

**DETERMINANTS OF BANK PROFITABILITY: EVIDENCE FROM THE  
US, 2010–2016**

by

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## **Abstract**

This paper examines how bank-specific variables and macroeconomic variables affect the profitability of US commercial banks over the period 2010–2016. Taking return on assets (ROA) and return on equity (ROE) as measures of profitability, we estimate regressions using Ordinary Least Squares (OLS). We find that capital ratio, loans, deposits, noninterest income, and unemployment rate affect bank profitability. When we divide banks into several size groups, we find that size affects the profitability of small banks.

### **Keywords:**

bank; profitability; bank-specific variables; macroeconomic variables; size

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# 1. Introduction

Commercial banks play an increasingly important role in economic development. According to the Federal Deposit Insurance Corporation, US commercial banks had total assets of \$16 trillion at year end 2017. After the financial crisis of 2007–2009, more stringent regulations on bank capital, liquidity, and corporate structure have been passed to increase the resilience of the banking system, which prompt banks to adopt new strategies to generate profits. Along with the recovery of the economy, the real GDP in the US has grown steadily by around 2% each year (see Figure 1), while the unemployment rate has decreased steadily (see Figure 2). Meanwhile, bank profits have increased gradually, measured by ROA and ROE (see Figures 3 and 4). The focus of our research is on the determinants of bank profitability.

The existing literature provides comprehensive examinations of bank-specific and macroeconomic determinants on bank profitability before the financial crisis. In this paper, we want to see whether these determinants have changed after the crisis. For this purpose, we use 6,733 observations on bank holding companies in the US from 2010 to 2016. First, we analyze how the bank-specific and macroeconomic variables affect bank profitability which is measured by ROA and ROE. Then, we extend our analysis by dividing banks into three size groups (small, medium-sized and large) and analyze how the determinants vary across banks of different sizes.

We collect bank-specific data from the Wharton Research Data Services (WRDS), using the Federal Reserve's Consolidated Financial Statements for Bank Holding Companies (FR Y-9C). Besides, we collect macroeconomic data from the Bureau of

Economic Analysis. Also, we winsorize bank-specific variables to reduce the effect of possibly spurious outliers. We find that bank profitability is affected by capital ratio, loans, deposits, noninterest income, and unemployment rate. Surprisingly, our results also indicate a negative relationship between GDP growth rate and bank profitability. Finally, we find that size affects the profitability of small banks, but not that of medium-sized or large banks.

The remainder of this paper is organized as follows. Section 2 provides descriptions of our variables as well as a review of the related literature. Section 3 introduces the data and methodology applied in our regression analysis. The main results and further analysis are shown in Section 4 and 5. The last section draws our conclusion.

## **2. Related literature and variable determination**

We select our variables according to previous literature and economic theory. Table 1 lists the definition of all the variables that we use in this study.

### **2.1 Dependent variables**

Following previous studies, we use both return on assets (ROA) and return on equity (ROE) as measures of bank profitability.

#### **2.1.1 ROA**

The first measure, ROA, is defined as the ratio of net income over total assets. As the profit earned per dollar of assets, ROA reflects banks' ability to utilize assets to generate profits (Athanasoglou, 2008; Sufian & Habibullah, 2010). ROA is the most commonly used measure for bank profitability in the literature.

#### **2.1.2 ROE**

Our second measure of profitability, ROE, is defined as the ratio of net income to total equity capital. This variable reflects the amount of net income that a bank generates using the money invested by its shareholders. Because ROE disregards the higher risk associated with a higher leverage (Dietrich & Wanzenried, 2011), we use ROA as our key ratio to evaluate bank profitability and use ROE as a supplementary measure.

## 2.2 Independent variables

### 2.2.1 Bank-specific variables

The bank-specific variables used in our analysis are bank size, capital ratio, loans, deposits, and noninterest income. Previous studies find that these variables affect bank profitability.

