

THE DETERMINANTS OF BANK PROFITABILITY: THE CASE OF U.S.

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Abstract

This paper analyses the determinants of bank profitability, using a sample of U.S. bank holding companies from 2002 to 2018. We discuss the impact of overall economy on the banking system as well as major political events and legislative reform during the period. To investigate the determinants statistically, we perform a regression analysis to examine the influence of macroeconomic and bank specific factors on profitability. Furthermore, we separately examine the relationship for small, medium-sized, and large banks. We find that a higher percentage of capital, loans or deposits in total assets, more noninterest income and faster GDP growth lead to higher bank profitability. In contrast, bank size, unemployment rate and inflation are negatively associated with bank profitability.

Keywords: Bank profitability; GDP growth; inflation; size; capital; loans; deposits; noninterest income

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1: Introduction

Banks play an important role in the stability of the financial system and economic growth. Therefore, it is crucial to understand the factors that determine bank profitability. Many papers have been written on this topic. For example, Trujillo-Ponce (2013) examines the determinants of bank profitability using Spanish bank from 1999 to 2009. His results show that higher bank profitability is associated with more loans, customer deposits and better assets. Athanasoglou, Brissimis and Delis (2008) examine the determinants of profitability of Greek banks.

In this paper, we conduct our research using U.S. banks. We are interested in U.S. banks because U.S. has a large number of banks, which allow us to examine a large sample of banks of different sizes. Our sample period is from 2002 to 2018.

We measure bank profitability using return on assets (ROA) and return on equity (ROE). The independent variables include size, capital, loans, deposits, noninterest income, GDP growth rate, unemployment rate and inflation. The results of our analysis show that bank profitability is positively related to a higher percentage of capital, loans or deposits in total assets, more noninterest income and GDP growth, and negatively related to bank size, unemployment and inflation. These results hold for banks of different sizes with several exceptions. For example, we find that profitability is not influenced by size for small banks. For medium and large banks, however, profitability is negatively influenced by size.

Our paper is structured as follows. Section 2 focuses on macroeconomic analysis. Section 3 describes the sample and data. Section 4 presents empirical model. Section 5 shows the regression results. Section 6 is the conclusion.

2: Macroeconomic analysis

2.1 GDP growth rate

Economic conditions affect the stability of the financial system. Therefore, it is important to keep track of economic growth in order to analyze the performance of banks which are in the center of financial system.

Figure 1 illustrates the GDP growth rate from 2002 to 2018 in the U.S. GDP growth rate was at its highest of 3.8% in 2004 and its lowest of -2.5% in 2009 following the 2008 financial crisis. It remains steady ranging from 1.6% to 2.9% since 2010. GDP growth reflects the past and current state of economy and affects monetary policy decisions and legislations.

Since the 2008 financial crisis and until 2015, the Federal Reserve lowered its federal funds target rate (the interest rate charged when banks borrow or lend reserves to each other) to nearly zero. Such an expansionary monetary policy aimed to lower the borrowing costs for companies and encourage investment to stimulate the economy. However, the cut in the federal funds rate means that banks make less profit when making loans to households and businesses.

In July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act (the “Dodd Frank Act”) was passed by the United States Congress. The legislation aimed

to limit risk taking and increase transparency for financial institutions in response to the 2008 financial crisis.

The provisions include the Volcker Rule. It sets limit in banks' investments in private equity funds and hedge funds and requires credit ratings agencies conduct their evaluation process more thoroughly and provide reliable credit ratings. More legislation limits the opportunities for banks to take on high-risk, high-return activities, and thus reduces their profitability.

2.2 Unemployment

Naruševičius (2018) states that unemployment rate affects bank's operating expense since operating expense consists mainly of salary payments. When unemployment rate is high, banks can cut or defer salary payments. When unemployment is low, employees seek salary increase or commissions.

On the other hand, the demand for bank loans may be low when unemployment rate is high. Moreover, many borrowers may default on their loans. Therefore, unemployment rate also affects bank profitability.

Figure 2 shows the U.S. unemployment rate from 2002 to 2018. It rose to the highest of around 10 percent in 2010, but has gradually decreased to below 4 percent since then.

