Determinants of Profitability of Listed Commercial Banks: A Case of China

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Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Banking and Finance

Eastern Mediterranean University
January 2018
Gazimağusa, North Cyprus

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ABSTRACT

The method least square panel was adopted to analyze the determinants of profitability of 16 listed commercial banks in China, from 2010 to 2015. As found by the study, the profitability of listed banks is associated not only with the characteristics taken on by banks, but also with how the financial markets are structured. More evidently, the Non-performing loan losses ratio, reserve rate, and equity ratio are negatively correlated with the profitability. Markedly, Herfindal-Hirschman Index, X-Efficiency, Non-interest rate and profitability were positively correlated with each other. The z-score and profitability are not evidently positively correlated. To improve their profitability, China's listed commercial banks are required to facilitate their operation, control operating costs, increase efficiency, and further reduce the NPL ratio.

Keywords: Profitability, Listed commercial banks, NPL ratio

ÖZ

En küçük kare paneli yöntemi, 2010'dan 2015 yılları arasında listelenmiş olan 16 Çin ticari bankalarının olasılık belirleyicilerini analiz etmek için kullanılmıştır. Araştırma sonuçlarına göre, listedeki bankaların karlılık oranı, sadece bankaların karakteristik özelliklerine bağlı değil, aynı zamanda finansal pazarlamanın nasıl oluştuğuyla da alakalıdır. Daha belirgin olarak, takipteki kredilerin kar ve zarar oranları, rezerv oranı ve öz sermaye oranı, karlılık ile negatif bir ilgileşim içindedir. Belirgin olarak, Herfindal- Hirschman İndeksi, X etkinliği, faiz dışı oran ve karlılık birbirleri ile pozitif bir ilgileşim içindedir. Z-skor ve karlılık belirgin olarak pozitif bir korelasyona sahip değildir. Karlılığı artırmak için, listelenmiş Çin ticari bankalarının işlemlerini kolaylaştırmaları, işletme maliyetlerini kontrol etmeleri, etkinliklerini artırmaları ve NPL oranlarını düşürmeleri gerekmektedir.

Anahtar kelimeler: Kârlılık, Listelenen ticari bankalar, NPL oranı

DEDICATION

To family

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LIST OF ABBREVIATIONS

EFF   X-Efficiency

EQ   Equity ratio

GDP   Gross Domestic Product

HHI   Herfindal - Hirschman Index

NII   Non-interest income rate

NPL   Non-Performing Loan ratio

ROE   Return on equity

RR   Reserve rate

ZSC   Z-score

Chapter 1

INTRODUCTION

1.1 Background

Since the introduction of China's reform in economy, China has established the relations progressively closer with all countries in the trade by virtue of its proactive engagement in international economic activities, and the economy has been boomed sustainably and rapidly. Banking industry is of critical significance for the financial system. To better study the determinants of profitability of China's listed commercial banks, the realistic background of these banks are to be factored in necessarily so that this research is able to keep pace with the economic development. In this regard, the background was split into international and domestic parts.

1.1.1 International financial background

The emerging economic markets remain not optimistic though the international financial markets were comparatively stable by and large. For the fifth consecutive year, the emerging markets have been slackened in growth in 2015, with structural problems highlighted, comparatively slow reform and pressure to further devalue the domestic currency and pose systematic financial risks. As a vital part of the emerging economic market, China is inevitably pressured by economic downside risks.

1.1.2 Domestic financial background

On the basis of $10.482 trillion, such a huge economic aggregate in 2014, the economic growth remains higher than that of the previous years, though the growth rate of China's gross domestic product (GDP) continued to decline less rapidly to 6.9% in 2015.[1] This situation, known as the new normal of China's economy, has been ongoing since the Sub-prime mortgage crisis in 2008 and the introduction of Chinese economic stimulus plan in 2008-2009.

In such a comparatively stable new economic context, the banking industry has also been changed. The domestic credit provided by banking sector (% of GDP) in China was at 193 % in 2015 as reported by the World Bank's statistical data. [2]Accordingly, the banking sector is crucial and irreplaceable for China's economy. In the meantime, its operational level directly impacts the development of the economy.

The operation of the Chinese banking industry in 2015 remained stable by and large, with the continuous growth of total assets and liabilities. The total assets of commercial banks reached RMB 155.8 trillion at the end of 2015, RMB 21.0 trillion more than that at the end of 2014, marking a year-on-year growth by 15.6%, an increase of 2.1% from 2014 as indicated by the information released by China Banking Regulatory Commission. The total liabilities amounted to RMB144.3

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[1] https://home.kpmg.com/cn/zh/home/insights/2016/09/mainland-china-banking-survey-2016.html

[2] https://tradingeconomics.com/china/domestic-credit-provided-by-banking-sector-percent-of-gdp-wb-data.html

trillion, 19.2 trillion more than that at the end of 2014, marking an increase year-on-year growth of by 15.3%. It increased by 2.4% compared with that of 2014.

In the past two years, China's economic increase slowed, possibly indicating the start of a downtrend. Consequently, the overall profit growth of the banking industry has also fallen. The rise in non-performing loans has been jointly expected by the industry.

1.2 Aim and sense of study

1.2.1 Aim of study

This paper primarily seeks to anatomize the determinants of profitability taken on by listed commercial banks in China. China's listed commercial banks have improved their profitability in the past and have solved some of the problems existing in their operation. Yet these listed commercial banks are required to draw upon their strengths to find the profit-making path for further elevation of their profitability as they seek to take up a place in the new challenge.

1.2.2 Sense of study

Profitability is prioritized by banks for business. Accordingly, the profitability is of critical significance. In the meantime, as commercial banks are effectively managed with well-operated business, they are ensured to taken on a stable and sustainable profitability. The determinants of profitability of 16 listed banks, on behalf of Chinese commercial banks, can be delved into to expound the basic characteristics taken on by the Bank of China and to better assess the prospect.

Although this research only selected 16 banks, these banks are listed companies and 16 already include all Chinese listed banks. The impact of the market on listed companies is more direct than that of unlisted banks. This is useful for measuring some of the risk-related variables. Compared with non-listed banks, their financial status is more transparent and open, which can reduce errors caused by statistical errors or counterfeiting.

Through adopting the panel model, the determinants of profitability of China's listed commercial banks are anatomized in this paper to shed light on the profitability of China's commercial banks and perfect the relevant theories.

1.3 Structure of thesis

This thesis falls into 5 chapters. The first chapter introduces the entire text. Chapter 2 reviews the literature, with the world and Chinese researchers involved. The methodology and research data are presented in Chapter 3. Chapter 4 refers to the empirical results of the data. Chapter 5 draws the conclusion and gives the suggestion based on results.

