THE IMPACT OF CREDIT RISK ON PROFITABILITY OF COMMERCIAL BANKS

by

Chuxuan Sun
Bachelor's Degree, Economics, Shanghai Maritime University, 2017

and

Xiaoyue Chang
Bachelor's Degree, Pharmacology, McGill University, 2016

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Name:	**Chuxuan Sun**
	Xiaoyue Chang
Degree:	**Master of Science in Finance**
Title of Project:	**The impact of credit risk on profitability of commercial banks**

Supervisory Committee:

_____

Christina Atanasova
Senior Supervisor
Associate Professor, Finance

_____

Victor Song
Second Reader
Lecturer, Finance

Date Approved: _____

Abstract

This paper examines the relationship between credit risk and profitability of US commercial banks. We use Capital Adequacy Ratio and Non-performing Loan Ratio to measure credit risk and Return on Equity and Return on Assets to measure profitability of commercial banks. Using a sample of 83 US commercial banks for the period from December 2010 to December 2017, we estimate OLS regressions and find that credit risk has an important effect on profitability. Our results show that 1% increase in NPL decreases ROA by 0.0881% and decreases ROE by 0.141%. Our findings have important implications for bank regulators and policy makers.

Keywords: Commercial banks; Credit risk; Profitability; Capital adequacy; Non-performing loans

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1: Introduction

Commercial banks are enterprises that manage risks. They hold deposits, bind them together as loans, operate payment mechanisms and so on. From the very beginning, they are always exposed to different types of risks that are inseparable from each other. In recent years, with the rapid development and expansion of the financial securities markets, the banking industry worldwide has become increasingly complex. Thus, the ability and level of comprehensive risk management have become the basic requirement for the steady operation and sustainable development of commercial banks. Also, the banks' attitudes and exposures to risk has become more complicated and prone to institutional failures that can lead to the collapse of the entire economic systems of the country in which they operate. Commercial Banks in almost all countries are subject to many regulations in order to stabilize the economy. However, due to the global contagion of financial risks and differences in the way that countries regulate, it is difficult to regulate transnational financial institutions without cooperation between countries effectively. Besides, the practicing regulatory reforms attempted by these countries did not work well and ended up with unsatisfied outcomes such as economic turndown around the globe.

In 1974, several banks released Deutschmarks to the Herstatt Bank in exchange for dollar payments deliverable in New York City. Due to differences in the time zones, there was a lag in the dollar payment to the counterparty banks. During this lag period, before the dollar payments could be affected in New York, the Herstatt Bank was liquidated by German regulators. The failures of Germany's Herstatt Bank and America's Franklin

National Bank has stunned regulators into a comprehensive review of bank regulation with extensive international operations. In 1975, the year after the banks failed, the Basel Committee was formed by central bank governors of the G10 countries and the first Basel Accord was introduced. Since then, the Basel Accord has gone through a deepening process of continually updating the content, improving the methods and maturing the ideas. In 2004, aims to enhance the critical supervisory issue and improve the quality of banking supervision, the Basel II was introduced. One of the regulations is the capital requirement, which is the minimum capital that commercial banks must keep absorbing loss when unexpected things happen. However, the 2007 financial crisis made the Basel committee realized that Basel II seems not complete enough for the complicated financial markets. In 2007-08, the surge of defaults in the subprime housing industry and the credit crunch in the United States triggered the shock, panic, and crisis in the international financial market. Therefore, in 2010 the Basel III was published, and the Basel Committee reformed to strengthen global capital and liquidity rules with the goal of promoting a more resilient banking sector. The objective of the reforms is to improve the banking sector's ability to absorb shocks arising from financial and economic stress, thus reducing the risk of spill over from the financial sector to the real economy.