2.3 Inflation

Santoni (1986) examines the effects of inflation on commercial bank. The basic source of profit for banks is the interest rate difference from taking deposits from households and making loans to companies and individuals. Banks undergo this process using nominal financial instruments which are affected by nominal interest rate. Santoni finds that an anticipated inflation will not affect banks' profitability. However, an unanticipated inflation, where the increase in inflation is higher than anticipated, will decrease bank capital value.

Figure 3 shows the U.S. inflation measured as the change in the Consumer Price Index (CPI) from 2002 to 2018. Inflation was at its highest of 4 percent in 2008 but dropped below zero in 2009. It went down to zero again in 2015 but has steadily moved up since then.

One important factor influencing inflation is oil price, which went up substantially in early 2008 but fell dramatically afterwards. Oil price had another big drop in 2015. The ongoing U.S.-China trade tensions have also caused many repercussions in the global economy.

3: Sample and Data

We use annual observations on U.S. bank holding companies from 2002 to 2018. The first group of data are obtained from the WRDS database. We select bank specific variables from the Federal Reserve's Y-9C report. The definitions for these variables are listed in table 1. The second group of variables are microeconomic factors including GDP growth rate, unemployment rate and inflation.

Table 2 shows the number of banks in each year. The change in the number of banks in our sample is partly due to the change in the asset-size requirement for filing the FR Y-9C for bank holding companies. Specifically, in March 2006, the asset-size threshold was increased from \$150 million to \$500 million. The threshold was further increased from \$500 million to \$1 billion in March 2015, and from \$1 billion to \$3 billion in September 2018.

4: Empirical model

To analyze the determinants of profitability of U.S. banks, we estimate the following equation:

$$\begin{aligned} \textit{Profitability}_{i,t} = & \alpha + \beta \cdot \textit{Bank specific variables}_{i,t} \\ & + \gamma \cdot \textit{Macroeconomic variables}_t + \varepsilon_{i,t} \end{aligned}$$

where i and t represent bank and year, respectively. $\textit{Profitability}_{i,t}$ represents either $\textit{ROA}_{i,t}$ or $\textit{ROE}_{i,t}$ in separate regressions. $\varepsilon_{i,t}$ represents the error term in the regression analysis.

5: Empirical Results

Table 3 presents summary statistics for the main variables. The result is based on 20,510 observations. ROA has a mean of 0.008, and ROE has a mean of 0.080. The standard deviations of 0.010 and 0.142, respectively, indicate significant variation. The size of a bank has a mean of 20.757 and a standard deviation of 1.467. Capital ratio has a mean of 9.4% and a standard deviation of 3.2%. Loan ratio has a mean of 66.4%, which suggests loans are a critical factor in banks' operations. However, the standard deviation of 13.6% indicates a significant variation in the importance of loans across banks. Deposit ratio has a mean of 78.5% and a standard deviation of 11.3%, indicating the importance of deposits. The noninterest income ratio has a mean of 17.9% and a standard deviation of 12.8%, indicating significant variation across banks in the importance of noninterest income.

5.1 Regression analysis for the whole sample

Table 4 presents the regression results using all the banks in our sample, regardless of the size of the bank. Column (1) presents the regression results when the dependent variable is return on assets (ROA). Column 2 presents the regression results when the dependent variable is return on equity (ROE).

The results indicate a negative and significant relation between bank size and profitability. This can be explained that as an bank grows, it becomes increasingly

difficult to manage the bank's resources. Also, bureaucracies and control become more centralized, resulting in rigidity pertaining to the bank's growth decisions (e.g., Athanasoglou, Brissimis, & Delis, 2008).

Capital has a positive and significant relation with profitability. A possible explanation is that an increase in capital enables the bank to take advantage of profitable lending opportunities. Indeed, Athanasoglou, Brissimis, and Delis (2008) argue that capital supports banks in enhancing their operations, such as asset investment and loan issuing, among other key functions.

Loans have a positive and significant relation with profitability. A possible explanation is that more loans lead to higher interest income for the bank (Athanasoglou, Brissimis, & Delis, 2008).