Chapter 2

LITERATURE REVIEW

Smirlock (1985) studied 270 U.S. banks and sought to probe into how the profit rate and the market structure are correlated with each other. As the result indicates, market share is positively correlated with bank profit margin and exerts an evident impact. Yet market share only reflects market forces and factors out the impact exerted by banks' own efficiency.

The determinants of net interest rate of the Banks in America were analyzed, and the impact exerted by internal bank characteristic variables on net interest rates was examined by Angbazo (1997). The opportunity cost, leverage ratio and net interest rate of non-interest-bearing reserve assets are positively correlated, whereas the liquidity risk is negatively correlated with the net interest rate of banks as indicated by the results.

Through adopting weighted least squares regression, the determinants of commercial bank interest margins and profitability were anatomized by Demirgue-Kunt and Huizinga (1999). The sample banks were selected in 80 countries from 1988 to 1995. The bank characteristics, macroeconomic conditions, the taxation, deposit insurance regulation, overall financial structure, some underlying legal and institutional

indicators were accordingly found to serve as the determinants of the profitability equipped with by these banks. More specifically, some vital results have given a blow. First and foremost, the profitability of banks shall be lowered with the decline of concentration ratio. In the meantime, banks with comparatively high non-interest earning assets are less profitable as they are principally dependent on deposit funding. This shall change the operation cost, impact interest margins and even affect the deposit customers. Secondly, the foreign ownership variable is positive in coefficient, bespeaking that foreign banks with higher international ownership have higher margins compared with domestic banks in developing counties.

How the market structure of banking industry and performance of banks are related in China was studied by Lu, Fung & Jiang (2007). The sample was selected from 4 state-owned commercial banks, 10 joint-share commercial banks and all foreign banks in China. The market structure was measured adopting concentration ratio and HHI. As the result indicates, market structure of banking industry does have effect on performance of bank in China. In addition, China banking industry is moderately concentrated and in a state of monopolistic competition.

Athanasoglou, Brissimis & Delis (2008) examined combinations of Bank-specific, industry-specific and macroeconomic of bank profitability in Greek from 1985 to 2001. The result shows: the economic cycle is positively correlated with the profitability of the bank, and the cycle of economic growth is more significant. Meanwhile, the influence of industry concentration on profitability has not been

supported by empirical test. Other factors besides bank's internal factors have a significant positive impact on profitability.

García-Herrero, Gavila & Santabárbara (2009) Analyzed the reasons for the low profit of Chinese banks for the period 1997-2004 by using GMM two-step system estimated and 87 Chinese banks were selected.   They found that better-capitalized banks tend to be more profitable and the low profitability mainly explained by poor asset quality, low efficiency and scarce capitalization. To be more specific, the NPL and NPL/Total Assets ratio of Chinese banks are much higher than international standards. Meanwhile, the Capital/Assets ratio is too low. In summary, the study concludes that there is a significant positive relationship between capital level, X and deposit share, and profitability.

The panel data during 1997~2010 and the GMM method were adopted by Lu, Sudao & Yin (2013) to analyze 144 Chinese commercial banks empirically. As they found, the profitability of banks was associated not merely with the characteristics taken on by bank, but also the structure of financial market and the macroeconomic variables; the percentage of non-performing loan, the amount of bad debt, the bankruptcy probability and other risk indicators were evidently negatively associated with the ratio of profit; the share of bank deposits and operational efficiency were evidently positively associated with profit; the factors of external macro-environment, inclusive of GDP growth, inflation and the benchmark rate of deposit and loan, etc., also impact the profit of commercial bank.

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Firth, Li & Shuye Wang (2013) studied growing non-traditional banking business for Chinese big-four state-owned banks in the period 1998-2007.As a result of the study, they found the bank which has narrow net interest margin tend to develop the nontraditional business. Moreover, they give the evidence to prove that the ownership type of banks will impact the non-traditional activities. Furthermore, they got a conclusion that state-owned banks' financial performance is good as rest of the banks.

Dietrich & Wanzenried (2014) collected 10,165 commercial banks across 118 countries over the period from 1998 to 2012 and divided into low-, middle-, and high-income countries three levels. Based on this, they analyzed determinants of commercial banking profitability, which including bank-specific characteristics, macroeconomic variables, and industry-specific factors. They observe the private banks in middle- and low-income countries are profitable than state-owned banks compare to high-income countries. In addition, GDP growth and market structure could explain substantial part bank profitability in middle- and low-income countries.

The comparison between Chinese biggest banks ("big four") and the global top 20 commercial banks in the period 2006-2012 was drawn by Funke, Li & Löchel. (2016). What made these Chinese state-owned banks highly profitable in this period was accordingly acquired. This was principally arising from "double monopoly", bespeaking high interest margin and low staff costs. Due to regulated interest rate system and dominate the market, "big four" got unbelievable revenue. In the

meantime, the higher NPL the higher ROAA of "big four" was found. In line with the foregoing conclusions, these scholars speculated that Chinese state-owned banks are experiencing a downward in profitability, as the labor costs continue to rise and interest rates are progressively liberalized.

The impacts exerted by risk and competition and other factors on bank profitability in China were analyzed by Tan (2016). The banks were split into 3 groups (i.e.4 state-owned commercial banks, joint-stock commercial banks, and city commercial banks) and explicated respectively by author. He used Lerner index and Herfindahl-Hirschman index as the measurement of the banks' competition. Meanwhile, the stability inefficiency, Z-score, and ratio of loan loss provision were used to measure the risk of banks. The traditional SCP hypothesis is not applied to Chinese banks while the result is shown in this paper the Chinese banking sector is a relatively competitive structure. In addition, he found the taxation and non-interest income had a significant and negative impact on Chinese banking profitability, but the labor productivity and inflation had an opposite impact.

Paolo Saona (2016) analyzed the data of seven Latin American countries commercial banks from 1995 to 2012. The study focus on five aspects of profitability factor: capital ratio, asset diversification, revenue diversification, market concentration and the legal and regulatory system. As with previous studies, the article also believes that higher concentration tends to be more profitable.

Chapter 3

COMMERCIAL BANKS OF CHINESE ECONOMY

3.1 Banking system in China

Chinese banking system is composed of central banks, regulatory agencies, self-regulatory organizations and banking and financial institutions.

The People's Bank of China is a central bank responsible for formulating and implementing the RMB-related policies, preventing and resolving financial risks and maintaining China's financial prosperity and stability from a macro perspective.

China Banking Regulatory Commission is a government agency that supervises banks, financial asset management companies and trust and investment companies. It was separated from the People's Bank of China in 2003 and is the product of China's further improvement of its financial regulation so as to make it more specialized and detailed.

China Banking Association is a self-regulatory organization in China's banking industry.