#### Size

Bank size is measured as the natural logarithm of total assets (Naceur & Omran, 2011; Demirgüç-Kunt et al., 2004). Previous results found mixed results regarding the impact of size on bank profitability. Some studies found that size does not significantly affect bank profitability (e.g., Brissimis et al., 2008). However, other studies found that profitability is affected by size (e.g., Demirgüç-Kunt & Huizinga, 2000). Some studies found a negative relationship between size and bank profitability (Pasiouras & Kosmidou, 2007; Spathis et al., 2002), whereas Smirlock (1985) and Pilloff & Rhoades (2002) found a positive relationship between bank size and profitability. Sufian (2009) argued that larger banks could be more profitable than smaller banks because of the economies of scale. Consequently, our expectation is that bank size would positively affect profitability.

#### Capital

We define capital ratio as total equity over total assets. Brissimis et al. (2008) and Pasiouras et al. (2008) found that capital plays an important role

in explaining bank profitability and that a stricter capital requirement would decrease profit efficiency. Following similar arguments, Flamini et al. (2009) and Ahokpossi (2013) reported that capital ratio could make a positive contribution to bank profitability in their studies of Africa banks. A recent study found that well-capitalized banks are more likely to stay profitable before, during, and after the financial crisis. (Adelopo et al., 2018).

In general, banks with higher capital ratios are considered to be safer, and their enhanced creditworthiness can benefit them by reducing the funding costs. Given this point, we expect a positive relationship between capital ratio and bank profitability.

### **Loans**

We explain the impact of loans on bank profitability using the ratio of loans and leases over total assets. Demirgüç-Kunt & Huizinga (1999) found that the relationship between loans and bank profitability depends on economic cycle: they are negatively correlated under bad economic conditions, but positively correlated under good economic conditions.

As a result, if the market condition is good enough to enable a bank to provide additional profitable loans, bank profitability would increase. However, if a bank stays in a bad economic situation and is less prepared for its liquidity needs, a high loan ratio would decrease its profitability. Because there are effects in opposite directions, the relationship between loans and profitability cannot be determined theoretically.

### **Deposits**

We measure deposits as the ratio of total deposits over total assets. Previous studies find mixed results. For example, Berger & Bonaccorsi di Patti (2006) and Goddard & Wilson (2004) found a negative relationship between bank performance and deposits. In contrast, Trujillo-Ponce (2013) argued that deposits constitute stable funding resources with lower costs and contribute positively to bank profitability. Moreover, more deposits may enable a bank to expand its business and improve its profitability. Thus, we expect a positive relationship between deposits and bank profitability.

### **Noninterest income**

We use the ratio of noninterest income to total operating income to proxy this variable. Total operating income is the sum of interest income and noninterest income (Stiroh, 2004; Lepetit et al. 2008). Noninterest income is an important source of bank profits. Because margins derived from noninterest operations are usually higher than those derived from lending operations, we predict that banks with a higher share of noninterest income to be more profitable and thus expect a positive relationship between this variable and bank profitability.

### **2.2.2 Macroeconomic variables**

The macroeconomic variables used in our analysis are GDP growth rate, unemployment rate, and inflation rate, which we obtained from the Bureau of Economic Analysis. Influence of these indicators on bank profitability is at the macro level.

### **GDP growth rate**

We use the annual growth rate of real GDP to examine the impact of economic growth on bank profitability. On the one hand, there are reasons why a positive relationship should exist between GDP growth rate and bank profitability (Bikker & Hu, 2002; Pasiouras & Kosmidou, 2007; Albertazzi & Gambacorta, 2009). The improvement of national productivity would contribute to an increase in disposable income and create a favorable investing environment, and raise bank profitability due to rising loans and credit level (Athanasoglou et al., 2014). On the other hand, arguments also exist supporting a negative relationship between the two variables. For example, Naceur & Omran (2011) stated that faster GDP growth rate could lead to higher competitions, and decrease bank profitability.