Deposits have a positive and significant relation with profitability. This is perhaps because more deposits allow banks to capitalize on lending opportunities as they arise. Also, deposits can reduce the liquidity risk of banks.

Noninterest income has a positive and significant relation with profitability. Because noninterest income diversifies banks' income sources, it increases both return on equity and return on assets.

GDP growth has a positive effect on bank profitability. This is unsurprising, because an increase in the GDP growth increases the purchasing powers in the economy, which allows individuals to consume more bank products and services (Naruševičius, 2018). Increased flow of production resources in the economy allows banks to take advantage of favorable economic conditions.

In contrast, unemployment has a negative effect on bank profitability. This is also unsurprising, because an increase in the unemployment rate reduces the purchasing power in the economy. As a result, individuals consume less bank products and services, which adversely influences commercial activities in the economy. Unemployment also lowers the productivity of labor among banks. On the other hand, unemployment rate negatively affects the operating expenses of banks (Naruševičius, 2018).

Finally, inflation has a negative effect on bank profitability. This is perhaps because inflation increases the costs of living, which adversely affects consumers' purchase decisions (Naruševičius, 2018).

5.2 Regression results for banks of different sizes

To gain more insight into the determinants of bank profitability, we divide banks into three groups. Small banks have total assets up to \$1 billion. Medium-sized banks have total assets from \$1 billion to \$10 billion. Large banks have total assets over \$10 billion. We then estimate regressions for each group.

Tables 5 and **6** report the regression results. In **table 5**, the dependent variable is ROA. In **table 6**, the dependent variable is ROE. In each table, column (1) presents the regression results for small banks, column (2) presents the regression results for medium-sized banks, and column (3) presents the regression results for large banks.

The regression results in **table 5** can be summarized as follows:

(1) There is no relation between size and profitability for small banks. However, there is a negative relation between size and profitability for medium and large banks.

(2) Capital has a positive and significant relation with profitability for small, medium-sized and large banks.

(3) Loans have a positive and significant relation with profitability for small and large banks. However, the relation is insignificant for medium-sized banks.

(4) Deposits have a positive relation with profitability for small banks, but such a relation does not exist for medium-sized and large banks.

(5) Noninterest income has a positive and significant relation with profitability for small, medium-sized, and large banks.

(6) GDP growth has a positive and significant effect on the profitability of banks of different sizes.

(7) Unemployment has a negative and significant effect on the profitability of banks of different sizes.

(8) Inflation has a negative and significant effect on the profitability of small banks, but it has no effect on the profitability of medium-sized or large banks.

The regression results in **table 6** are qualitatively similar to those in **table 5** with a notable exception: While capital still has a positive and significant relation with profitability for small and medium-sized banks, the relation becomes negative and significant for large banks.

5.3 Discussion of regression results for banks of different sizes

Size: The results indicate a negative relation between size and profitability for medium-sized and large banks, while such a relation does not exist for small banks. The negative relation between bank size and profitability for the medium-sized and large banks could be explained by the diseconomies of scale, e.g., organizational issues within banks (Athanasoglou, Brissimis and Delis, 2008). For example, communication becomes more challenging as banks expand, because explicit instructions and guidelines from management become limited due to the reduction of face-to-face meetings. Moreover,

agency costs, overhead costs resulting from bureaucratic processes, and other costs increase the overall operational and managerial costs as banks become larger (Athanasoglou, Brissimis and Delis, 2008).

Capital: Capital is positively related to return on assets (ROA) regardless of bank sizes. This suggests that higher levels of capital will enhance a bank's ROA. One possible explanation for this finding is that higher levels of capital allow a bank to acquire new assets, and these newly acquired assets can be used for income-generating activities. Therefore, the bank becomes profitable. Moreover, Athanasoglou, Brissimis and Delis (2008) find that capital acts as a cushion for the bank when there are harsh business conditions, and so the bank can maintain profitability even in tough times. However, capital is negative related to return on equity (ROE) for large banks. This finding suggests that, as large banks exploit available opportunities, it is important for them not to hold too much capital.