Banking financial institutions include policy banks, major commercial banks, small and medium-sized commercial banks, rural financial institutions, and China Postal Savings Bank and foreign-funded banks.

3.2 Economy environment and banking industry

China's economic environment has undergone major changes. The period of rapid economic growth has become a thing of the past. China's GDP growth rate presents a L-shaped curve, which shows that the gradual slowdown in China's economic growth is an obvious trend.
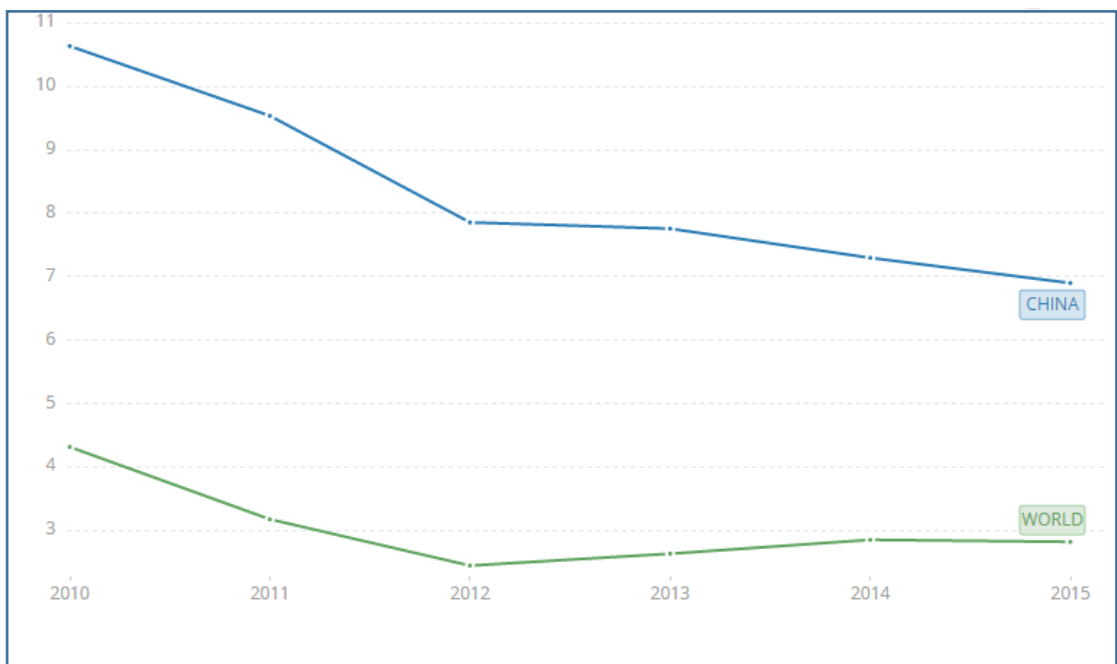
Figure 1: GDP growth 2010-2015

At the same time, China is experiencing market-oriented reforms. This reform includes many aspects, including interest rates, exchange rates, but also full competition within the financial system. Moreover, the invasion of Internet capital speeds up this process even more.

When it comes to the Internet, we have to mention the impact of technology on the entire banking industry. Its impact on the industry's profitability model, risk structure and regulation can be subversive. For example, the Ant Financial Services Group , through third-party payment technology to break the barriers to entry into the banking sector. Now it not only offers wealth investment product, but also provides personal deposits, credit services, directly compete with the banks.

3.3 Profitability of banks in China

In 2016, the growth rate of total net profit of city commercial banks was significant. The total net profit in the whole year increased at a rate of 13.76%. The net profit growth of state-owned commercial banks, joint-stock commercial banks and rural commercial banks was relatively low, while the net profit of foreign- Total profit decreased by 6.88%.
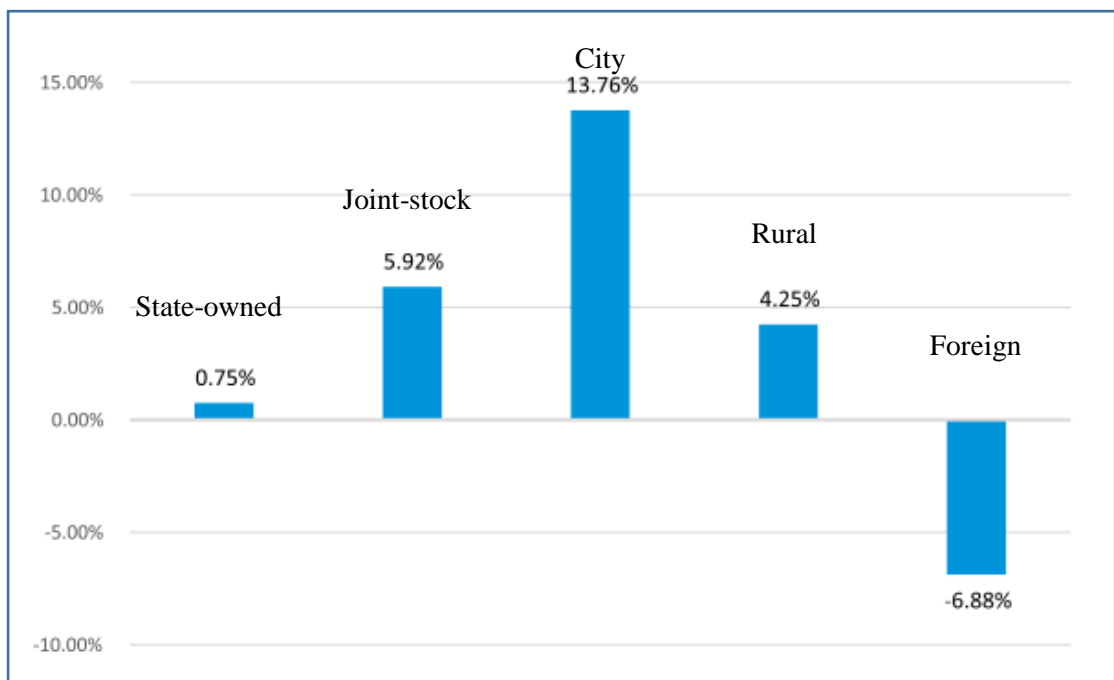
Figure 2: Banks total net profit growth
Source: https://assets.kpmg.com