Generally, despite competitions, banks should benefit from faster economic growth because a good economic environment favors investing and lending activities. Therefore, we expect that the GDP growth rate to positively affect bank profitability.

### **Unemployment rate**

The unemployment rate is defined as the number of unemployed individuals divided by all individuals currently in the labor force. Bordeleau & Graham (2010) suggested that a high level of unemployment can result in more default on loans, reducing bank profitability. Accordingly, we expect a negative relationship between unemployment rate and bank profitability.

### **Inflation rate**

The inflation rate is calculated as the percentage increase in the price of a basket goods and services over the year. As shown in Figure 5, the inflation rate shows no trend during recent years. Previous results reported mixed results. Some studies found a positive influence of inflation rate on bank profitability (Dietrich & Wanzenried 2014; Ahokpossi, 2013; Flamini et al., 2009). However, Goddard et al. (2011) found an insignificant relationship between inflation rate and bank profitability.

Some researchers argued that the impact of inflation on banks profitability depends largely on the extent to which the inflation can be accurately predicted and transmitted to customers (e.g., Flamini et al., 2009; Athanasoglou et al., 2008). If inflation is not anticipated and banks fail to adjust interest rates correctly, costs may grow faster than revenues, which would adversely affect bank profitability (Dietrich & Wanzenried, 2014).

As a result, we suggest that the effect of inflation rate on bank profitability is theoretically undetermined.

### 3. Data and methodology

#### 3.1 Data

Our data covers all the US bank holding companies that reported to the Federal Reserve between 2010 and 2016. We collect bank-specific data from the Wharton Research Data Services (WRDS), and obtained the macroeconomic data from the Bureau of Economic Analysis. Specifically, we use the Federal Reserve's Consolidated Financial Statements for Bank Holding Companies (FR Y-9C). To obtain robust regression results, we winsorize bank-specific variables to reduce the effect of possibly spurious outliers.

To examine whether the determinants of bank profitability differ across size groups, we divide banks in our sample into small banks (below \$1 billion in assets), medium-sized banks (between \$1 billion and \$10 billion in assets) and large banks (over \$10 billion in assets).

Table 2 shows the number of banks in the period of 2010–2016. The number of banks in our sample significantly declined in the last two years. The drop was highly concentrated among small banks, and was driven largely by the change in the reporting requirements of the Federal Reserve. Specifically, the asset-size threshold for filing the FR Y-9C form increased from \$1 billion to \$3 billion in March 2015. This regulation change significantly reduced the number of banks in our sample.

Table 3 reports the summary statistics of the variables used in our regression analysis. On average, banks in our sample have an ROA of 0.6% and an ROE of

5.8% over the period from 2010 to 2016. In addition, the standard deviation for size is pretty high as 1.402, indicating a large variation of bank size, which inspires our further analysis of size.

### 3.2 Methodology

We use the Ordinary Least Squares (OLS) as an estimation method to test the effects of bank-specific and macroeconomic variables on bank profitability. We separately use  $ROA_{i,t}$ , and  $ROE_{i,t}$  as the dependent variable. The equations are given by (1) and (2):

$$\begin{aligned}
 ROA_{i,t} = & \beta_0 + \beta_1 \cdot Size_{i,t} + \beta_2 \cdot Capital_{i,t} + \beta_3 \cdot Loans_{i,t} + \beta_4 \cdot Deposits_{i,t} + \\
 & \beta_5 \cdot Noninterest\ income_{i,t} + \beta_6 \cdot GDPgrowth_t + \beta_7 \cdot Unemployment\ rate_t + \beta_8 \cdot \\
 & Inflation_t + \varepsilon_{i,t}
 \end{aligned}
 \tag{1}$$

$$\begin{aligned}
 ROE_{i,t} = & \beta_0 + \beta_1 \cdot Size_{i,t} + \beta_2 \cdot Capital_{i,t} + \beta_3 \cdot Loans_{i,t} + \beta_4 \cdot Deposits_{i,t} + \\
 & \beta_5 \cdot Noninterest\ income_{i,t} + \beta_6 \cdot GDPgrowth_t + \beta_7 \cdot Unemployment\ rate_t + \beta_8 \cdot \\
 & Inflation_t + \varepsilon_{i,t}
 \end{aligned}
 \tag{2}$$

In both equations,  $i$  represents one of the bank holding companies in the sample,  $t$  represents one of the years over the sample period, and  $\varepsilon$  is the error term.

