

DETERMINANTS OF BANK PROFITABILITY: EVIDENCE FROM US

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Abstract

This paper examines the variables that affect bank profitability. We construct a sample of US banks from 2003 to 2015, and use return on assets (ROA) and return on equity (ROE) to measure bank profitability. We find that banks with higher profitability are the banks that have: (1) a higher deposits to total asset ratio, (2) a higher diversification ratio, and (3) higher operational efficiency. We also find that better-capitalized banks tend to be more profitable only when we use ROA as the measure of profitability. Furthermore, loans have a positive impact on profitability before the financial crisis, but not during the crisis. Size has a positive impact on profitability when the bank is small.

Keywords: Bank profitability; Size of the banks; Financial crisis

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1: Introduction

There are thousands of banks in the US, and they play significant roles in economic activities. Banks are financial institutions that accept deposits from the public and create credit. Lending activities are performed mostly by banks. Levine et al. (2002) state that banks translate customer deposits into productive investments in a way that supports economic growth. Therefore, a more profitable bank should be able to not only make better contributions to the countries and society, but also maintain sufficient capital ratios, even in a risky business environment.

US banks are influential and important in global economic environment, and present a significant resource to study bank profitability for two reasons. First, US banking system is one of the most advanced systems in the world, and there is enough number of banks that we can use as samples to analyse. Second, following a period of financial deregulation and increased competition in the banking and financial sectors, US banks were hit by a major financial crisis between 2007 and 2009, which brought unexpected losses to the world. Thus, banks should learn how to prevent losses and maintain profitability even during economic recessions.

A lot of researchers have studied the determinants of bank profitability over different sample periods and in different countries. For example, Flamini et al (2009) and Smirlock (2009) find a positive relationship between the size of a bank and its profitability, while Pasiouras (2006) finds the relationship to be negative. Berger (1995b) finds that increasing capital ratio may increase bank profitability. Freixas (2005) suggests

that a bank can benefit more with higher loans to asset ratio because of informational advantage.

In this paper, we examine not only the relationship between different factors and bank profitability, but also how the relationship differs across bank size groups and over time. Since banks of different size often follow different strategies to grow their profitability, we study which determinants matter most for each size group. Moreover, the relationship might change in different economic conditions. Therefore, we divide all banks into three size groups, and we analyse each group separately in three time periods: before the crisis, during the crisis and after the crisis.

We use Stata to run linear regressions and measure profitability using both return on assets (ROA) and return on equity (ROE). ROA is calculated as the ratio of net income to total assets. It is the most popular way for comparing banks to each other, and is also used by banks to monitor their own performance from period to period. Nowadays, there are still many banks that prefer to use ROA though these banks are typically small. ROE is defined as a ratio of net income to shareholders' equity. It is not asset-dependent, and therefore is gaining popularity recently. ROE can be used to monitor any line of business or any product in the bank, and ROE also permits people to look at the comparative profitability of lines of business like deposit services, while it would be difficult to analyse the profitability with ROA. Many observers recommend ROE, because it focuses on shareholders' interest in the business.

This paper proceeds as follows. Section 2 reviews several significant empirical studies that help to develop our hypothesis. Section 3 explains the data and methods we

use to estimate the empirical equation. Section 4 presents and discusses the results.

Section 5 gives summary and gives advice on improving bank profitability.

2: Literature Review

2.1 Size

Chronopoulos et al. (2015) find a nonlinear relationship between the scale and bank profitability. They also find evidence that profitability tends to increase during periods of economic growth, and deteriorates during periods of slow economic growth. Barros et al (2007) find that larger, more diversified Banks are more likely to have poor performance; this suggests that smaller, specialized Banks can more effectively reduce the asymmetric information problems related to loans. Berger and Humphrey (1997) find that, in general, large banks performed better than smaller Banks, but it was not clear whether large banks benefited from economies of scale. They point out that better practices are more important than economies of scale in terms of technical and managerial structures.

Flamini et al. (2009) and Smirlock (1985) find a positive link between size and profitability. One possible reason is that large banks are more diversified in their products and services, which reduces the risk level and thus improves operational efficiency and profitability. Moreover, large banks can raise relatively cheap capital and thus appear to be more profitable. In addition, some studies have found that, in the absence of competition environment, large banks have larger market share by providing lower deposit rates to obtain higher profits, and maintain a higher lending rates (Flamini et al., 2009). On the other hand, Pasiouras and Kosmidou (2007) and Stiroh and Rumble (2006) find the link to be negative. They argue that the increase in bank size will result in an increase in marketing and operating costs, and bureaucratic costs rise, leading to the

negative correlation between the profitability and scale. So, the scale effect on profitability is still a puzzle.