In 2016, some foreign banks and some banks in the city commercial banking sector turned losses into profits or profit from breakeven in 2016, making the arithmetic average growth rate of net profit higher while that of joint-stock commercial banks maintained a steady net profit of 9.26% on average Growth, the state-owned large commercial banks and rural commercial banks increased relatively lower.
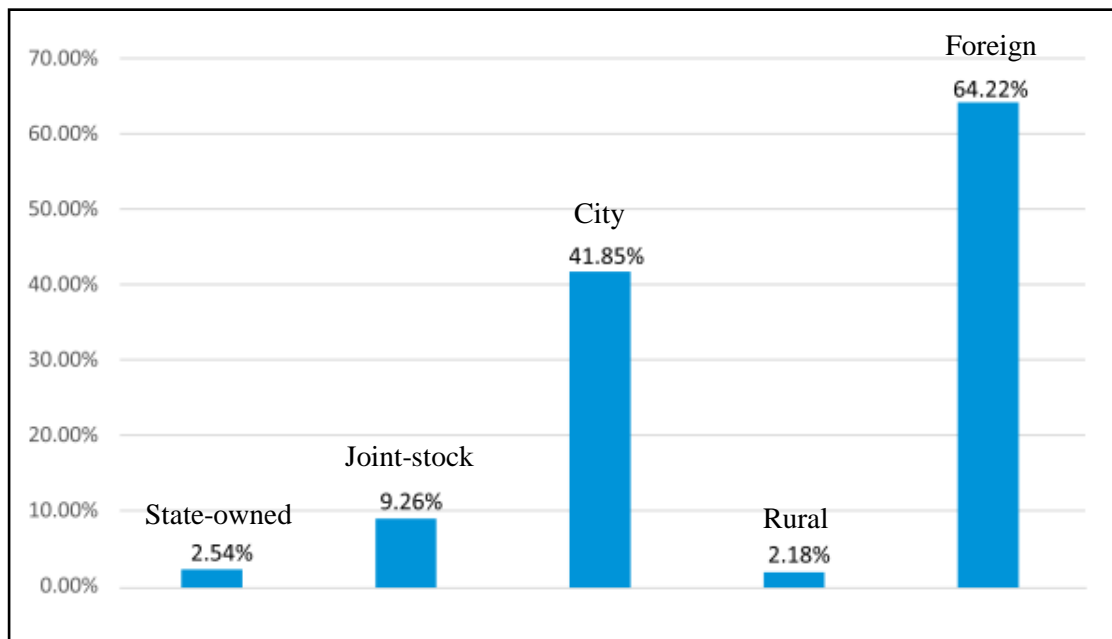
Figure 3: Average net profit growth
Source: https://assets.kpmg.com

Profitability of Chinese listed banks

A total of 16 Chinese banks listed in Shanghai and Hong Kong are listed together. Foreign banks listed overseas are not covered by this thesis.

The below figure shows the return on assets ratio of 16 Chinese listed banks from 2010 to 2015. During the whole period the average curve rose gradually from 2010 to 2012 and reached 1.20%. After a short plateau, the curve was replaced by a slight

decline to the 1.07%. The ROA trend of state-owned banks, joint-stock banks and city banks were roughly consistent. Moreover, the state-owned banks have performed the best and have maintained their advantage in ROA.
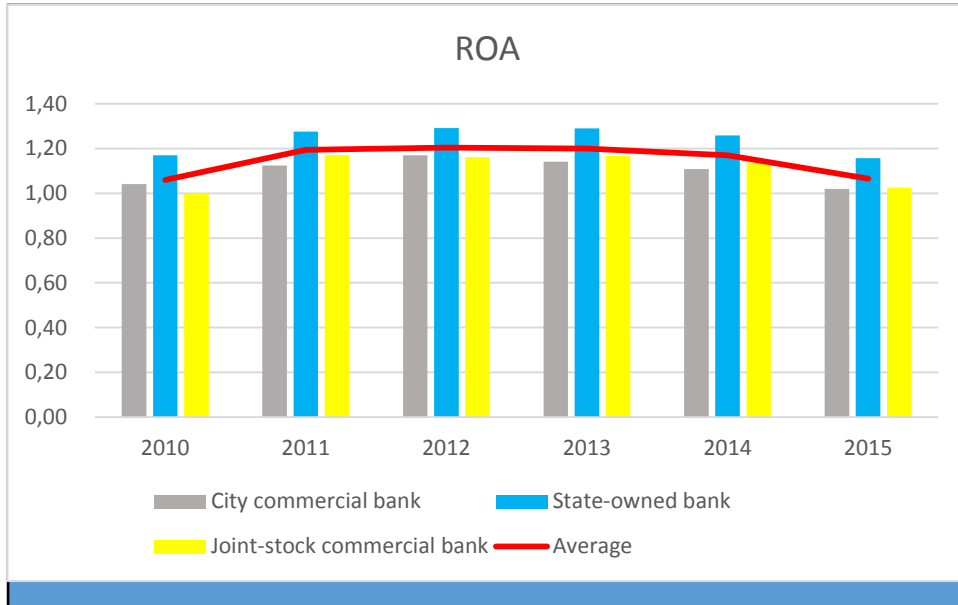
Figure 4: ROA 2010-2015

There is Figure 5 below, another profitability index:
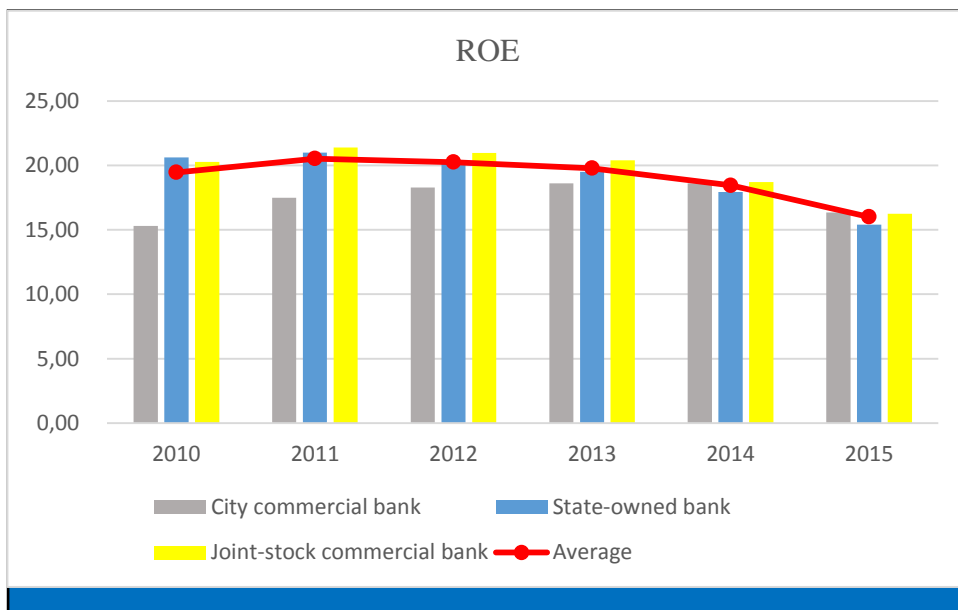
Figure 5: ROE 2010-2015

The above figure shows the return on equity ratio of 16 Chinese listed banks from 2010 to 2015. During the whole period the average curve rose gradually from 2010 to 2011 and reached 20.53%. Since 2011, the average ROE of listed banks has been accelerating declining.