## 4. Main results

Table 4 presents the empirical results of our regression using the whole sample.

Capital ratio positively and significantly affects bank profitability measured by both return on assets (ROA) and return on equity (ROE), which is consistent with our prediction and the studies of Flamini et al. (2009), Ahokposi (2013), and Adelopo et al. (2018). High capital ratios can help banks reduce their borrowing costs, and improve their profitability. Furthermore, as argued by Goddard et al. (2004), banks with sound capital conditions can pursue business opportunities more effectively and profit from new business opportunities more flexibly, and achieve higher profitability.

Loans have a positive and significant influence on ROA for banks in our sample. Demirgüç-Kunt & Huizinga (1999) suggested a positive relationship between loans and bank profitability when the economic condition is good, but a negative relationship when the economic condition is bad. Our results suggest that loans affect ROA in a positive way, possibly due to the improvement of the US economy after the latest financial crisis. When the economic condition is good, higher loan ratios often indicate that banks can issue loans with lower credit risk. Thus, high profits come along with a high proportion of loans in total assets.

Deposits are significantly and positively correlated with bank profitability in terms of both ROA and ROE, consistent with Berger & Bonaccorsi di Patti (2006). Having more deposits enables a bank to expand its business, as

deposits are cheap and stable funding sources. Moreover, banks can sell other products to their depositors, further improve their profitability.

Noninterest income is positively associated with profitability according to both ROA and ROE, consistent with our expectations and previous studies (Stiroh, 2004; Lepetit et al., 2008). Noninterest income increasingly occupies a large proportion of banks' total operating income. Because the margins on noninterest income are usually higher than those on lending activities, higher noninterest income indicates greater ability of banks to generate profits.

Unemployment rate exhibits a significantly negative impact on bank profitability measured by both ROA and ROE. This outcome is consistent with the findings of Bordeleau & Graham (2010). If the unemployment rate rises, more people will fail in repaying their bank loans, thereby increasing banks' credit risk. To mitigate this risk, banks adopt risk-averse strategies, including creating a loan loss provision or enhancing lenders' monitoring. However, because the loan loss provisions are created from retained earnings, and the improved monitoring requires higher costs, these strategies lead to lower profitability.

GDP growth rate has an unexpected result. In contrast with our prediction and most previous studies (Bordeleau & Graham 2010; Alexiou & Sofoklis, 2009), our finding indicates that this variable negatively affects bank profitability. A possible reason is increased competition, as suggested by Demirgüç-Kunt & Levine (2004) and Liu & Wilson (2010). Despite the positive effect on banking business, faster GDP growth rate also creates a more competitive environment which brings extra pressure on bank interest margins. Because of the increased

competition, faster GDP growth may not necessarily lead to higher bank profitability.

## 5. Further Analysis

To examine whether the results change for banks of different size, we extend our analysis by separating banks into three groups (small, medium and large) by assets. We then run regressions separately for each group. Table 5 reports the regression results when the dependent variable is ROA.

Size has a positive and significant effect on the profitability of small banks only. By increasing size, small banks can increase operational efficiency and have more diversification in their products and services which would reduce risk. On the other hand, this effect is not significant for medium-sized and large banks. Ani, Ezeudu, and Ugwuanyi (2012) argued that an increase in size may not necessarily lead to an increase in bank profitability due to diseconomies of scale and bureaucratic reasons.