Based on the prior literature, we also hypothesize that the impact of size on profitability is especially important during a crisis, and small banks may be influenced differently than large bank.

Therefore, based on the scale of profitability and economies of scale, there are two uncertain assumptions about the impact of bank size on bank profitability that needs to be tested.

Hypothesis 1a: There is a positive relationship between bank size and bank profitability.

Hypothesis 1b: There is a negative relationship between bank size and bank profitability.

2.2 Capitalization

In terms of expected returns, equity costs are the most expensive funding sources. Similarly, because capital is risky and requires a higher return, banks generally believe that higher equity requirements will add to the cost of financing. That is why bankers are less enthusiastic when asked to raise capital adequacy ratios.

The following reasons explain that higher profitability can result from better capitalization of a bank. First, a bank would have high bankruptcy cost at the time when their capital ratios are low; this is known as the expected bankruptcy cost hypothesis of Berger (1995b). Second, a bank with higher capital ratio would have lowering interest expenses on debt. Finally, Berger (1995b) argues that banks can use higher capital ratios to signal good prospects.

It is also suggested that Capitalization would particularly help small banks to gain profit. Berger and Bouwman (2013) find that capital would enhance profitability of small

banks at all time, and improve profitability of medium and large banks during banking crises. They point out that size could be a source of economic strength for a bank, and small banks benefit the most from capital as their access to the financial market is more limited compare to medium and large banks.

Hypothesis 2: There is a positive relationship between the amount of capital of a bank and the bank's profitability.

2.3 Asset Structure

Asset structure refers to the composition of assets held by a bank. To study the impact of asset structure on bank profitability, we focus on the loan to asset ratio. Following reasons supports the idea of a positive relationship between this ratio and bank profitability. First, Freixas (2005) suggests that banks with higher loan to asset ratio would have more informational advantage, and therefore would generate higher profits. Second, banks often charge high interest rates on loans as a compensation for taking liquidity risk. Above finding are reported in recent study by Barros et al. (2007), Chiorazzo et al. (2008), DeYoung and Rice (2004), Goddard et al. (2004) and Iannotta et al. (2007).

It is also reasonable to hypothesize that banks with a higher ratio of loans to asset tend to suffer more during the crisis. Therefore, we wish to analyze whether loans always have a positive impact on bank profitability, or whether the impact changes over time.

Hypothesis 3: There is a positive relationship between the loans-to-assets ratio and bank profitability.

2.4 Deposit

Several papers examine the effect of customer deposits on bank profitability. Claeys and Vander Venet (2008) suggest that higher shares of customer deposits should be able to increase bank profitability. They argue that customer deposits are a cheaper and more stable financial resource than other financing resources in bank liabilities. Beltratti and Stulz (2009) also find that large banks with more deposit financing at the end of 2006 had higher profitability during the crisis. Therefore, more customer deposits in bank liabilities mean higher bank profitability (Rasiah 2010).

However, if the commercial policy is aggressive, banks will have to pay higher deposit rates in order to attract depositors from competitors, and thus lower bank margins. This is so called 'deposit war'. What is more, according to Liu and Wilson (2010), if banks pass lower costs on to their customers in the form of higher deposit rates, the profits will be reduced. Therefore, we examine the relation between customer deposits and bank profitability in this paper.

Hypothesis 4a: There is a positive relationship between the deposits of a bank and the bank's profitability.

Hypothesis 4b: There is a negative relationship between the deposits of a bank and the bank's profitability.

2.5 Diversification

The decline in interest margins in the last decade has driven traditional banks to change their focus on lending activities, and searched for new sources of revenue. The argument that whether diversification has a positive impact on bank profitability has aroused many scholar's interest. Some researchers argue that income diversification has a

positive impact on bank profitability. Chiorazzo et al. (2008) and Elsas et al. (2010) conclude that income diversification increases bank profitability through higher margins from non-interest businesses. Khanna and Tice (2001) find that income diversification can reduce risk.

However, other researchers find evidence that income diversification has a negative impact on bank profitability. Acharya, Hasan, and Saunders (2002) find that diversification can reduce bank returns. Lepetit et al. (2008) finds that certain loans that have lower interest rate aiming to capture customers for other products and services provided by the banks can cause detriment in the banks. That is, the revenue from non-interest product cannot offset the cost of lowering interest rate. Stiroh and Rumble (2006) conclude that greater income diversification does not necessarily turn into an improvement on bank profitability.

