 25th Percentile | 75th Percentile |
|----------|-----|--------|--------|--------------|--------------------|--------------------|
| q | 687 | 1.050 | 1.038 | 0.078 | 0.992 | 1.098 |
| mb | 687 | 1.552 | 1.380 | 0.828 | 0.928 | 2.085 |
| Nii | 687 | 0.315 | 0.291 | 0.181 | 0.199 | 0.395 |
| Size | 687 | 17.654 | 17.173 | 1.383 | 16.518 | 18.492 |
| Capital | 687 | 0.102 | 0.100 | 0.026 | 0.084 | 0.116 |
| Loans | 687 | 0.573 | 0.635 | 0.171 | 0.479 | 0.688 |
| Deposits | 687 | 0.665 | 0.694 | 0.150 | 0.610 | 0.771 |
| ROE | 687 | 0.127 | 0.142 | 0.152 | 0.084 | 0.201 |

Panel B: Summary statistics for medium-sized banks

| | N | Mean | Median | Std. Dev. | 25th Percentile | 75th Percentile |
|----------|-------|--------|--------|--------------|--------------------|--------------------|
| q | 2,257 | 1.044 | 1.035 | 0.069 | 0.993 | 1.086 |
| mb | 2,257 | 1.468 | 1.349 | 0.784 | 0.926 | 1.951 |
| Nii | 2,257 | 0.176 | 0.161 | 0.104 | 0.113 | 0.226 |
| Size | 2,257 | 14.720 | 14.610 | 0.636 | 14.176 | 15.191 |
| Capital | 2,257 | 0.096 | 0.094 | 0.027 | 0.079 | 0.110 |
| Loans | 2,257 | 0.662 | 0.675 | 0.114 | 0.603 | 0.738 |
| Deposits | 2,257 | 0.767 | 0.785 | 0.088 | 0.727 | 0.823 |
| ROE | 2,257 | 0.071 | 0.122 | 0.238 | 0.060 | 0.175 |

Panel C: Summary statistics for small banks

| | N | Mean | Median | Std. Dev. | 25th Percentile | 75th Percentile |
|----------|-------|--------|--------|--------------|--------------------|--------------------|
| q | 1,364 | 1.036 | 1.032 | 0.065 | 0.985 | 1.079 |
| mb | 1,364 | 1.405 | 1.349 | 0.742 | 0.835 | 1.864 |
| Nii | 1,364 | 0.149 | 0.132 | 0.096 | 0.089 | 0.184 |
| Size | 1,364 | 13.286 | 13.357 | 0.380 | 13.086 | 13.585 |
| Capital | 1,364 | 0.093 | 0.090 | 0.026 | 0.077 | 0.105 |
| Loans | 1,364 | 0.676 | 0.687 | 0.115 | 0.607 | 0.761 |
| Deposits | 1,364 | 0.778 | 0.795 | 0.090 | 0.736 | 0.839 |
| ROE | 1,364 | 0.078 | 0.115 | 0.206 | 0.060 | 0.168 |

Panel D: How noninterest income has changed over time

| | Before Crisis | <i>Changes</i> | During Crisis | <i>Changes</i> | After Crisis |
|--------------|---------------|----------------|---------------|----------------|--------------|
| Small Banks | 0.154 | -18% | 0.127 | 24% | 0.158 |
| Medium Banks | 0.173 | -10% | 0.155 | 24% | 0.192 |
| Large Banks | 0.314 | -17% | 0.260 | 32% | 0.342 |