The effect of the capital ratio is significantly positive for all groups, which is consistent with our expectation: the higher the capital ratio, the higher the profitability. This result is consistent with that of Ahokpossi (2013), as banks with higher capital ratio have higher flexibility to take advantage of new business opportunities.

The coefficient on loans is positive and significant for small and large banks. There is no statistically significant effect of loans on the profitability of medium-sized banks.

Deposits exhibit a significantly positive impact on small banks whose lending capacity is more limited by the magnitude of their customers' deposits. In

contrast, medium-sized and large banks have more diversified funding sources which enable them to attract funds from other alternatives, and thus mitigating the impact of deposits on their profitability.

Noninterest income has a positive and significant effect on the profitability of banks in all groups. Therefore, regardless of size, the higher the percentage of noninterest income in total operating income, the more profitable the bank.

Considering macroeconomic factors, we find that the coefficients on the unemployment rate are significantly negative in all groups, suggesting that bank profits usually increase as the unemployment rate drops. Moreover, the absolute value of the coefficient is much larger for small banks than for large banks, suggesting that the effect is more pronounced for small banks who are less able to deal with the increasing credit risk associated with the higher employment rate.

Table 6 reports the regression results when the dependent variable is ROE. The results are mostly similar to those reported in Table 5, and we just highlight one important difference between the two sets of regression results.

In table 6, the GDP growth rate has a significantly negative effect on the profitability of small banks. As suggested by Demirgüç-Kunt & Levine (2004) and Liu & Wilson (2010), faster GDP growth may cause more severe competition. Large and medium-sized banks are better able to deal with the increased competition, and thus their profitability is not affected by GDP growth. In contrast, small banks are less able to deal with the increased competition, and thus their profitability is affected by faster GDP growth.

## 6. Conclusion

In this paper, we examine the determinants of bank profitability using data on US banks from 2010 to 2016. Our study is relevant for several reasons.

Firstly, while many papers have examined the determinants of bank profitability before the recent financial crisis, our research focuses on the period after the crisis. Secondly, we consider both bank-specific and macroeconomic variables. Thirdly, we winsorize bank-specific variables to ensure the robustness of the regression results. Finally, by separating banks into three size groups, we gain additional insights into the relationship between bank size and profitability.

Our results indicate that the profitability of US banks is affected by both bank-specific and macroeconomic variables. Specifically, capital ratio, deposits, and noninterest income positively and significantly influence on both ROA and ROE, while loans have positive influence only on ROA. Meanwhile, there is a significantly negative relationship between unemployment rate and bank profitability.

Our results also indicate that size positively affects the profitability of small banks, but not that of medium or large banks. In addition, GDP growth negatively affects the profitability of small banks, but not that of medium or large banks.

Overall, our paper provides some interesting insights into the determinants of bank profitability.

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## Appendix

Table 1. Variable definitions

<i>Variable</i>	<i>Definition</i>
ROA	The ratio of net income to total assets.
ROE	The ratio of net income to total equity capital.
Size	The natural logarithm of total assets.
Capital ratio	The ratio of total equity capital to total assets.
Loans	The ratio of loans and leases to total assets.
Deposits	The ratio of deposits in domestic offices to total assets.
Noninterest income	The ratio of noninterest income to total operating income.
GDP growth rate	Annual GDP growth rate.
Unemployment rate	Annual unemployment rate.
Inflation	Annual inflation rate.

**Table 2.** Number of banks by year

<b>Year</b>	<b><i>Small banks</i></b>	<b><i>Medium-sized banks</i></b>	<b><i>Large banks</i></b>	<b><i>Total</i></b>
2010	541	391	77	1009
2011	539	404	75	1018
2012	567	479	93	1139
2013	569	479	94	1142
2014	541	491	96	1128
2015	68	483	101	652
2016	43	491	111	645

*Notes: This table compares the numbers of small, medium-sized and large banks in our sample by year. Small banks are banks with total assets up to \$1 billion. Medium-sized banks are banks with total assets exceeding \$1 billion and up to \$10 billion. Large banks are banks with total assets exceeding \$10 billion.*