The performance of state-owned banks and listed banks is unsatisfactory. In particular, the state-owned banks, which are large in scale and occupy a dominant position in the market for a long time, have lost their sense of smell to the market.

The best performance are city banks. Although these banks ROE has been below the state-owned and joint-stock banks until 2014, their profitability has been growing. With the overall decline in profitability of banks, city banks inevitably affected. Even so, the city banks' ROEs surpassed other types banks in both 2014 and 2015.

Chapter 4

METHODOLOGY

4.1 Dependent variable selection (measure of profitability)

The return on Equity（ROE） indicates the net profit earned by shareholders' investment. The higher the return on capital, the greater the return to shareholders. The performance of the bank can be better reflected by ROE, which is crucial for listed companies.

Therefore, it is very reasonable to choose roe as explained variable. At the same time, the collection of roe's data for six consecutive years can also better expose the profitability of China's listed banks.

4.2 Independent variables selection

The determinants of profitability are split into two categories in this thesis, i.e. Internal determinants and External determinants.

This paper primarily analyzes determinants of bank profitability from the perspective of risk. Thus, risk-based indicators are adopted in 3.2.1 to 3.2.4.

Table 1: Variable characteristics

Variables	Formula	Abbreviation
Internal determinants		
Return on Equity	Pre - tax return on equity	ROE
Non-Performing Loan ratio	Impaired Loans (NPLs) / Gross Loans	NPL
Reserve rate	Loan Loss Reserve / Gross Loans	RR
Z-score	(ROA+Equitiy to Assets ratio)/Standard Deviation of ROA	ZSC
X-Efficiency	rank x 0 to 1	EFF
Equity ratio	Total equity/Total loans	EQ
Non-interest income rate	Non-interest income/Total assets	NII
External determinants		
Market concentration	Herfindal - Hirschman Index	HHI

4.2.1 Asset quality

As the theory of bank crisis states, the anti-risk ability of commercial banks counts as the most basic prerequisite as they pursue the sustainability of profitability. As generally believed, the non-performing loan ratio is bound by the property of the bank's assets, as the higher the bank's non-performing loan ratio, the greater the bank default risk and potential economic losses. Accordingly, the bank profitability shall be lowered.

Therefore, the non-performing loan ratio is selected in this paper objectively to bespeak the asset quality of each bank.

4.2.2 Reserve rate

The reserve ratio of bad loans is a factor to make up loan losses and prevent loan risks. In other words, it is factor of bank risk prevention and control.

4.2.3 Bankruptcy risk

Z - Score serves as the bankruptcy risk factor in this study. This indicator is factored in by Demirguc-kunt and Huizinga (2010) to ascertain the probability of bank bankrupt after the Sub-prime mortgage crisis. This indicator equals to the ROA and Equity Ratio (Equity-to-Assets) divided by the sum of the standard deviation of ROA. As indicated by the research, smaller Z-score bespeaks higher bankrupt probability to a bank.

4.2.4 Liabilities

The equity ratio serves as a ratio to measure overall leverage effect. If the equity ratio is excessively small, enterprises are indicated to be over-indebted, and the ability of bank to withstand external shocks shall be weakened. If the equity ratio is excessively big, it bespeaks that banks tend to introduce the conservative business strategy.

4.2.5 Operational efficiency

The X-Efficiency is adopted in this paper to indicate the operational efficiency of banks. The higher the indicator, the higher the operational efficiency rank of banks. As found by Berger (1995), X-efficiency of most banks is bound by a high rate of return.

The cost efficiency of China's listed banks from 2010 to 2015 is estimated through adopting the translog function proposed by Berger, Klapper &Turk-Ariss (2009), and then the efficiency result was transformed into a unified rank order. On that basis, Lu et al. (2013)'s method is referenced in this paper and adopted as an explanatory variable to analyze profitability.

4.2.6 Non-interest income rate

Currently, the primarily revenue of commercial banks in China remains interest income, counting as the main business of bank profits. In these days, as the reform of market-oriented interest rates has been introduced, non-interest income has been

progressively significant and has become one among the factors for scholars to study the profitability of banks, especially for listed banks.

4.2.7 HHI

Given that merely 6-year data are selected, the number of selected banks is less than the total number of banks, with only 16 listed banks selected. In this regard, variables capable of representing the market structure are selected other than macro variables.

Structure-Conduct-Performance hypotheses (abbreviated as SCP) is that the bank shall gain more profit with the rise of the banking concentration. The market shares of the bank's total assets and the total market share of the bank's deposits are adopted to calculate the market share of the bank. Herfindahl-Hirschman index shall be necessarily adopted to measure market concentration. The Herfindahl Index, abbreviated as HHI, is advantaged to factor in all firms in the industry other than just large firms[3]. The relevant equation is presented below:

$$H = \sum_{i=1}^{n} (X_i / T)^2$$

Where, T denotes the total market size; n denotes the total number of enterprises in the industry; Xi denotes the various business-related values, market concentration in this paper in the light of deposit analysis.

153 banks were selected from 2010 to 2015 deposits as data to calculate the following results：

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[3] http://wiki.mbalib.com/zh-tw/Herfindahl-Hirschman Index

Table 2: HHI from 2010 to 2015

Year	2010	2011	2012	2013	2014	2015
HHI	0.1070	0.1027	0.0990	0.0940	0.0905	0.0867

HHI value is confined between 0 and 1 by and large, whereas the usual way to do this is to multiply its value by 10000 to enlarge it. Accordingly, HHI is required to be between 0 and 10,000. The HHI was adopted by U.S. Department of Justice and Federal Trade Commission (1997).

Table 3: Market standard of concentration

Market structure	concentrated				competition	
	Monopolized I	Monopolized II	Moderately concentrated I	Moderately concentrated II	Competition I	Competition II
HHI value	HHI≥3000	1800≤HHI< 3000	1400≤HHI< 1800	1000≤HHI< 1400	500≤HHI< 1000	HHI<500

Accordingly, the HHI of China's banking industry dropped successively from 1,070 points in 2010 to 867 points in 2015, and the state of the market is moderately changed from a moderate monopoly to competition.