Table 4: Regression results of the whole sample,

Tobin's q and Market-to-book ratio are the dependent variables

| | (1) Tobin's q | (2) Market-to-book ratio |
|--------------------|---------------------|-----------------------------|
| Nii | 0.091*** (0.010) | 0.756*** (0.100) |
| Size | 0.003*** (0.001) | 0.051*** (0.007) |
| Capital | 0.036 (0.037) | -2.793*** (0.368) |
| Loans | -0.005 (0.009) | -0.103 (0.089) |
| Deposits | 0.054*** (0.013) | 0.669*** (0.121) |
| ROE | 0.072*** (0.006) | 1.070*** (0.076) |
| Constant | 0.976*** (0.016) | 0.856*** (0.154) |
| Year fixed effects | Yes | Yes |
| Observations | 4,308 | 4,308 |
| Number of Entity | 625 | 625 |
| R-squared | 0.502 | 0.550 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Regression results, Tobin's q is the dependent variable, large banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | 0.146*** (0.035) | 0.145*** (0.044) | 0.110*** (0.025) |
| Size | -0.013*** (0.002) | -0.013*** (0.003) | -0.019*** (0.002) |
| Capital | 0.794*** (0.139) | -0.925*** (0.151) | -0.280** (0.136) |
| Loans | -0.011 (0.025) | -0.007 (0.034) | 0.054** (0.025) |
| Deposits | 0.021 (0.033) | -0.010 (0.063) | -0.087*** (0.022) |
| ROE | 0.424*** (0.062) | 0.116*** (0.019) | 0.377*** (0.069) |
| Constant | 1.121*** (0.055) | 1.314*** (0.086) | 1.352*** (0.052) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 222 | 155 | 310 |
| Number of Entity | 70 | 60 | 67 |
| R-squared | 0.636 | 0.571 | 0.622 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Large banks have total assets exceeding US\$10 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

Table 6: Regression results, Tobin's q is the dependent variable, medium-sized banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | 0.046 (0.030) | 0.237*** (0.030) | 0.036** (0.017) |
| Size | 0.010*** (0.003) | 0.005 (0.004) | 0.019*** (0.003) |
| Capital | 0.320** (0.126) | -0.248*** (0.079) | 0.066 (0.065) |
| Loans | -0.027 (0.017) | -0.047* (0.027) | -0.033* (0.019) |
| Deposits | 0.097*** (0.025) | -0.028 (0.034) | 0.028 (0.030) |
| ROE | 0.283*** (0.089) | 0.043*** (0.008) | 0.051*** (0.012) |
| Constant | 0.812*** (0.045) | 0.991*** (0.061) | 0.712*** (0.054) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 754 | 591 | 912 |
| Number of Entity | 248 | 228 | 244 |
| R-squared | 0.308 | 0.386 | 0.284 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Medium-sized banks have total assets between US\$1 billion and US\$10 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

Table 7: Regression results, Tobin's q is the dependent variable, small banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | -0.018 (0.023) | 0.076 (0.048) | 0.033* (0.017) |
| Size | 0.001 (0.004) | 0.014 (0.011) | -0.002 (0.009) |
| Capital | 0.320*** (0.092) | -0.225** (0.095) | 0.019 (0.112) |
| Loans | 0.008 (0.014) | -0.091*** (0.028) | 0.018 (0.024) |
| Deposits | 0.147*** (0.026) | 0.052 (0.047) | 0.012 (0.031) |
| ROE | 0.291*** (0.045) | 0.039*** (0.008) | 0.022* (0.012) |
| Constant | 0.884*** (0.057) | 0.875*** (0.145) | 0.977*** (0.120) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 740 | 293 | 331 |
| Number of Entity | 266 | 137 | 119 |
| R-squared | 0.337 | 0.333 | 0.220 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Small banks have total assets up to US\$1 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

Table 8: Regression results, Market-to-book ratio is the dependent variable, large banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | 1.497*** (0.412) | 1.657*** (0.450) | 0.939*** (0.234) |
| Size | -0.129*** (0.026) | -0.127*** (0.034) | -0.179*** (0.019) |
| Capital | -2.200 (1.383) | -8.723*** (1.704) | -5.142*** (1.278) |
| Loans | -0.327 (0.302) | -0.252 (0.377) | 0.343 (0.255) |
| Deposits | 0.514 (0.391) | 0.348 (0.644) | -0.644*** (0.226) |
| ROE | 5.220*** (0.745) | 1.417*** (0.201) | 3.672*** (0.598) |
| Constant | 2.994*** (0.605) | 3.876*** (0.890) | 4.634*** (0.501) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 222 | 155 | 310 |
| Number of Entity | 70 | 60 | 67 |
| R-squared | 0.610 | 0.599 | 0.614 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Large banks have total assets exceeding US\$10 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