The banking theory (Bhattacharya & Thakor, 1993) states six significant risks associated with the credit policy of banks, including credit risk, credit deficiency risk, operating risk, portfolio risk, interest risk, and trade union risk. In all these cases, the most exposed risk is credit risk, which is hard to spot and is one of the significant risks in commercial bank operation. Credit risk, also known as default risk, refers to the risk of economic loss caused by the failure of the counterparty to fulfil the obligations in the contract. That is the possibility of deviation between the expected income of the credit

issuer and the actual income caused by the recipient's failure to fulfil the obligation of repayment of principal and interest. It has been identified by the Basel Committee as a main source of risk in the early stage of Basel Accord. Different studies in the context of the global banking crisis have revealed the fact that bad credit (asset quality) is the leading cause of bank failures. After the 1990 s, the financial crisis brought the global economy suffered from high impact. National government agencies and even ordinary people have started to pay attention to risk management issues, the pressure of the Banks in credit risk management is also increased. In 2007-2018, The global financial crisis caused by the subprime mortgage crisis in the United States not only led to the collapse of many financial institutions, including the collapse of Bear Stearns, the bankruptcy of Lehman Brothers, the acquisition of Merrill Lynch securities, but also led to a substantial devaluation of global wealth, and the world economy entered a long-term recession and depression.

Therefore, based on the significant impact of credit risk on commercial banks and economy, it is essential to find the relationship and impact of credit risk with/on the profitability of the commercial banks. Since the 1980s, the operating environment of American commercial Banks has become more and more uncertain. In addition, with the integration of commercial banks' business into globalization, credit risk management of American commercial Banks has become more important, and many new technologies and rich experience of credit risk management have been accumulated. The U.S. subprime mortgage crisis and so on sounded the alarm bell of bank credit risk management. Hence, this paper attempts to make some contribution to the literature of credit risk through the analysis of its impact on the U.S. banking industry with the focus on 83 American commercial banks. Our research question will be: “What is the relationship between credit risk management and profitability of commercial banks in American from 2007 to 2017?”.

The remainder of this thesis is organized as follows. Section 2 provides literature review. Section 3 is the methodology of our research. Section 4 is empirical results. And Section 5 provides our conclusion.

2: Literature review

In our research, one of the critical variables for credit risk is the nonperforming loans (NPLs). A study conducted by Abdelkader (2009) analysed the cross-country determinants of NPLs. He stated that NPLs is a significant indicator to explain banking performance, failures, and crisis. High level of NPLs will increase the bank's exposure to default risks. The study conducted by Kwambai & Wandera (2013) on the financial statement on banks in Kenya from 2007 to 2012 also found that the NPLs are related to credit information sharing. They also found that when the NPLs level is high, the assets provisions will not be high enough to protect the bank against default risk.

There are many determinants factors of NPLs, in both internal and external extent. Rajan and Dhal (2003) performed a study to analyse the NPLs in India commercial banks. They found that NPLs are impacted by the term of credits, bank size, and macroeconomic shocks. Keeton and Morris (1999) performed a study on the causes of loan losses by estimating 2470 losses insured by U.S. commercial banks from 1975 to 1985. They used NPLs as their prime method for the calculation of loan growth and losses. They concluded that faster loan growth leads to higher loan losses, and supply shifts appear to account for much of the variation in loan growth.

Capital-based regulation has become a significant issue in the banking industry after the 2007 subprime mortgage crisis. Basel I and Basel II Accords (1988, 2004) suggested that banking firms should follow a minimum risk-based capital requirement that the CAR be at least higher than 8%, and CAR is one of the measures which ensure the financial soundness of banks in absorbing a reasonable amount of loss according to Fatima (2014). We use capital adequacy ratio (CAR) as our second variable for credit risks in this

research. Mathuva (2009) conducted a study to examine the relationship between capital adequacy and the performance of commercial banks in Kenya and found that bank profitability is positively correlated to the core capital ratio and the tier 1 risk-based capital ratio. In a study done by Olalekan (2013), the effect of capital adequacy on the profitability of banks was examined in Nigeria from 2006 to 2010, and it was found that capital adequacy played a significant role in the determination of profitability.

Avusharba et al. (2013) conducted research of determinants of CAR in Indonesian Islamic commercial banks. They found that the profitability and liquidity are positively correlated to the capital adequacy requirements. In a study conducted by Buuml and Abdioğlu (2011) on determinants of Turkish banks' capital adequacy ratio, they obtained banks' annual data from 2006 to 2010 and used panel data methodology to analyze the relationship. The result indicated that loans, return on equity and leverage negatively affect CAR, while loan loss reserve and return on assets positively affect CAR.