4.3 Bank selection

16 commercial banks, i.e. overall listed companies, are involved in this study. Five large state-owned listed commercial banks are selected in this paper among the state-owned listed commercial banks, i.e. Industrial and Commercial Bank, Construction Bank, Agricultural Bank, Bank of China and Bank of Communication; Among the national joint-stock commercial banks, 8 listed commercial banks are selected, inclusive of China Merchants Bank, CITIC Bank, Industrial Bank, Pudong Development Bank, Mingsheng Bank, Everbright Bank, Ping An Bank and Hua Xia Bank; Eventually, Bank of Beijing, Ningbo and Nanjing 3 City Commercial Bank are selected in this paper.

Table 4: State-owned Banks

Bank	Abbreviation	characteristic
Industrial and Commercial Bank of China	ICBC	State-owned
China Construction Bank	CCB	
Agricultural Bank of China	ABC	
Bank of China	BOC	
Bank of Communication	BOCOM	

Source: https://www.bvdinfo.com

Table 5: Joint-stock and City commercial banks

China Merchant Bank	CMB	
China CITIC Bank	CITIC	
Industrial Bank Co. Ltd	CIB	
Shanghai Pudong Development Bank	SPDB	Joint-stock commercial banks
China Mingsheng Bank Co. Ltd	/	
China Everbright Bank	/	
Ping An Bank	/	
Hua Xia Bank	/	
Bank of Beijing	/	
Bank of Ningbo	/	City commercial banks
Bank of Nanjing	/	

Source: https://www.bvdinfo.com

4.4 Data sources and descriptions

As China's banking industry has been rapidly developed in recent years, the economic data concluded a few years ago fail to keep pace with the current situation of China's economic development. Accordingly, this paper selects data from the data

panel of 2010-2015 home-based listed commercial banks, and 96 samples of 16 listed commercial banks in total were obtained in 6 years.

Table 6: Descriptive statistics of variables

variable	sample size	average	SD	min	max
ROA(%)	96	1.149	0.164	0.635	1.475
NPL	96	0.994	0.363	0.378	2.389
RR	96	2.468	0.617	1.359	4.526
Z-score	96	106.287	79.744	27.231	450.597
EQ	96	6.220	0.839	3.412	8.565
EFF	89	0.500	0.311	0.000	1.000
NII	96	0.577	0.241	0.158	1.316
HHI	96	0.097	0.007	0.087	0.107

The financial data of listed commercial banks are collected from Bankscope, and some of the data originate from statistics released by China Banking Regulatory Commission. Excel is firstly adopted to store and calculate the data, and Eviews 8 is secondly adopted for empirical analysis.

4.5 Model introduction

Because the data sample selected contains three aspects of information, variable indicators, individual bank, time information, and panel model can reflect these three aspects, panel data than the time series data, cross-sectional data more in line with the actual situation, can be carried out More comprehensive and in-depth research. Therefore, this paper selects the panel data model to make empirical research on profitability and its influencing factors.

There are three types of panel model: pooled model, fixed-effects model and random effects model, the general expression is:

$$y_{it} = \alpha_{it} + X_{it}^{'} \beta_{it} + \varepsilon_{it}$$

Where y_{it} is the vector of response variable, $X_{it}^{'}$ means the k×1order explanatory variable vector, i means the number of samples, t means the time series, k means the number of variables, ε_{it} means the random error term, α_{it} and β_{it} represent the parameters to be estimated.

The pooled estimation model is expressed as:

$$y_{it} = \alpha + X_{it}^{'} \beta + \varepsilon_{it}$$

The most prominent feature taken on by the model is that for any individual, the intercepts are identical to regression coefficients, with neither individual differences nor structural changes.

Fixed effects model falls into 3 type:

Individual fixed effects model

$$y_{it} = \alpha_i + X_{it}'\beta_{it} + \varepsilon_{it}, N; t = 1,2,...,T$$

Time fixed effects model

$$y_{it} = \gamma_t + X_{it}'\beta_{it} + \varepsilon_{it}, N; i = 1,2,...,N$$

Individual time fixed effects model

$$y_{it} = \alpha_0 + \alpha_i + \gamma_t + X_{it}'\beta_{it} + \varepsilon_{it}, N; i = 1,2,...,N; t = 1,2,...,T$$

The biggest characteristic taken on by random effects model is that the change of α_i is not correlated with X_{it}. The equation can be denoted as:

$$y_{it} = \alpha_i + X_{it}'\beta_{it} + \varepsilon_{it}, N; i = 1,2,...,N; t = 1,2,...,T$$

The empirical analysis of the panel is based on a reliable model. Select the model needs further testing. By testing to choose a relatively suitable model for the real economy has a reference value. Therefore, we need to test each of them then select the best one for empirical research. This paper applies two test methods, F test and Hausman test. Select mixed model or fixed effect model, judge by test, choose random effect model or fixed effect model, judge by inspection.

4.6 Model settings

The bank profitability (ROE) serves as the dependent variable, the internal and external variables of 7 variables are adopted as independent variables to establish panel data model. Prior to establishing the model, unit root test requires to be performed. The first-order difference of variables shall obstruct its economic significance though the test results show that some individual variables are not stable.

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In addition, merely 6-year data from 2010 to 2015 are intercepted in this paper, with the comparatively narrow time span. Thus, the sample data is directly gone through the regression analysis, and the regression model is denoted as:

$$ROE_{it} = \alpha_{it} + \beta_1 NPL_{it} + \beta_2 RR_{it} + \beta_3 ZSC_{it} + \beta_4 EQ_{it} + \beta_5 EFF_{it} + \beta_6 NII_{it} + \beta_7 HHI_{it} + \varepsilon_{it}$$

4.7 The Profitability of the Empirical Analysis of Determinants

Hausman test

Hausman test is a further test. It is used to test whether the model should be tested for random effects, the process is as follows:

H0: The individual effects are not correlated with the regression variables (random effects model)

H1: The individual effects are correlated with the regression variables (Fixed Effect Model)

Using the software to carry on the individual random effects regression model estimation of the panel data in this thesis, only from the regression results analysis, this regression estimates the model, the fitting degree is average. The results shown in the table below:

Table 7: Hausman test

Test	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Hausman test	14.996750	7	0.0360

At a significant level of α = 0.05, P = 0.0360 <0.05 Therefore, this paper should reject the null hypothesis and choose a regression model of individual fixed effects for empirical research analysis.

The model is only 6 years in length, while the number of individuals is 16. This is a typical short-panel data, and the model selects the cross section weight option, considering the possible heteroscedasticity of short panels.

Model selected

Based on the previous model selection, this paper determined the use of individual fixed-effects regression model for estimation. Using the regression estimation of the model, the consistent estimation of each parameter is shown in the table.

$$ROE_{it} = 20.9971 - 4.5674 * NPL_{it} - 0.7494 * RR_{it} + 0.0014 * ZSC_{it} - 1.2692 * EQ_{it}$$
$$+ 8.7972 * EFF_{it} + 4.1687 * NII_{it} + 58.5025 * HHI_{it} + \varepsilon_{it}$$

Chapter 5

EMPIRICAL RESULTS

After the previous chapter's steps, this chapter is used to illustrate the results.By

Hausman test we conclude that this article should use the Fixed effect model.