What is more, Dietrich and Wanzenried (2011) suggest that only larger banks benefit from revenue diversification. This is because larger banks have economies of scale (e.g., increased operational efficiency) and economies of scope (e.g., higher degree of product and loan diversification) than smaller banks.

Therefore, we are interested in finding the possible relationship between income diversification and bank profitability, and whether the relationship differs across different sizes of banks.

Hypothesis 5a: There is a positive relationship between the level of diversification of a bank and the bank's profitability.

Hypothesis 5b: There is a negative relationship between the level of diversification of a bank and the bank's profitability.

2.6 Efficiency

As the development in financial technologies, information and communication in finance industry, banks have been performing their traditional services more efficiently. Therefore, efficiency in delivering banking services has constituted a significant determinant of the bank profitability. A number of researchers have found a positive relationship between efficiency and bank profitability, for both US and European banks (Berger, 1995a; Goddard et al., 2001).

Previous scholars often use the cost-to-income (CI) ratio, which is a proxy for operational efficiency, to examine the relationship between bank profitability and managerial efficiency. Lowering the bank's cost ratio, and hence increasing managerial efficiency, is expected to enhance bank profitability. Furthermore, there is also evidence that cost-income ratio (CIR) (Goddard et al., 2009) or overhead costs over total assets (Athanasoglou et al., 2008), the proxy for operational efficiency, affects bank profitability. Dietrich and Wanzenried (2011) find evidence that the more efficiently banks operate, the higher profits banks obtain. According to Trujillo-Ponce (2013), on average, banks may have costs about 20 per cent higher than the industry minimum because of low managerial efficiency.

However, Liu and Wilson (2010) suggest that if banks with higher operational efficiency pass the lower costs to their customers through, for example, lower loan rates and/or higher deposit rates, bank profits will decline. Given the findings of previous studies, we expect a positive relationship between efficiency and bank profitability.

Hypothesis 6: There is a positive relationship between the efficiency of a bank and the bank's profitability.

3: Sample and Methodology

3.1 Sample

In order to achieve the goal of this research paper, we obtain data from the Wharton Research Data Service (WRDS). Specifically, we download accounting data (with annual frequency) of Bank Holding Companies in the US over the period from 2003 to 2015.

There are 16,829 observations on 2,843 unique banks in our sample. We then divide banks into three groups based on their total assets. Small banks have total assets up to \$1 billion. Medium banks have total assets between \$1 billion and \$10 billion. Large banks have total assets of more than \$10 billion.

In order to learn the effect of financial crisis, we divide our sample period into three periods. We define 2003 to 2006 as ‘Before the crisis’, 2007 to 2009 as ‘During the crisis’, and 2010 to 2015 as ‘After the crisis’.

3.2 Variable definitions

3.2.1 Dependent variables

We use two dependent variables in this paper, which are return on assets (ROA) and return on equity (ROE), to measure the ability of banks to generate profit. ROA indicates how profitable a bank is given its assets. It gives investor and manager an idea of how efficient the management of a bank is to generate return using its assets. ROE

quantifies how much profit a bank could generate with the money that shareholders have invested in the bank.

3.2.2 Independent variables

We choose the following variables as the independent variables: Asset Size, Capital Ratio, Net Loans, Deposits, Asset Diversity, and Cost-income Ratio. We test the effect of these variables on ROA and ROE over the three periods: before the crisis, during the crisis, and after the crisis.

For Asset Size, we have taken the natural logarithm of total asset in thousands of dollars to reduce the heteroscedasticity.

For Capital Ratio, we use the ratio of equity to total assets as measurement. Following our second Hypothesis, we expect a positive relationship between capital ratio and bank profitability.

For Net Loans, we use the ratio of net loans to total assets. From our third Hypothesis, we expect to observe a positive relationship between the ratio of net loans to total assets and profitability.

For Deposits, we use the ratio of total deposits to total assets. We have no clear prior of the impact of deposits on bank profitability. On the one hand, deposits are stable and cheap funding sources, and banks take advantage of deposits. On the other hand, banks may increase their interest expenses when they try to attract more deposits. Thus, the impact of deposits on bank profitability is ambiguous.

For Income Diversity, we use the ratio of noninterest income to total operating income, where total operating income is the sum of interest income and noninterest income. We expect a positive relationship between this variable and bank profitability.

For Cost-income Ratio, we use the ratio of total noninterest expense to total operating income. This is a useful ratio to test the impact of efficiency on bank profitability. A higher cost-income ratio indicates lower efficiency.