**Table 3.** Summary statistics

	<i>Mean</i>	<i>Std. dev.</i>	<i>25th percentile</i>	<i>Median</i>	<i>75th percentile</i>	<i>N</i>
ROA	0.006	0.01	0.004	0.008	0.011	6733
ROE	0.058	0.152	0.044	0.077	0.107	6733
Size	21.281	1.402	20.36	20.874	21.705	6733
Capital ratio	0.101	0.037	0.082	0.098	0.116	6733
Loans	0.647	0.138	0.577	0.666	0.741	6733
Deposits	0.792	0.112	0.765	0.816	0.857	6733
Noninterest income	0.212	0.156	0.118	0.184	0.259	6733

*Notes: This table reports summary statistics for the variables. All variables are defined in Table 1.*

**Table 4.** Regression results using the whole sample

	<i>ROA</i>	<i>ROE</i>
Size	0.000	0.001
	(0.000)	(0.002)
Capital ratio	0.100***	0.633***
	(0.003)	(0.054)
Loans	0.004***	0.009
	(0.001)	(0.014)
Deposits	0.008***	0.102***
	(0.001)	(0.021)
Noninterest income	0.015***	0.136***
	(0.001)	(0.013)
GDP growth rate	-0.046	-0.980*
	(0.034)	(0.574)
Unemployment rate	-0.123***	-1.746***
	(0.010)	(0.173)
Inflation	0.041	0.581
	(0.025)	(0.420)
Constant	-0.008***	0.009
	(0.003)	(0.049)
Observations	6733	6733
R-Squared	0.238	0.079

*Notes: In column (1), the dependent variable is ROA. In column (2), the dependent variable is ROE. All variables are defined in Table 1. Standard errors are reported in parenthesis. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.*

**Table 5.** Regression results by size, ROA

	Small banks ROA	Medium-sized banks ROA	Large banks ROA
Size	0.004***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Capital ratio	0.131***	0.081***	0.051***
	(0.005)	(0.005)	(0.010)
Loans	0.004***	0.002	0.008***
	(0.001)	(0.001)	(0.002)
deposits	0.023***	0.002	-0.002
	(0.003)	(0.002)	(0.002)
Noninterest income	0.015***	0.016***	0.011***
	(0.001)	(0.001)	(0.002)
GDP growth rate	-0.084	-0.050	0.027
	(0.058)	(0.047)	(0.092)
Unemployment rate	-0.134***	-0.122***	-0.085***
	(0.016)	(0.015)	(0.030)
Inflation	-0.002	0.047	0.101
	(0.039)	(0.037)	(0.073)
Constant	-0.095***	0.005	0.009
	(0.010)	(0.006)	(0.008)
Observations	2868	3218	647
R-squared	0.281	0.224	0.139

*Notes: This table compares the regression results of small, medium-sized and large banks using ROA as the dependent variable. All variables are defined in Table 1. Standard errors are reported in parenthesis. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.*

**Table 6.** Regression results by size, ROE

	Small banks ROE	Medium-sized banks ROE	Large banks ROE
Size	0.030***	-0.002	-0.002
	(0.009)	(0.004)	(0.003)
Capital ratio	0.999***	0.418***	-0.069
	(0.100)	(0.074)	(0.094)
Loans	-0.032	0.034*	0.050**
	(0.027)	(0.019)	(0.021)
deposits	0.229***	0.055*	-0.002
	(0.048)	(0.030)	(0.020)
Noninterest income	0.107***	0.185***	0.080***
	(0.025)	(0.017)	(0.019)
GDP growth rate	-1.965*	-0.973	0.294
	(1.095)	(0.729)	(0.909)
Unemployment rate	-2.096***	-1.563***	-0.969***
	(0.305)	(0.233)	(0.292)
Inflation	0.140	0.387	1.300*
	(0.733)	(0.565)	(0.717)
Constant	-0.629***	0.084	0.124
	(0.195)	(0.093)	(0.078)
Observations	2868	3218	647
R-squared	0.085	0.091	0.053