Table 8: Fixed effect model results (unweighted)

Variable	Coefficient	t-Statistic	Prob.
Constant	19.951	2.596	0.012
NPL ratio	-4.324	-6.697	0.000
RR	-0.603	-1.089	0.280
ZSC	0.002	0.987	0.327
HHI	52.907	1.333	0.187
EFF	12.466	1.782	0.079
NII	3.697	2.240	0.029
EQ	-1.373	-4.771	0.000
R-squared	0.862	F-statistic	18.738
Durbin watson	1.873		

Table 9: Fixed effect model results (Cross-section weights)

Variable	Coefficient	t-Statistic	Prob.
Constant	20.997	4.982	0.000
NPL ratio	-4.567	-10.432	0.000
RR	-0.749	-2.199	0.031
ZSC	0.001	1.452	0.1513
HHI	58.502	2.821	0.006
EFF	8.797	1.937	0.057
NII	4.169	3.183	0.002
EQ	-1.269	-6.682	0.000
R-squared	0.961	F-statistic	74.505
Durbin watson	1.719		

NPL ratio

Unweighted: The coefficient of NPL ratio is -4.324 and the p-value is 0.0000.
Indicators for measuring the quality of non-performing loan ratio for each additional
1 percentage point, less profitable banks 4.324 percentage points.

Cross-section weights: The coefficient of NPL ratio is -4.567 and the p-value is 0.0000. Indicators for measuring the quality of non-performing loan ratio for each additional 1 percentage point, less profitable banks 4.567 percentage points.

From this article, listed commercial banks showed a negative correlation between NPL ratio and profitability. The high NPL ratio of listed commercial banks will cause banks to face higher risks, thus reducing their profitability. However, the low NPL ratio shows that banks have high profitability gained through high risk acquisition and less profitability.

Reserve rate

Unweighted: The coefficient of Reserve rate is -0.603 and the p-value is 0.280. It is not significant.

Cross-section weights: The coefficient of Reserve rate is -0.749 and the p-value is 0.031. It is significant in 0.05 level. Indicators for Reserve rate for each additional 1 percentage point, less profitable of banks 0.7494 percentage points.

Z-score

It is not significant in both of unweighted and cross-section weights model.

Equity ratio

Unweighted: The coefficient of Equity ratio is -1.373 and the p-value is 0.0000. Indicators for Equity ratio for each additional 1 percentage point, less profitable banks 1.373 percentage points.

Cross-section weights: The coefficient of Equity ratio is -1.269 and the p-value is 0.0000. Indicators for Equity ratio for each additional 1 percentage point, less profitable banks 1.269 percentage points.

EFF

Unweighted: significant in 0.1 level.

Cross-section weights:The coefficient of X is 8.7972 and the p-value is 0.057. It is significant in 0.1 level. Indicators for X for each additional 1 percentage point, more profitable banks 8.7972 percentage points.

Non-interest income

Unweighted: significant in 0.1 level.

The coefficient of Non-interest income is 4.169 and the p-value is 0.002. It is significant in 0.01 level. Indicators for X for each additional 1 percentage point, more profitable banks 4.169 percentage points.

HHI

Unweighted: not significant in 0.1 level.

Cross-section weights: The coefficient of HHI is 58.503 and the p-value is 0.003.It is significant in 0.01 level. Indicators for X for each additional 1 percentage point, more profitable banks 58.5025 percentage points.

It can be seen HHI has huge effect on profitability of listed banks. The concentration of market still cannot be ignored power.

Chapter 6

CONCLUSION AND SUGGESTIONS

Managers should reduce the NPL ratio. The regression results show that the NPL ratio is still the most important factor for harmful to the profitability of banks, and the notable significance is obvious. Therefore, the listed banks should improve the management mechanism and risk control so as to improve the bank's profitability by improving the quality of bank assets.

The non-interest income of the bank mainly includes the bank's financial revenue, all kinds of fee income, such as the collection and payment of bank bills, settlement of bills, transaction fees, agency fees and so on. As can be seen from the empirical results, the non-interest income of banks has an important impact on bank profitability. This shows that the current Chinese listed banks gradually increase their input in the intermediary business. With the rapid development of Internet finance, interest rate liberalization and the access of private banks, the competition in China's banking industry will become more intense and the bank will be broadened and upgraded The ability of intermediary business to increase the proportion of non-interest income in operating income may be the only way for banks to continue to make profits and develop continuously in the future.

The current impact of Z-score is not significant for China's listed banks, which means that over the years, the profitability of listed banks has not been much affected by bankruptcy risk, and as a precaution over the financial crisis banks can now relax.

It is clearly that result shows positive relationship between profitability and HHI. It means the more deposits concentrate on these listed banks the more profitability of them. To the whole banking industry, it is worth when the market concentration decrease, but for the state-owned banks is the fact they have to face: the profit is decline. They are losing control of market. Therefore, they have to look for more profit points.

By analyzing the determinants of profitability of China's listed banks, we can get a rough idea of the general situation of commercial banks in China. In an increasingly competitive environment, banks should increase their focus on non-interest income for better profitability. In this way, banks can gradually reduce the pressure on profitability due to competition and make more profits in new projects.

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Chinese)

APPENDIX

Table 10: pooled model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL_RATE	-4.650940	0.637439	-7.296291	0.0000
RESERVE_RATE	1.777478	0.307085	5.788221	0.0000
Z_SCORE	0.003481	0.002065	1.686270	0.0955
HHI	215.2937	10.73743	20.05078	0.0000
EFFIENCY	2.038397	0.562450	3.624136	0.0005
NON_INTEREST	8.279962	0.937727	8.829821	0.0000
EQUITY	-1.211938	0.190755	-6.353385	0.0000

Weighted Statistics			
R-squared	0.731236	Mean dependent var	21.80256
Adjusted R-squared	0.711570	S.D. dependent var	6.414602
S.E. of regression	1.694041	Sum squared resid	235.3215
Durbin-Watson stat	1.225720		

Unweighted Statistics			
R-squared	0.606931	Mean dependent var	19.21635
Sum squared resid	253.3958	Durbin-Watson stat	1.048467

Table 11: F-test

Redundant Fixed Effects Tests
Equation: EQ02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	22.815163	(15,66)	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ROE
Method: Panel EGLS (Cross-section weights)
Date: 01/10/18   Time: 10:56
Sample: 2010 2015
Periods included: 6
Cross-sections included: 16
Total panel (unbalanced) observations: 89
Use pre-specified GLS weights