Table 1 provides variable definitions. Table 2 reports the number of banks each year from 2003 to 2015. Table 3 provides the summary statistics such as mean, standard deviation, 25th percentile, Median, 75th Percentile, and number of observation for each variable.

3.3 Methodology

We perform linear regressions using STATA to examine the impact of each independent variable on bank profitability. Our equation is as follow:

$$Y_{i,t} = \alpha + \beta_1 * Size_{i,t} + \beta_2 * \frac{Equity_{i,t}}{TA_{i,t}} + \beta_3 * \frac{Loans_{i,t}}{TA_{i,t}} + \beta_4 * \frac{Deposits_{i,t}}{TA_{i,t}} + \beta_5 * Diversification_{i,t} + \beta_6 * CIR_{i,t} + \varepsilon_{i,t}$$

Where

$Y_{i,t}$: Either ROA or ROE in different regressions

β : Coefficient on independent variables

$\varepsilon_{i,t}$: Error term

We estimate above equation separately for the three periods in order to understand whether the impact of each variable changes over time .

4: Results

4.1 Determinants of the profitability of large banks

Tables 4 and 5 report the regression results for both dependent variables (ROA and ROE) using large banks.

The coefficient on size is negative in all regressions no matter whether the dependent variable is ROA or ROE. Therefore, the results show that there is a negative relationship between bank size and bank profitability, meaning that banks cannot increase their profitability by increasing size anymore when they reach a certain level of economies of scale. Increasing size would reduce bank profitability by generating lots of other costs, which cannot be offset by the increase in revenue.

The coefficient on the loans-to-total-assets ratio is positive before the crisis, while negative during the crisis. It provides mixed evidence for our hypothesis that there is a positive relationship between asset structure and bank profitability for large banks. We conclude that, for large banks, having more loans can have positive impact on bank profitability when the economy is good and stable. However, holding more loans may hurt bank profitability during recessions because of the bad debts and the collapse of housing market.

Deposits in large banks have a positive and significant impact on bank profitability in all periods. Therefore, we conclude that there is a positive relationship between deposits and profitability for large banks. The traditional business of taking deposits still matters for the profitability of large banks in the US.

Diversification has a positive and statistically significant impact on bank profitability for large banks in all periods. Therefore, we conclude that for large banks, having more non-interest income can increase profitability. Being diversified in business can bring extra revenue to the banks, especially for business such as portfolio management that can generate higher service fees, which is more profitable than the traditional lending activities.

The coefficient on the cost-income-ratio for large banks is negative and significant, meaning lower operational efficiency can cause significant damage to bank profitability no matter at which stage of the economic cycle. This result supports our hypothesis that there is a positive relationship between bank efficiency and bank profitability. A bank with higher operational efficiency has a lower managerial cost with the same amount of outcome, especially for large banks that already have a significant amount of different costs. Therefore, higher operational efficiency can lead to higher profitability.

The impact of capital on bank profitability depends on how profitability is measured. When the dependent variable is ROA, the coefficient on capital in all periods is positive. When the dependent variable is ROE, the coefficient on capital is negative before the crisis, but positive during the crisis. We suggest that the different calculation for ROA and ROE may be the main reason, and the result is also consistent with the previous literature (e.g., Trujillo, 2013). Indeed, banks can reduce the costs of external debt and compensate for the higher costs of own funds. The negative effect of bank capital on ROE can be explained by the simultaneous increase of the numerator and the denominator. Recall that ROE equals net income divided by shareholders' equity. An

increase in capital can lead to an increase in net income. However, it also leads to an increase in the denominator.

4.2 Determinants of the profitability of medium banks

Tables 6 and 7 report the regression results for medium banks. We find that size, deposit, diversification and cost-income-ratio have the same impact on medium banks as that on large banks. Thus, for medium banks in the US, increasing bank size cannot have a positive impact on bank profitability, since the bank cannot offset the cost of expanding by the increase in revenue.

However, the coefficient on capital is different from that on large banks. Capital has a positive and significant impact on bank profitability during and even after the financial crisis when the dependent variable is ROE. Indeed, the sources of profitability might have changed for medium banks during the financial crisis, and more capital is good for return on equity, because people view capital as an important element to reduce the insolvency risk of a bank, and more capital means less insolvency risk. Therefore, during and after the financial crisis, capital is important for a medium bank to generate profits.