Loan: Loans are positively related to profitability for small and large banks. This finding is similar to Athanasoglou, Brissimis and Delis (2008), who find that a more substantial loan portfolio broadens the bank's relative lending size. More lending capability leads to higher net interest income, which positively influences the bank's profitability. One exception here is that there is an insignificant relationship between loans and profitability for medium-sized banks.

Deposits: The coefficient on deposits is positive and significant for small banks regardless of whether the dependent variable is ROA or ROE. This finding suggests that an increase in deposits improves the profitability of small banks. According to Albertazzi and Gambacorta (2009), an increase in either households' or firms' deposits enhances the profitability of small banks because deposits are a cheaper and more reliable source of funding compared with borrowed funds. Therefore, deposits improve small banks' stability and profitability. Medium-sized and large banks have better access to financial markets, and they rely less on deposits as a source of funding.

Noninterest income: In each regression, the coefficient on noninterest income is positive and significant, suggesting that the availability of noninterest income significantly boosts profitability for banks of different sizes. Noninterest income diversifies banks' income sources, which reduces the risk of insolvency or failure. Moreover, the wide range of noninterest incomes such as commissions and fees enhances the earnings ability of banks and directly boosts profitability (Albertazzi and Gambacorta, 2009).

GDP growth: In each regression, the coefficient on GDP growth is positive and significant, suggesting that an increase in GDP growth would enhance bank profitability. This finding is consistent with Naruševičius (2018), who argues that GDP growth enables households and firms to expand their demand for credit, which in turn increase the lending activities of banks. Thus, an increase in GDP growth positively influences lending activities of banks of all sizes. Moreover, the quality of a bank's credit portfolio

improves when GDP growth is high, which reduces the credit loss resulting from defaulting loans, and further increases bank profitability.

Unemployment: The macroeconomic environment, such as the unemployment rate of a nation, can have significant impact on bank profitability. Our results indicate a negative relation between unemployment rate and bank profitability. This relation holds whether profitability is measured as ROA or ROE. To understand the reasons behind the relation, note that an increase in unemployment rate reduces the purchasing power in the economy. As a result, individuals consume less, which adversely influences bank profitability. Moreover, a higher unemployment rate could increase the number of bad loans including both business loans and consumer loans (Bolt et al., 2012), and this also reduces bank profitability.

Inflation: The coefficient on inflation is negative and significant for small banks, which suggests that the presence of inflation in the economy adversely affects small banks' profitability. According to Tan and Floros (2012), small banks experience the adverse effects of inflation due to their lack of long-term perspective and insufficient financial reserves. Indeed, small banks usually have limited access to financial markets, which restricts their ability to finance key profitable operations during inflationary periods. Inflation tend to impact small banks' profitability negatively because small banks have little capital to expand or invest due to increased costs. In contrast, the profitability of medium-sized and large banks is not impacted by inflation. This is perhaps because they have diversified operations, which can be used to finance critical

operations during inflationary periods. Moreover, medium-sized and large banks have better access to financial markets, which allows them to expand during periods of high inflation.

6: Conclusion

This study aims at examining the impact of bank specific and macroeconomic variables on bank profitability. We find that capital, loans, deposits, noninterest income and GDP growth have a positive relation with bank profitability. In contrast, bank size, unemployment rate, and inflation have a negative relation with bank profitability.

We further examine whether the determinants of bank profitability differ across banks of different sizes. We find that: (1) size negatively affects the profitability of medium-sized and large banks. (2) Capital positively affects the profitability of all banks, with the exception that it negatively affects the ROE of large banks. (3) Loans positively affect the profitability of small and large banks, but not medium-sized banks. (4) Deposits positively affect the profitability of small banks. (5) Noninterest income and GDP growth positively affect the profitability of all banks, while unemployment negatively affects the profitability of all banks. (6) Inflation negatively affects the profitability of small banks.

Because the impact of size, capital, loans, and deposits on profitability depends on bank size, our results suggest that small and large banks may choose such variables differently. On the other hand, because noninterest income has positive impact on profitability regardless of bank size, our results suggest that both large and small banks need to increase their reliance on noninterest income.