*Notes: This table compares the regression results of small, medium-sized and large banks using ROE as the dependent variable. All variables are defined in Table 1. Standard errors are reported in parenthesis. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.*

Figure 1

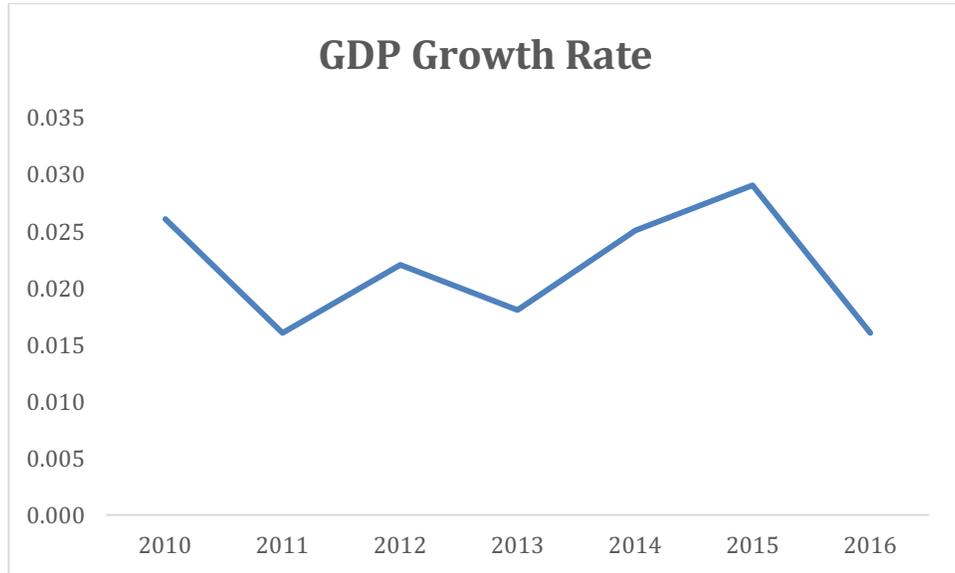