Furthermore, loans have a negative impact on medium banks not only during the financial crisis, but also after the crisis. We suggest that compared to the large banks, medium banks do not have a high reputation and customer bases, therefore more loans in the asset structure can be risky for medium banks after the recession. People may view a medium bank with higher amount of loans as having higher credit risk.

4.3 Determinants of the profitability of small banks

Table 8 and 9 report the regression results for small banks. We find that the coefficients on deposits, diversification, and cost-income-ratio are qualitatively similar to those reported in previous tables. Therefore, we conclude that for all banks in the US, having more deposits, being more diversified and having higher efficiency can increase bank profitability.

However, size has a negative and significant impact on bank profitability for small banks before crisis, but a positive impact during the crisis. We suggest that it is difficult for small banks to compete with big banks during the crisis. Increasing the size can bring benefits to small banks during the crisis by reducing insolvency risk through better diversification.

5: Summary

This paper empirically analyzes the variables that influence the profitability of US banks from 2003 to 2015. We divide banks into three groups: large banks, medium banks and small banks, and analyze them over different sample periods.

We find that: (1) Banks with higher levels of deposits, revenue diversification and higher efficiency tend to have higher profitability. These results hold whether we measure profitability using ROA and ROE. (2) Large and medium banks cannot increase their profitability by enlarging their size, while small banks can do so. (3) Banks with higher loans tend to have higher profitability before the financial crisis, but lower profitability during the financial crisis. (4) Banks with higher capital tend to be more profitable, but only when we use ROA to measure profitability.

We conclude that, if a bank wants to improve its profitability, it can attract more deposits, become more diversified in, and improve its operational efficiency.

One limitation of this paper is that the regressions may be endogenous. We assumed that capital affects bank profitability. However, in practice, profitability may in turn affect capital, because banks with higher profits will have higher capital. If capital is endogenous, estimating the empirical equation using ordinary least squares may produce biased estimates. We leave this issue to future research.

6: Appendix

6.1 Appendix A: Tables

Table 1 Variable definitions

| Variable | Definition |
|-------------------|---|
| | |
| Return on assets | The ratio of net income to total assets |
| | |
| Return on equity | The ratio of net income to total equity capital |
| | |
| Size | The natural logarithm of total assets in thousands of dollars |
| | |
| Capital | The ratio of equity to total assets |
| | |
| Loans | The ratio of loans and leases to total assets |
| | |
| Deposits | The ratio of domestic deposits to total assets |
| | |
| Diversification | The ratio of noninterest income to total operating income |
| | |
| Cost-income ratio | The ratio of noninterest expense to total operating income |

Table 2 Number of observations by year

| Year | Number of Banks |
|------|-----------------|
| 2003 | 2186 |
| 2004 | 2301 |
| 2005 | 2310 |
| 2006 | 986 |
| 2007 | 966 |
| 2008 | 973 |
| 2009 | 1015 |
| 2010 | 1009 |
| 2011 | 1018 |
| 2012 | 1140 |
| 2013 | 1143 |
| 2014 | 1129 |
| 2015 | 653 |

Table 3 Summary of statistics

Panel A: Summary Statistics for the whole sample

| <i>Variable</i> | <i>Mean</i> | <i>Std.dev</i> | <i>25th percentile</i> | <i>Median</i> | <i>75th percentile</i> | <i>N</i> |
|-------------------|-------------|----------------|----------------------------|---------------|----------------------------|----------|
| Size | 13.793 | 1.391 | 12.906 | 13.512 | 14.288 | 16829 |
| Capital | 0.093 | 0.033 | 0.074 | 0.090 | 0.108 | 16829 |
| Loans | 0.665 | 0.135 | 0.593 | 0.684 | 0.759 | 16829 |
| Deposits | 0.785 | 0.112 | 0.751 | 0.811 | 0.855 | 16829 |
| Diversification | 0.177 | 0.126 | 0.101 | 0.150 | 0.217 | 16825 |
| Cost-income ratio | 0.527 | 0.147 | 0.426 | 0.508 | 0.613 | 16825 |
| ROA | 0.007 | 0.010 | 0.005 | 0.009 | 0.012 | 16825 |
| ROE | 0.073 | 0.162 | 0.055 | 0.094 | 0.132 | 16825 |