Finally, because banks play important roles in financial stability and economic growth, and because GDP growth, unemployment rate, and inflation can have significant impact on bank profitability, governments and central banks need to create a more favourable environment for banks to operate.

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Appendices

Figure 1. GDP growth rate

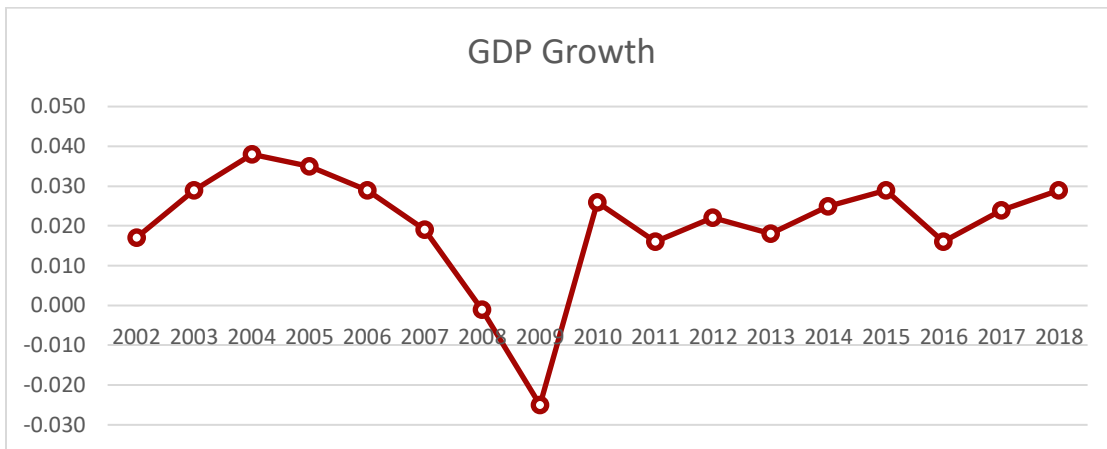


Figure 2. Unemployment rate

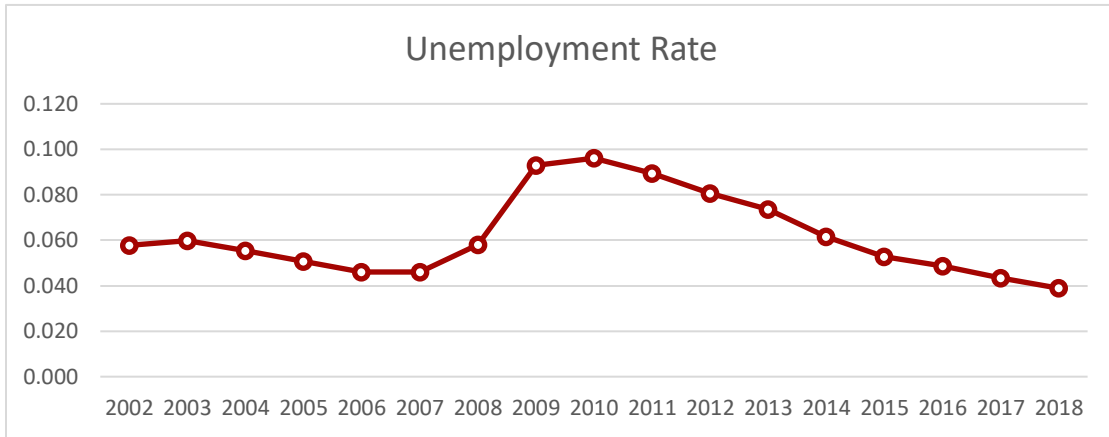


Figure 3. Inflation



Table 1. Variable definitions

Variable	Definition
Return on Assets (ROA)	Net income/Total assets
Return on Equity (ROE)	Net income/Total equity capital
Size	Natural log of total assets
Capital	Total equity capital/Total assets
Loans	Loans and leases/Total assets
Deposits	Deposits in domestic offices/Total assets
Non-Interest Income	Noninterest income/Total operating income