In our research, ratio analysis is used to measure and analyze the bank's profitability. Guru et al. (1999) stated the advantage of using ratios since ratios are inflation invariant and they will not be affected by price level change. Many researches have used return on assets (ROA) and/or return on equity (ROE) as an indicator of bank performance and profitability. ROA is calculated as a percentage of net income and total assets, it states the level of net income generated by the bank and determines how the bank has used its assets to generate profits over the years. ROE is a percentage of net income over shareholder's equity, it is the most commonly used method to determine the effectiveness of bank revenue generation according to various elements of shareholder equity. Saeed (2016) analyzed the impact of credit risk on the profitability of five big UK commercial banks, and they used ROA and ROE as their dependent variables and the prime indicator

of bank's profitability, and net charge-off (or impairments), and nonperforming loans as variables for credit risks. After performing several statistical analyses on theses bank data from 2007 to 2015, they found that credit had a positive correlation with the profitability of the banks. They also found that bank size, leverage, and growth were also positively interlinked with each other.

Li and Zou (2014) have found that that credit risk management does have positive effects on the profitability of commercial banks based on data from the largest 47 commercial banks in Europe from 2007 to 2012. They also used ROE and ROA as indicators of bank's performance, and CAR and NPLR (nonperforming loans ratio) as independent variables. Their empirical findings showed that the relationship between CAR and ROE is not significant, while NPLR is negatively correlated to ROE and ROA. This research is the novel aspect of our project. Instead of European banks, we perform our study based on U.S. banks. We also increase the number of banks from 47 to 83.

3: Methodology

3.1 Data collection

In order to analyze the relationship between credit risk and profitability of commercial banks in the U.S., we search entire data base of commercial banks in U.S. in terms of total assets from year 2010 to 2017. Quarterly data related to total assets and variables are acquired from WRDS data base. In order to perform our regression analysis, we collect the data we need from WRDS data base. We use ROA and ROE as our dependent variables and use CAR and NPLR as our independent variables. Also, we use 'total assets' and take logarithm as the criteria for bank size. All data range from year 2010 to 2017. We retrieve entire data from the database first and delete banks that don't have total asset information. Finally, we have 83 banks which can be used in our research. Table 1 is the list of 83 banks after data processing in U.S.

Table 2 is the summary of research variables.

	Name	Calculating formula	Data resource
Dependent variable	ROE	Net Income/ Total Equity Capital	WRDS
	ROA	Net Income/Total Assets	WRDS
Independent variable	CAR	Total Equity Capital/Total Assets	WRDS
	NPLR	Loans 90+days late /Total Loans	WRDS
Control variable	Bank Size (LNTA)	Natural log of banks' total assets	WRDS

Table 3 is the descriptive of descriptive of statistics of variables.

There are total 2395 observations for total assets. The average of 83 US banks is 132549658.3($) and the median is 12562399.0($). Our sample of 83 US banks is representative but may still have bias of not including financial crisis.

3.2 Indicators for profitability

3.2.1 Return on equity (ROE)

ROE is one of financial performance measurements, calculated as net income divided by total equity capital. The difference between a company's assets and liability is shareholder's equity, so ROE could be view as the return on net assets. ROE is a measurement of a company's ability to generate earnings growths with its investments. It is also a factor in stock valuation that higher ROE implies higher stock prices.

ROE is an important indicator of bank's profitability measuring the bank's efficiency in making profits.

3.2.2 Return on assets (ROA)

ROA, calculated as ratio of net income to total assets, shows the percentage of the profitability of a company's assets in generating revenue. ROA gives investors an idea of how effective the company is in converting the money it invests into net income. The higher ROA value means that the company is earning more money with less investment and has better performance. ROA is known as good profitability multiplier for the reason that equity multiplier does not influence it.