Panel B: Summary statistics for small banks

| <i>Variable</i> | <i>Mean</i> | <i>Std.dev</i> | <i>25th percentile</i> | <i>Median</i> | <i>75th percentile</i> | <i>N</i> |
|-------------------|-------------|----------------|----------------------------|---------------|----------------------------|----------|
| Size | 12.987 | 0.545 | 12.513 | 13.125 | 13.435 | 10448 |
| Capital | 0.090 | 0.032 | 0.072 | 0.087 | 0.105 | 10448 |
| Loans | 0.671 | 0.131 | 0.593 | 0.688 | 0.766 | 10448 |
| Deposits | 0.810 | 0.079 | 0.776 | 0.825 | 0.864 | 10448 |
| Diversification | 0.155 | 0.105 | 0.093 | 0.135 | 0.189 | 10448 |
| Cost-income ratio | 0.522 | 0.140 | 0.426 | 0.503 | 0.600 | 10448 |
| ROA | 0.007 | 0.010 | 0.005 | 0.009 | 0.012 | 10448 |
| ROE | 0.079 | 0.157 | 0.059 | 0.098 | 0.135 | 10448 |

Panel C: Summary statistics for medium banks

| <i>Variable</i> | <i>Mean</i> | <i>Std.dev</i> | <i>25th percentile</i> | <i>Median</i> | <i>75th percentile</i> | <i>N</i> |
|-------------------|-------------|----------------|----------------------------|---------------|----------------------------|----------|
| Size | 14.581 | 0.619 | 14.060 | 14.424 | 14.966 | 5245 |
| Capital | 0.097 | 0.034 | 0.077 | 0.093 | 0.110 | 5245 |
| Loans | 0.667 | 0.130 | 0.603 | 0.685 | 0.755 | 5245 |
| Deposits | 0.775 | 0.105 | 0.736 | 0.797 | 0.840 | 5245 |
| Diversification | 0.192 | 0.128 | 0.114 | 0.171 | 0.236 | 5241 |
| Cost-income ratio | 0.538 | 0.157 | 0.427 | 0.521 | 0.635 | 5241 |
| ROA | 0.007 | 0.011 | 0.005 | 0.008 | 0.012 | 5241 |
| ROE | 0.062 | 0.176 | 0.050 | 0.088 | 0.126 | 5241 |

Panel D: Summary statistics for large banks

| <i>Variable</i> | <i>Mean</i> | <i>Std.dev</i> | <i>25th percentile</i> | <i>Median</i> | <i>75th percentile</i> | <i>N</i> |
|-------------------|-------------|----------------|----------------------------|---------------|----------------------------|----------|
| Size | 17.565 | 1.052 | 16.567 | 17.412 | 18.595 | 1136 |
| Capital | 0.103 | 0.035 | 0.082 | 0.100 | 0.120 | 1136 |
| Loans | 0.594 | 0.172 | 0.498 | 0.646 | 0.713 | 1136 |
| Deposits | 0.604 | 0.197 | 0.490 | 0.659 | 0.747 | 1136 |
| Diversification | 0.308 | 0.182 | 0.187 | 0.283 | 0.395 | 1136 |
| Cost-income ratio | 0.525 | 0.156 | 0.415 | 0.512 | 0.626 | 1136 |
| ROA | 0.008 | 0.010 | 0.005 | 0.009 | 0.012 | 1136 |
| ROE | 0.073 | 0.136 | 0.050 | 0.088 | 0.130 | 1136 |

Table 4 Regression results, Large banks, ROA

| | Before the crisis | During the crisis | After the crisis |
|--------------------|------------------------|------------------------|------------------------|
| Size | -0.0004* (0.0002) | -0.0018* (0.0007) | -0.0006* (0.0003) |
| Capital | 0.03397*** (0.0065) | 0.06437*** (.0191) | 0.0542*** (0.0091) |
| Loans | 0.0068*** (0.0015) | -0.0196*** (0.0051) | 0.0025 (0.0021) |
| Deposits | 0.0096*** (0.0013) | 0.01367*** (0.0050) | 0.0072*** (0.0020) |
| Diversification | 0.0369*** (0.0019) | 0.0529*** (0.0046) | 0.0282*** (0.0024) |
| Cost income Ratio | -0.0377*** (0.0024) | -0.0622*** (0.0042) | -0.0396*** (0.0027) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 377 | 223 | 536 |
| R ² | 0.6020 | 0.6499 | 0.3915 |

Note: The dependent variable is ROA. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