Figure 2

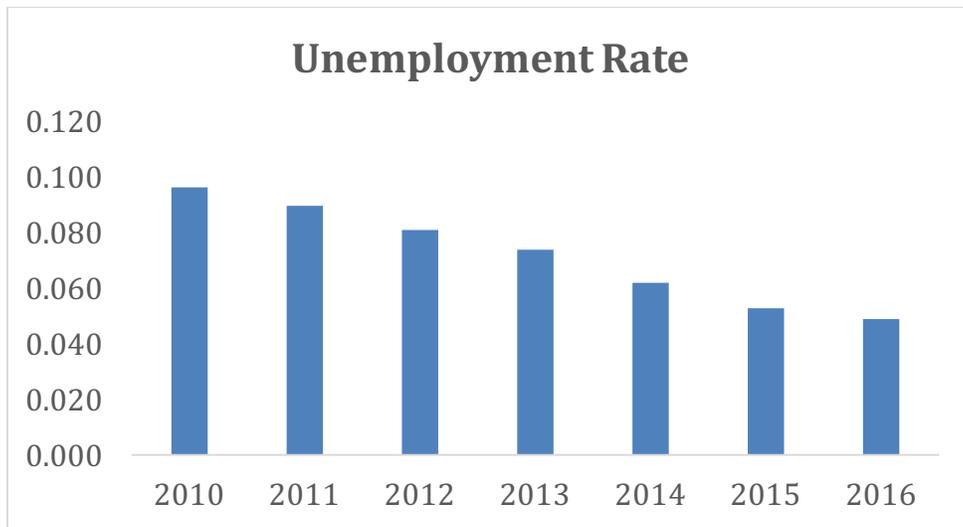
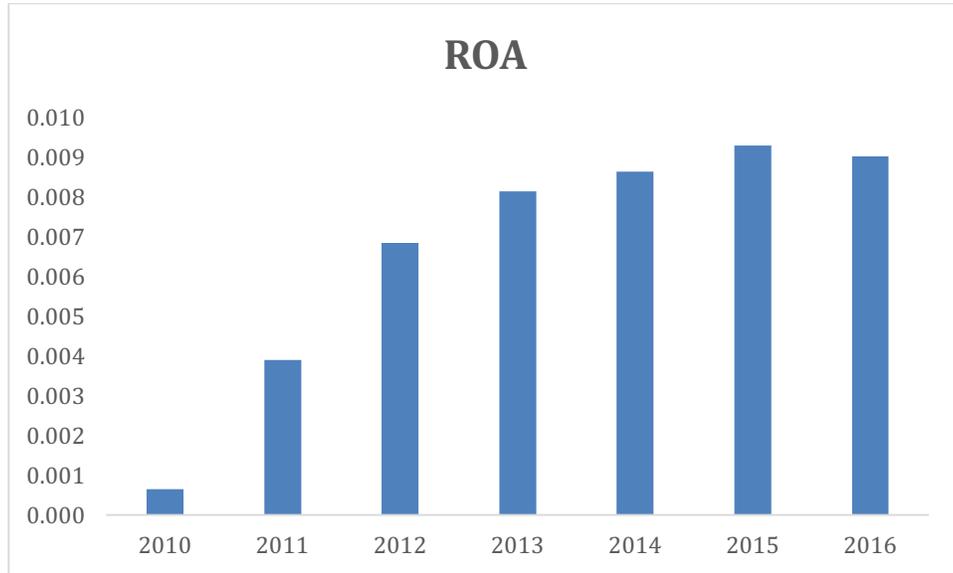
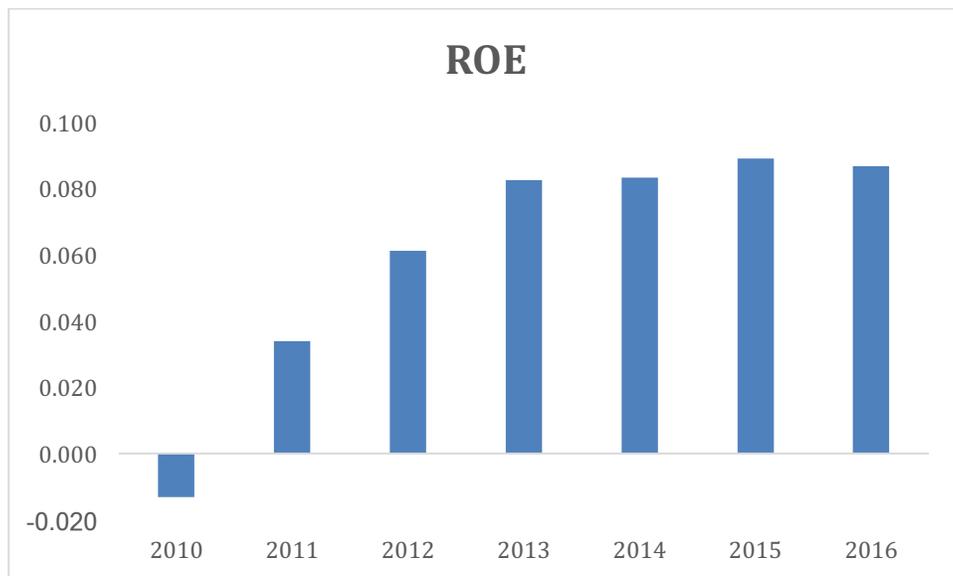


Figure 3



*Notes: This figure shows the average ROA by year of banks in our sample.*

Figure 4



*Notes: This figure shows the average ROE by year of banks in our sample.*

Figure 5