3.3 Indicators for credit risk management

3.3.1 Capital adequacy ratio (CAR)

CAR is the ratio of bank's capital to its risk and is calculated as total capital divided by bank's total risk-weighted assets. CAR protects depositors and promotes the stability and efficiency of financial systems around the world by lowering the risk of banks becoming insolvent.

When a bank's winding-up process, depositors' funds are given a higher priority than capital so that the depositors can only lose their savings if a bank's loss outsize the capital. The higher CAR ratio means that depositors' assets are better protected by the bank.

There are two kinds of capital needed to be measured when calculating CAR.

Tier one capital can absorb which can absorb losses without a bank being required to cease trading. Tier two capital can absorb losses in the event of a winding-up and provides lower level of protection to depositors. It is used to absorb losses when a bank loses all its tier one capital.

Actually, in practice, because there is very limited data in terms total capital and risk-weighted assets, we use the ratio of total equity capital divided by total assets to substitute the original calculation formula.

3.3.2 Non-performing loans ratio (NPLR)

Non-performing loan is the sum of loans that debtors cannot make scheduled payment for a period of at least 90 days for commercial banking loans and 180 days for consumer loans.

NPLR is the ratio of the amount of nonperforming loans in a bank's loan portfolio to the total amount of outstanding loans the bank holds. The NPL ratio measures the effectiveness of a bank in receiving repayments on its loans and the quality of bank loans. The quality of bank loans is important in bank soundness because making loans is one of bank's core business.

A bank's goal is to maximize its profit. While in order to improve the performance, the bank must increase the risk. Among all the risks, credit risk is the most significant factor for commercial banks. The credit risk management may have great impact on the profitability of commercial banks, so our research wants to find out this relationship.

3.4 Model

Our research is to study the impact of credit risk on profitability of commercial banks in U.S., so we need to find out the relationship between credit risk and profitability of banks. We use credit risk indicators, CAR and NPLR, as independent variables and profitability indicators, ROA and ROE, as dependent variables to build the regression model based on Ordinary Least Squares (OLS). The general form of OLS is:

$$Yi = \beta 0 + \beta iXi + \varepsilon i$$

Where:

i: the number of observations

Yi: dependent variables

Xi: independent variables

β0: intercept

βi: slope

εi: residuals

Based on our previous analysis, the dependent variables will be ROA and ROE.

The independent variables will be CAR and NPLR. We also have a control variable that is bank size, the natural logarithm for banks' total assets.

Table 2 is our summary table of research variables used in our research.

By putting our research variables into the general OLS equation, our new model will be:

$$ROEt = \beta0 + \beta1CARt + \beta2NPLRt + \beta3Size + \varepsilon t$$

$$ROAt = \beta0 + \beta1CARt + \beta2NPLRt + \beta3Size + \varepsilon t$$

3.5 Hypothesis

3.5.1 Hypothesis 1

Null hypothesis: there is no correlation between profitability (ROE) and credit risk (CAR and NPLR).

H0: $\beta1 = \beta2 = 0$

Alternative hypothesis: there is correlation between profitability (ROE) and credit risk (CAR and NPLR).

3.5.2 Hypothesis 2

Null hypothesis: there is no correlation between profitability (ROA) and credit risk (CAR and NPLR).

H0: $\beta 1 = \beta 2 = 0$

Alternative hypothesis: there is correlation between profitability (ROA) and credit risk (CAR and NPLR).

3.6 Correlation(R^2)

We want to know the correlation between independent variables (CAR and NPLR) and dependent variables (ROA and ROE), so we use R2 to evaluate the fitness of our model. R2 can be calculated as follow:

$$R2 = 1 - \sum ei2 / \sum (Yi - \bar{Y})2$$

Higher R2 indicates that the regression model fits the data better.

3.7 Multicollinearity

Multicollinearity is a phenomenon when an independent variable in a regression model is linearly correlated with another independent variable. When multicollinearity happens, the regression model is not that valid anymore, so we need to do the multicollinearity test. We can test the correlation coefficient between independent variables

CAR and NPLR. If the r is high, it means CAR and NPLR is highly correlated and multicollinearity exists in our regression model.