Table 5 Regression results, Large banks, ROE

| | Before the crisis | During the crisis | After the crisis |
|----------------------|------------------------|------------------------|------------------------|
| Size | -0.0052* (0.0029) | -0.0197 (0.0152) | -0.0041 (0.0033) |
| Capital | -0.5889*** (0.0833) | 1.8473*** (0.3975) | -0.0144 (0.0940) |
| Loans | 0.0770*** (0.0190) | -0.3553*** (0.1054) | -0.0027 (0.0219) |
| Deposits | 0.1063*** (0.0170) | 0.2063** (0.1048) | 0.0765*** (0.0208) |
| Diversification | 0.3599*** (0.0246) | 0.7245*** (0.0950) | 0.2367*** (0.0244) |
| Cost income Ratio | -0.3458*** (0.0309) | -0.7217*** (0.0868) | -0.3518*** (0.0275) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 377 | 223 | 536 |
| R ² | 0.4041 | 0.4313 | 0.2919 |

Note: The dependent variable is ROE. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

Table 6 Regression results, Medium-sized banks, ROA

| | Before the crisis | During the crisis | After the crisis |
|----------------------|------------------------|------------------------|------------------------|
| Size | -0.0004* (0.0002) | -0.0027*** (0.0004) | -0.0008*** (0.0002) |
| Capital | 0.0470*** (0.0039) | 0.1369*** (0.0086) | 0.0708*** (0.0045) |
| Loans | 0.0031*** (0.0009) | -0.0064** (0.0025) | -0.0035*** (0.0011) |
| Deposits | 0.0106*** (0.0011) | 0.0135*** (0.0029) | 0.0111*** (0.0017) |
| Diversification | 0.0310*** (0.0013) | 0.0561*** (0.0027) | 0.0283*** (0.0011) |
| Cost income Ratio | -0.3456*** (0.0013) | -0.0620*** (0.0019) | -0.0421*** (0.0010) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 1346 | 1168 | 2727 |
| R ² | 0.4271 | 0.6622 | 0.5219 |

Note: The dependent variable is ROA. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

Table 7 Regression results, Medium-sized banks, ROE

| | Before the crisis | During the crisis | After the crisis |
|----------------------|------------------------|------------------------|------------------------|
| Size | -0.0043 (0.0025) | -0.0468*** (0.0094) | -0.0108*** (0.0040) |
| Capital | -0.5381*** (0.0518) | 2.1750*** (0.1818) | 0.5422*** (0.0811) |
| Loans | 0.0430*** (0.0125) | -0.1172** (0.0530) | -0.02952 (0.0200) |
| Deposits | 0.1149*** (0.0149) | 0.2182*** (0.0607) | 0.1845*** (0.0305) |
| Diversification | 0.3423*** (0.0177) | 0.7435*** (0.0567) | 0.3316*** (0.0193) |
| Cost income Ratio | -0.4220*** (0.0178) | -0.9857*** (0.0396) | -0.5067*** (0.0189) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 1346 | 1168 | 2727 |
| R ² | 0.3669 | 0.5072 | 0.2998 |

Note: The dependent variable is ROE. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

Table 8 Regression results, Small banks, ROA

| | Before the crisis | During the crisis | After the crisis |
|----------------------|------------------------|------------------------|------------------------|
| Size | -0.0006*** (0.0001) | 0.0014* (0.0007) | 0.0006 (0.0005) |
| Capital | 0.0537*** (0.0021) | 0.1694*** (0.0082) | 0.0853*** (0.0046) |
| Loans | 0.0031*** (0.0005) | -0.0031 (0.0022) | -0.0027** (0.0012) |
| Deposits | 0.0122*** (0.0008) | 0.0194*** (0.0029) | 0.0205*** (0.0021) |
| Diversification | 0.0289*** (0.0008) | 0.0469*** (0.0025) | 0.0243*** (0.0012) |
| Cost income Ratio | -0.0340*** (0.0007) | -0.0597*** (0.0020) | -0.0467*** (0.0011) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 6,060 | 1,563 | 2,825 |
| R ² | 0.3812 | 0.6141 | 0.5538 |

Note: The dependent variable is ROA. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