Table 2. Number of banks by year

year	Freq.	Percent	Cum.
2002	2,028	9.89	9.89
2003	2,186	10.66	20.55
2004	2,301	11.22	31.76
2005	2,310	11.26	43.03
2006	986	4.81	47.84
2007	966	4.71	52.55
2008	973	4.74	57.29
2009	1,015	4.95	62.24
2010	1,009	4.92	67.16
2011	1,018	4.96	72.12
2012	1,139	5.55	77.67
2013	1,142	5.57	83.24
2014	1,128	5.50	88.74
2015	652	3.18	91.92
2016	645	3.14	95.07
2017	640	3.12	98.19
2018	372	1.81	100.00
Total	20,510	100.00	

Table 3. Summary Statistics

Summary statistics					
Variable	Obs	Mean	Std.Dev.	Min	Max
ROA	20,510	0.008	0.010	-0.041	0.031
ROE	20,510	0.080	0.142	-0.869	0.348
Size	20,510	20.757	1.467	18.850	26.215
Capital	20,510	0.094	0.032	0.016	0.226
Loans	20,510	0.664	0.136	0.192	0.904
Deposits	20,510	0.785	0.113	0.202	0.916
Non-Interest Income	20,510	0.179	0.128	-0.004	0.766

Table 4. Regression result using the whole sample

Variables	(1) ROA	(2) ROE
Size	-0.0005*** (0.0000)	-0.0051*** (0.0007)
Capital	0.0866*** (0.0018)	0.3922*** (0.0294)
Loans	0.0021*** (0.0004)	0.0241*** (0.0072)
Deposits	0.0032*** (0.0006)	0.0413*** (0.0098)
Noninterest Income	0.0132*** (0.0005)	0.1493*** (0.0082)
GDP Growth	0.1607*** (0.0050)	2.3888*** (0.0800)
Unemployment	-0.1303*** (0.0043)	-1.6772*** (0.0692)
Inflation	-0.0302*** (0.0067)	-0.3394** (0.1073)

Standard errors in parentheses

*** $P < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$

Table 5. Regression results for banks of different sizes, ROA

Variables	(1) Small ROA	(2) Medium ROA	(3) Large ROA
Size	-0.0001 (-0.0001)	-0.0004*** (0.0002)	-0.0005** (0.0002)
Capital	0.1025*** (0.0024)	0.0803*** (0.0034)	0.0269*** (0.0063)
Loans	0.0042*** (0.0006)	-0.0009 (0.0009)	0.0090*** (0.0015)
Deposits	0.0093*** (0.0009)	0.0011 (0.0011)	0.0004 (0.0013)
Noninterest Income	0.0109*** (0.0007)	0.0166*** (0.0009)	0.0147*** (0.0014)
GDP Growth	0.1505*** (0.0066)	0.1641*** (0.0086)	0.2612*** (0.0177)
Unemployment	-0.1879*** (0.0063)	-0.1032*** (0.0069)	-0.0518*** (0.0136)
Inflation	-0.0971*** (0.0099)	0.0042 (0.0104)	-0.0114 (0.0217)

Standard errors in parentheses

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

Table 6. Regression results for banks of different sizes, ROE

Variables	(1) Small ROE	(2) Medium ROE	(3) Large ROE
Size	0.0017 (0.0023)	-0.0074*** (0.0027)	-0.0030 (0.0029)
Capital	0.4988*** (0.0399)	0.4505*** (0.0540)	-0.2129* (0.0814)
Loans	0.0501*** (0.0095)	-0.0123 (0.0138)	0.0758*** (0.0194)
Deposits	0.1040*** (0.0156)	0.0257 (0.0178)	0.0266 (0.0172)
Noninterest Income	0.1272*** (0.0118)	0.1785*** (0.0139)	0.1577*** (0.0181)
GDP Growth	2.2836*** (0.1108)	2.5356*** (0.1377)	3.1669*** (0.2302)
Unemployment	-2.4764*** (0.1059)	-1.3527*** (0.1102)	-0.4516** (0.1760)
Inflation	-1.2810*** (0.1649)	0.1421 (0.1661)	0.1410 (0.2820)

Standard errors in parentheses

*** $P < 0.01$, ** $0.01 < p < 0.05$, * $0.05 < p < 0.1$