3.10 Heteroskedasticity

Heteroskedasticity is a phenomenon that the variance of error term is not constant, and it is a violation of OLS assumptions. It is a problem in regression analysis if heteroskedasticity exists because it will impact the result of statistical tests. Although it will not change the coefficients of regression model, heteroskedasticity will change the variance and covariance. So, we need to do heteroskedasticity test for two models by using Chi square test.

4: Empirical results

4.1 Descriptive statistics

We use quarterly data for 83 banks in U.S. from 12/31/2010 to 12/31/2017. We calculate ROA, ROE, CAR and NPLR for each time period and bank. Table 3 is the summary of Descriptive statistics for our data. Number of observations, mean, median, 25th percentile, 75th percentile and standard deviation for each dependent and independent variable are included.

4.2 Multicollinearity test

As we mentioned before, we don't want the independent variables to be highly correlated, so we do the multicollinearity test. And we simply use the correlation coefficients between independent variables. Usually, if the correlation coefficient is higher than 0.8, we might think the two variables are highly correlated and that means multicollinearity is a problem in our research model. Table 4 is the correlation coefficient matrix for regression 1. Table 5 is the correlation coefficient matrix for regression 2. As we can see from both tables that the correlation coefficient between independent variable is less than 0.8 which means they are not highly correlated and the choice of independent variables for our model is reasonable.

4.3 Heteroskedasticity test

After the multicollinearity test, we also do the heteroskedasticity test for each regression. We use White test to test for heteroskedasticity. If the chi square value is larger than critical value, then the null hypothesis that there is heteroskedasticity should be

rejected. Table 6 is the white test result for ROE. We can see that chi square is large so that there is no heteroskedasticity in regression 1. Table 7 is the white test result for ROE. The chi square is large enough to reject null hypothesis so that no heteroskedasticity exists in regression 2.

4.4 Regression results

We perform two regressions using our model for ROE and ROA separately.

Table 8 is regression results for our model, using ROE and ROA as dependent variables.

4.4.1 Hypothesis 1

Null hypothesis: there is no correlation between profitability (ROE) and credit risk (CAR and NPLR).

Table 9 is the regression results for ROE using 83 banks in U.S. from 2010 to 2017.

We can see that the P value of NPLR is less than 5% significance level, so that the null hypothesis that no correlation between NPLR and ROE is rejected.

P value of CAR is 0.102, larger than 5% so we should not reject null hypothesis that no correlation between CAR and ROE. The result is different from previous research conducted by Ara, Bakaeva and Sun (2009) that there should be a positive relationship between CAR and ROE. While there is other research conducted by Kithinji (2010) shows no correlation between CAR and ROE The correlation coefficient of CAR and ROE is negative which means CAR can negatively impact a bank's profitability. The negative coefficient means that a bank may limit itself participating in activities that will improve

the bank's development in order to keep a high CAR. This insignificance result may result from Type II error that we fail to reject a false hypothesis. Also, the R^2 for our regression model is only 0.0258 which means it is not a good fitness. Maybe there are some other dependent variables that we should include into this model to complete it.

4.4.2 Hypothesis 2

Null hypothesis: there is no correlation between profitability (ROA) and credit risk (CAR and NPLR).

Table 10 is the regression results for ROE using 83 banks in U.S. from 2010 to 2017.

We can see that P value for both CAR and NPLR are less than 5% significance level and this significant result means we should reject the null hypothesis that no correlation between ROA and CAR and NPLR.

The coefficient for NPLR is negative and this negative relation between NPLR and ROA is identical to previous research performed by Kargi (2011). NPLR is an indicator of bank loans so the higher the ratio, more losses in loans and the worse the profitability is. Positive correlation coefficient of CAR and ROA is in accordance to previous research we mentioned before. R^2 for this model is 0.1004, higher than ROE model, which means a better fitness.

4.5 Omitted independent variables

The only independent variables we use in our research are NPLR and CAR, there can be several omitted variables, thus causing bias. Possible independent variables that

can be used in advance of this paper include growth, which can be obtained from growth in net interest income of bank. We expect a positive effect of growth on our dependent variables ROA and ROE. Besides, total leverage is also one of the omitted independent variables, it is calculated as the ratio of total debt to total assets. We also expect that leverage has a positive effect on dependent variables.