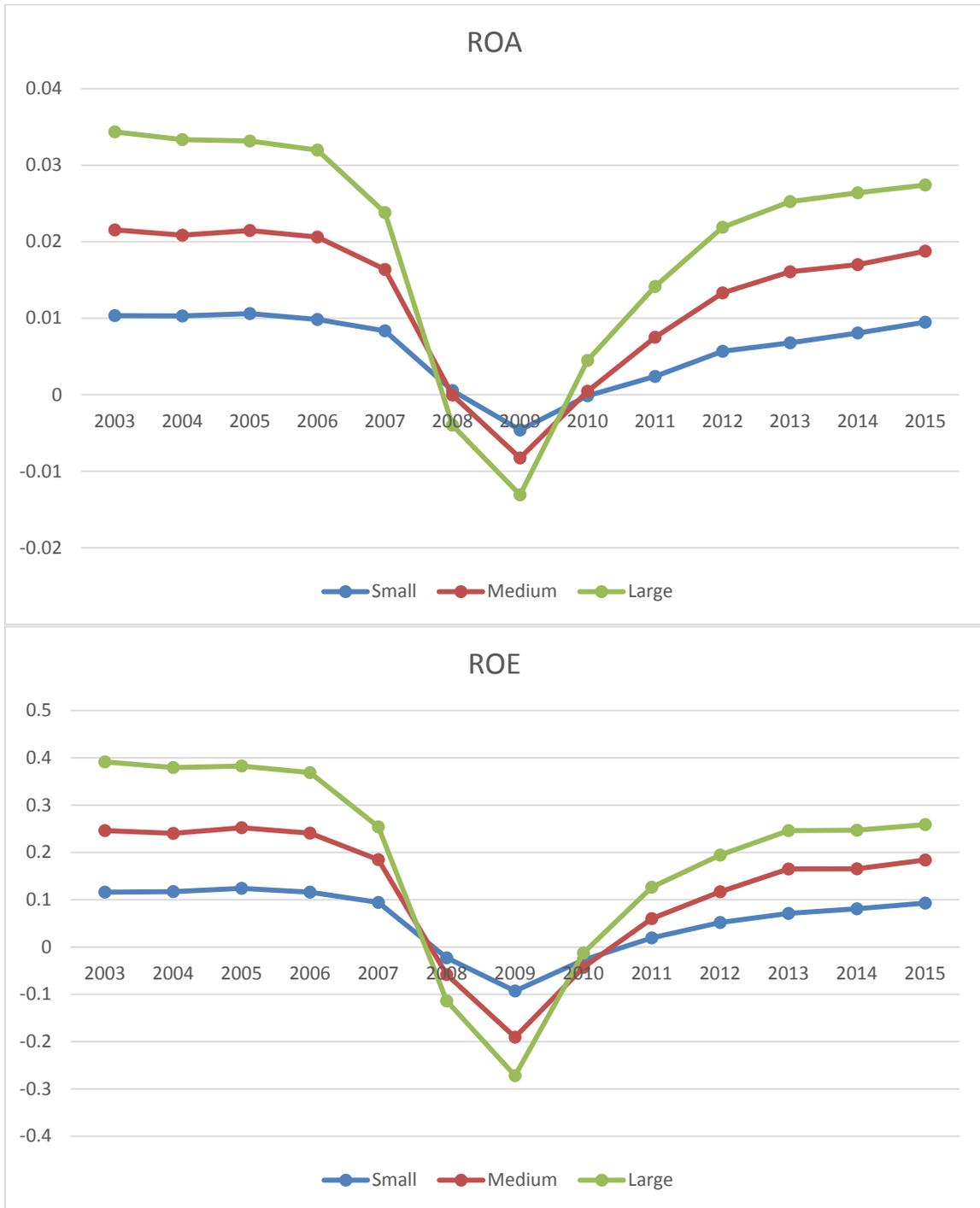
Table 9 Regression results, Small banks, ROE

| | Before the crisis | During the crisis | After the crisis |
|----------------------|------------------------|------------------------|------------------------|
| Size | -0.0053** (0.0017) | 0.0391** (0.0161) | 0.0066 (0.0105) |
| Capital | -0.4800*** (0.0284) | 2.2839*** (0.1827) | 0.8611*** (0.1048) |
| Loans | 0.0416*** (0.0062) | 0.0030 (0.0481) | -0.0881*** (0.0267) |
| Deposits | 0.1423*** (0.0106) | 0.2760*** (0.0652) | 0.2482*** (0.0466) |
| Diversification | 0.3298*** (0.0111) | 0.7100*** (0.0565) | 0.1994*** (0.0260) |
| Cost income Ratio | -0.3828*** (0.0093) | -0.8801*** (0.0436) | -0.4470*** (0.0254) |
| Year fixed effects | Yes | Yes | Yes |
| Observations | 6,060 | 1,563 | 2,825 |
| R ² | 0.2648 | 0.4021 | 0.2003 |

Note: The dependent variable is ROE. The sample period is from 2003 to 2015. It is divided into three periods: before the crisis (2003 to 2006), during the crisis (2006 to 2009), and after the crisis (2010 to 2015).

6.2 Appendix B: Figures

Figure 1 Profitability of US Banks from 2003 to 2015



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