Table 9: Regression results, Market-to-book ratio is the dependent variable, medium-sized banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | 0.462 (0.369) | 1.857*** (0.310) | 0.185 (0.153) |
| Size | 0.113*** (0.035) | 0.109*** (0.037) | 0.192*** (0.026) |
| Capital | -4.953*** (1.557) | -3.459*** (0.917) | 0.326 (0.740) |
| Loans | -0.425** (0.210) | -0.460 (0.290) | -0.178 (0.175) |
| Deposits | 0.881*** (0.328) | 0.262 (0.369) | 0.306 (0.263) |
| ROE | 3.160*** (1.196) | 0.798*** (0.092) | 0.569*** (0.177) |
| Constant | -0.058 (0.555) | -0.134 (0.604) | -2.011*** (0.474) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 754 | 591 | 912 |
| Number of Entity | 248 | 228 | 244 |
| R-squared | 0.325 | 0.392 | 0.263 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Medium-sized banks have total assets between US\$1 billion and US\$10 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

Table 10: Regression results, Market-to-book ratio is the dependent variable, small banks

| | (1) Before the crisis | (2) During the crisis | (3) After the crisis |
|--------------------|--------------------------|--------------------------|-------------------------|
| Nii | -0.130 (0.253) | 0.665 (0.428) | 0.385** (0.176) |
| Size | -0.028 (0.047) | 0.212* (0.124) | -0.012 (0.088) |
| Capital | -3.812*** (0.883) | -0.524 (1.064) | 1.898*** (0.713) |
| Loans | 0.183 (0.145) | -0.955*** (0.290) | -0.080 (0.196) |
| Deposits | 1.395*** (0.236) | 0.676 (0.461) | 0.376 (0.303) |
| ROE | 3.347*** (0.485) | 0.478*** (0.164) | 0.323** (0.155) |
| Constant | 0.960 (0.625) | -1.462 (1.635) | 0.408 (1.161) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 740 | 293 | 331 |
| Number of Entity | 266 | 137 | 119 |
| R-squared | 0.385 | 0.345 | 0.311 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: We divide the sample into three periods: before the crisis (2003 – 2006), during the crisis (2007 – 2009) and after the crisis (2010 – 2015). Small banks have total assets up to US\$1 billion. ***, **, and * indicate the 1%, 5%, and 10% significance level, respectively.

References

- Armstrong A., Fic T., 2014, Bank diversification and valuation: International evidence. National Institute of Economic and Social Research.
- Berger, A.N., Humphrey, D.B., 1997. Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research* 98, 175-212.
- Berger, P., Ofek, E., 1995. Diversification's effect on firm value. *Journal of Financial Economics* 37, 1-126.
- Campa, J.M., Kedia, S., 2002. Explaining the diversification discount. *Journal of Finance* 57, 1731-1761.
- Caprio, G., Laeven, L., Levine, R., 2007. Governance and bank valuation. *Journal of Financial Intermediation* 16, 584-617.
- Chen, S.H., Lin Y.Y., 2009. Diversification discount or premium? New international evidence from financial conglomerates. *SSRN Electronic Journal*.
- Elsas, R., Hackethal, A., Holzhäuser, M., 2010. The anatomy of bank diversification. *Journal of Banking & Finance* 34, 1274-1287.
- Gambacorta, L., Scatigna, M., Yang, J., 2014. Diversification and bank profitability: a nonlinear approach. *Applied Economics Letters* 21, 438-441.
- Graham, J.R., Lemmon, M.L., Wolf, J., 2002. Does corporate diversification destroy value? *Journal of Finance* 57, 695–720.
- Jensen M., 1986. Agency costs of free cash flow, corporate finances, and takeovers. *American Economic Review* 76.
- Laeven, L., Levine, R., 2007. Is there a diversification discount in financial conglomerates? *Journal of Financial Economics* 85, 331-367.
- Lang, L.H.P., Stulz, R.M., 1994. Tobin's q, corporate diversification and firm performance. *Journal of Political Economy* 102.
- Lepetit, L., Nys, E., Rous, P. et al., 2008. Bank income structure and risk: an empirical analysis of European banks. *Journal of Banking and Finance* 32, 1452–67.
- Maksimovic, V., Phillips, G.M., 1998. Asset efficiency and reallocation decisions of bankrupt firms. *Journal of Finance* 53.
- Rotemberg J., Saloner G., 1994. Benefits of narrow business strategies. *American Economic Review* 84.

Schmid, M.M., Walter, I., 2009. Do financial conglomerates create or destroy economic value? *Journal of Financial Intermediation* 18, 193-216.

Stiroh, K., 2004a. Do community banks benefit from diversification? *Journal of Financial Services Research* 25, 135-160.

Villalonga, B., 2004. Does diversification cause the diversification discount? *Financial Management* 33, 5-27.