5: Conclusion

At the beginning of our research we have explained that our goal is to analyse the relationship between credit risk management and profitability of commercial banks in the U.S. This was done by collecting data from 83 U.S. commercial banks from 2010 to 2017. In order to determine the relationship for credit risk management and profitability, we chose ROE and ROA as the proxies for bank profitability, and CAR and NPLR as proxies for credit risk. After the data collection, we used STATA (a statistic program) to test for our research question. Two hypotheses and two regression tests were performed for ROA and ROE respectively, the two independent variables. According to our empirical findings, we are able to conclude that there exists a relationship between credit risk management and profitability of U.S. Commercial banks from the period of 2010 to 2017.

Firstly, our empirical findings show that the relationship between CAR and ROE is not significant. The controversy theoretical prediction of the relationship between CAR and bank's profitability may be the reason. In addition, our model modification could be imperfect and incomplete. The impact of systematic risks of the financial crisis in 2007 should also be considered.

Secondly, our findings showed that there is a negative relationship between NPLR and ROE as well as between NPLR and ROA. This is consistent with most of the previous relating researches. This relationship indicates that the higher the NPLR, the less available capital for banks to invest and operate, and thus the lower profitability for banks.

Combined with the findings, we conclude that there is a positive relationship between credit risk management and profitability of commercial banks in the U.S., the better and more effective the risk management, the less credit risk, the higher the

profitability to the commercial banks. According to our conclusion, we suggest that commercial bank managers should pay attention to the management and control of credit risk in order to improve profitability, especially the control of NPLs. The ability to pay back should be examined more precisely and accurately by commercial banks. Even though there is no significant relationship between CAR and profitability, commercial bank managers should not neglect this important factor, as a low CAR can be a potential hazard to banks, and its profound impact may take time to show.

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Appendices

Table 1. List of 83 banks in U.S.

Entity Name	Total Assets at 9/30/2017 ($)
HUNTINGTON NB	102067828
WELLS FARGO INTL BKG CORP	10974813
STATE STREET B&TC	232359259
COMERICA BK	72191826
CITY NB	47595875
DELTA NB&TC	413844
BMO HARRIS BK NA	106190154
MERCANTIL BK NA	8492052
BANK LEUMI USA	6760271
CAPITAL ONE NA	290965143
STANDARD CHARTERED BK INTL AME	53848
EASTERN NB	524190
EAST WEST BK	36303343
OLD NB	14968072
NORTHERN TC	130997082
MUFG UNION BK NA	118552876
MIZUHO BK USA	6106388
REGIONS BK	122472010
HABIB AMER BK	1435600
TCF NB	23017904

KEYBANK NA	134818926
STATE STREET INTL HOLDINGS	57370518
HSBC BK USA NA	195906958
WELLS FARGO BK NA	1737980000
CITIBANK NA	1407297000
BANK OF AMER NA	1725215000
MANUFACTURERS & TRADERS TC	119875526
U S BK NA	452251826
FIRSTBANK PR	12157803
INTERAUDI BK	1719784
BANK OF NY MELLON	281342000
BANCO ITAU INTL	2062799
FALCON INTL BK	1132273
HSBC PRIVATE BK INTL	4016417
CATHAY BK	14597726
PNC BK INTL	1866250
BANCO SANTANDER INTL	6680621
MB FNCL BK NA	20047874
SUNTRUST BK	203380775
FAR EAST NB	1093146
BANK OF GUAM	2013517
BNY INTL FINANCING CORP	13747539
FIFTH THIRD BK	139988169
BAC FL BK	2077620