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	31.34537	4.303146	7.284291	0.0000
NPL_RATE	-5.519064	0.804981	-6.856145	0.0000
RESERVE_RATE	0.841219	0.417171	2.016484	0.0471
Z_SCORE	-0.000548	0.001957	-0.279900	0.7803
HHI	-1.693485	34.66607	-0.048851	0.9612
EFFIENCY	4.401387	0.806199	5.459432	0.0000
NON_INTEREST	1.507047	1.496184	1.007260	0.3168
EQUITY	-1.812895	0.241230	-7.515204	0.0000

Weighted Statistics

R-squared	0.760585	Mean dependent var	28.19450
Adjusted R-squared	0.739895	S.D. dependent var	17.88390
S.E. of regression	2.526250	Sum squared resid	516.9370
F-statistic	36.76076	Durbin-Watson stat	0.799411
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.566290	Mean dependent var	19.21635
Sum squared resid	279.5953	Durbin-Watson stat	1.085363

Table 12: Random effect model

Dependent Variable: ROE
Method: Panel EGLS (Cross-section random effects)
Date: 01/10/18   Time: 10:58
Sample: 2010 2015
Periods included: 6
Cross-sections included: 16
Total panel (unbalanced) observations: 89
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.78410	4.656822	4.677890	0.0000
NPL_RATE	-4.460570	0.585079	-7.623875	0.0000
RESERVE_RATE	0.293884	0.410309	0.716249	0.4759
Z_SCORE	0.001705	0.001907	0.893924	0.3740
HHI	62.61057	33.00871	1.896789	0.0614
EFFIENCY	3.394897	1.052869	3.224424	0.0018
NON_INTEREST	4.065249	1.230018	3.305033	0.0014
EQUITY	-1.462089	0.251528	-5.812823	0.0000

Effects Specification

			S.D.	Rho
Cross-section random			1.072845	0.4606
Idiosyncratic random			1.161028	0.5394

Weighted Statistics

R-squared	0.703543	Mean dependent var	7.961691
Adjusted R-squared	0.677923	S.D. dependent var	2.175392
S.E. of regression	1.214866	Sum squared resid	119.5479
F-statistic	27.46096	Durbin-Watson stat	1.591076
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.634404	Mean dependent var	19.21635
Sum squared resid	235.6848	Durbin-Watson stat	0.969441

Table 13: Hausman test

Correlated Random Effects - Hausman Test
Equation: EQ02
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.996750	7	0.0360

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
NPL_RATE	-4.324346	-4.460570	0.074682	0.6181
RESERVE_RATE	-0.602948	0.293884	0.138452	0.0159
Z_SCORE	0.001916	0.001705	0.000000	0.5605
HHI	52.906914	62.610573	486.818244	0.6601
EFFIENCY	12.466471	3.394897	47.815533	0.1896
NON_INTEREST	3.696628	4.065249	1.210989	0.7376
EQUITY	-1.373192	-1.462089	0.019561	0.5250

Cross-section random effects test equation:
Dependent Variable: ROE
Method: Panel Least Squares
Date: 01/10/18   Time: 11:00
Sample: 2010 2015
Periods included: 6
Cross-sections included: 16
Total panel (unbalanced) observations: 89

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.95106	7.685122	2.596063	0.0116
NPL_RATE	-4.324346	0.645755	-6.696577	0.0000
RESERVE_RATE	-0.602948	0.553900	-1.088550	0.2803
Z_SCORE	0.001916	0.001941	0.986943	0.3273
HHI	52.90691	39.70382	1.332540	0.1873
EFFIENCY	12.46647	6.994574	1.782306	0.0793
NON_INTEREST	3.696628	1.650434	2.239791	0.0285
EQUITY	-1.373192	0.287797	-4.771383	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.861994	Mean dependent var	19.21635
Adjusted R-squared	0.815991	S.D. dependent var	2.706598
S.E. of regression	1.161028	Akaike info criterion	3.354362
Sum squared resid	88.96713	Schwarz criterion	3.997492
Log likelihood	-126.2691	Hannan-Quinn criter.	3.613589
F-statistic	18.73811	Durbin-Watson stat	1.873108
Prob(F-statistic)	0.000000		

Table 14: Fixed effect model

Dependent Variable: ROE
Method: Panel Least Squares
Date: 01/10/18   Time: 11:01
Sample: 2010 2015
Periods included: 6
Cross-sections included: 16
Total panel (unbalanced) observations: 89

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.95106	7.685122	2.596063	0.0116
NPL_RATE	-4.324346	0.645755	-6.696577	0.0000
RESERVE_RATE	-0.602948	0.553900	-1.088550	0.2803
Z_SCORE	0.001916	0.001941	0.986943	0.3273
HHI	52.90691	39.70382	1.332540	0.1873
EFFIENCY	12.46647	6.994574	1.782306	0.0793
NON_INTEREST	3.696628	1.650434	2.239791	0.0285
EQUITY	-1.373192	0.287797	-4.771383	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.861994	Mean dependent var	19.21635
Adjusted R-squared	0.815991	S.D. dependent var	2.706598
S.E. of regression	1.161028	Akaike info criterion	3.354362
Sum squared resid	88.96713	Schwarz criterion	3.997492
Log likelihood	-126.2691	Hannan-Quinn criter.	3.613589
F-statistic	18.73811	Durbin-Watson stat	1.873108
Prob(F-statistic)	0.000000		

Table 15: Fixed effect model(Cross-section weights)

Dependent Variable: ROE
Method: Panel EGLS (Cross-section weights)
Date: 01/10/18   Time: 11:02
Sample: 2010 2015
Periods included: 6
Cross-sections included: 16
Total panel (unbalanced) observations: 89
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.99711	4.214228	4.982433	0.0000
NPL_RATE	-4.567370	0.437811	-10.43228	0.0000
RESERVE_RATE	-0.749380	0.340773	-2.199059	0.0314
Z_SCORE	0.001359	0.000936	1.451652	0.1513
HHI	58.50248	20.74136	2.820571	0.0063
EFFIENCY	8.797176	4.541299	1.937150	0.0570
NON_INTEREST	4.168703	1.309690	3.182968	0.0022
EQUITY	-1.269218	0.189956	-6.681630	0.0000

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.961293	Mean dependent var	28.19450
Adjusted R-squared	0.948390	S.D. dependent var	17.88390
S.E. of regression	1.125298	Sum squared resid	83.57558
F-statistic	74.50487	Durbin-Watson stat	1.718688
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.859435	Mean dependent var	19.21635
Sum squared resid	90.61657	Durbin-Watson stat	1.806234