BRICKELL BK	492839
HSBC INTL FNC CORP DE	109679
WEBSTER BK NA	26345521
BANK OF THE ORIENT	713738
BANKAMERICA INTL FNCL CORP	19211643
BANK OF HAWAII	17241018
SILICON VALLEY BK	49940631
BANK OF THE WEST	89722160
PNC BK NA	363680674
FINANCE FACT	576498
JPMORGAN CHASE BK NA	2153028000
BRANCH BKG&TC	214780000
INTERNATIONAL FNC BK	458145
JP MORGAN INTL FNC	563458600
NORTHERN TR INTL BKG CORP	14778463
SAFRA NB OF NY	7610210
SUMITOMO MITSUI TR BK USA	2757019
CITIBANK OVERSEAS INV CORP	309823872
BANCO POPULAR DE PR	32919000
MELLON OVERSEAS INV CORP	1256600
FIRST HAWAIIAN BK	20546455
FIRST MW BK	14059549
AMERICAN EXPRESS CENTURION BK	36588259
BLACKROCK INSTITUTIONAL TC NA	4584743

POPULAR AUTO LLC	1773113
NATIONAL BK OF INDIANAPOLIS	2042132
GOLDMAN SACHS BK USA	157953000
CAPITAL ONE BK USA NA	116456140
KEY EQUIP FNC INTL	357671
WEX BK	2573792
PNC CAP LEASING LLC	721563
CLS BK INTL	474092
CITIZENS BK OF PA	35664507
USB EUROPEAN HOLDS CO	9944159
US CENTURY BK	995559
USB AMERS HOLDS CO	369397
CITIZENS BK NA	120724694
WELLS FARGO INTL FNC LLC	2638062
CAPITAL ONE GLOBAL CORP	3526594

Table 3. Descriptive of statistics of variables

	N	*Mean*	*Median*	*Std. Dev.*	*25th percentile*	*75th percentile*
Total Assets	2395	132549658.3	12562399.0	345354159.6	1547693	97380474.5
ROE	2395	0.0456624	0.0368115	0.0863255	0.0168232	0.0687418
ROA	2395	0.0073384	0.0049759	0.0216954	0.0022479	0.0089561
CAR	2395	0.2025132	0.1223726	0.2088937	0.0990739	0.1777125
NPLR	2243	0.0059217	0	0.0580857	0	0

Table 4. Correlation coefficient matrix for regression 1

	ROE	CAR	NPLR	Size
ROE	1.0000			
CAR	-0.1059	1.0000		
NPLR	-0.1154	0.2356	1.0000	
Size	0.1392	-0.4404	-0.1357	1.0000

Table 5. Correlation coefficient matrix for regression 2

	ROA	CAR	NPLR	Size
ROA	1.0000			
CAR	0.1169	1.0000		
NPLR	-0.2612	0.2356	1.0000	
Size	0.0207	-0.4404	-0.1357	1.0000

Table 6. White test for heteroskedasticity for ROE

	Chi2	df	p
Heteroskedasticity	35.75	9	0.0000
Skewness	1.04	3	0.7919
Kurtosis	3.99	1	0.0457
Total	40.79	13	0.0001

Table 7. White test for heteroskedasticity for ROA

	Chi2	df	p
Heteroskedasticity	747.06	9	0.000
Skewness	84.06	3	0.000
Kurtosis	8.42	1	0.0037
Total	839.53	13	0.000

Table 8. Regression results, using ROE and ROA as dependent variables

	ROA	ROE
CAR	0.0227***	-0.0222
	(8.95)	(-1.64)
NPLR	-0.0881***	-0.141***
	(-14.50)	(-4.35)
Size	0.000368*	0.00363***
	(2.38)	(4.41)
Constant	-0.00271***	-0.00880***
	(-0.99)	(-0.60)
Observations	2243	2243
R-Squared	0.1004	0.0258

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

Table 9. Regression results for ROE, 95% confidence level

ROE	Coef.	t	P>|t|
CAR	-0.0221503	-1.64	0.102
NPLR	-0.1406456	-4.35	0.000
Size	0.0036274	4.41	0.000
Constant	-0.0088	-0.60	0.545
Observations		2243	
R-squared		0.0258	

Table 10. Regression results for ROA, 95% confidence level

ROA	Coef.	t	P>|t|
CAR	0.0227415	8.95	0.000
NPLR	-0.0880853	-14.50	0.000
Size	0.003677	2.38	0.000
Constant	-0.0027114	-0.99	0.321
Observations		2243	
R-squared		0.1004	