Determinants of Chinese Listed Commercial Banks' Profitability—Under A GMM Approach

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***Abstract*—This paper investigates macroeconomic determinants of listed Chinese commercial banks' profitability based on the period from 2007 to 2016. We use the system generalized method of moment (GMM). The estimation results are different from earlier studies of bank profitability on both international banks and Chinese banks which suggests that attention should turn to Chinese special economic environment. Generally, bank profitability is affected by macro and bank-specific factors.**

***Index Terms*—Chinese economy, bank profitability, GMM**
JEL classification number: G21.

I. Introduction

China has one of the fastest growing economies in the world today and, as such, it has an extremely powerful influence on the global economy. The great financial crisis of 2007, which began in the USA and spread to the rest of the world, led to the rapid growth of China's economy being stopped in its tracks. However, it began to recover from the beginning of 2009 after undergoing a bear market, but during the decade, domestic economic growth is largely based on government investment rather than consumption, personal investment and imports and exports causing many legacy problems.

Nowadays, bank acts as the soul of financial intermediates in an economy. Listed commercial banks take overwhelmingly capital and other resources. Therefore, there is necessity to identify the determinants of the profitability of market listed commercial banks and provide feasible advices for both bank manager and government regulators.

The long-term income of commercial banks has traditionally been derived from the spread of interest. The Chinese government began to liberalize the financial system in recent years, including the relaxation of the ceiling of loan interest rates and the floor of deposit rates [1], causing the bank profit to shrink. At present, financial products and services have gradually become their main source of income, especially in USA and EU Member States.

There still exists discrepancy between American and Chinese banks from the fact that the income of Chinese banks is still mainly derived from the spread of loan and deposit interest rate and their reform is still progressing. Although many researchers have put their efforts into identifying the determinants of bank profitability over time, most of them have focused on developed countries and empirical research of Chinese commercial banks is strikingly scarce. Therefore, there is a need to investigate the results of China's bank reform and find the significant factors that affect the profitability of Chinese commercial banks.

This study is meaningful for both bank executives, the financial sector and the government in terms of its analysis of the determinants of bank profitability and the way in which Chinese commercial banks currently make a profit.

Different factors have been introduced into the model and empirical analysis and the rest are the corresponding advises. Factors that may affect the profitability has been examined, including capital adequacy (EA), credit risk (LA), quality of assets (NPLR), efficiency, bank size (INA), interest rate spread (Spread), inflation (CPI) and economic development level (GDP).

Through the empirical analysis, this research can ascertain the extent to which bank-specific characteristics and macroeconomic factors contribute to the profit of Chinese listed commercial banks. Our research is an extension of earlier studies related to banks' profitability based on more recent data. It is expected that bank managers and the regulatory authorities can establish a more effective policy and improve specific aspects of their management based on the influence of these determinants of bank profitability analyzed in this research.

This paper is structured as follows: literature related to the determinants of banks' profitability is discussed in Section II with a brief review of important theories and empirical analysis. The methodology applied in this paper is explained in Section III. The empirical results are discussed in Section IV and finally, several findings are summarized in Section V as conclusion.

II. Literature Review

The determinants of banks' profitability have been reported in a large volume of the literature and they are generally divided into internal and external factors. Most literatures focus on analyzing the relationship between market structures, risk, bank efficiency, return and profits. The literature mainly includes two parts, one of which contains studies of the impact of a single factor like [2], [3], while the other consists of studies of the influence of multi-determinants on banks' profitability [4]–[6]. The single factor model is more focused on a structure-conduct-performance hypothesis (SCP) [1] and a

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[1] SCP state there is positive relationship between interest rate margin and market power which is represented as the concentration ratio.

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relative-market-power hypothesis (RMP). However, Berger argues that examining banks' profitability using only one factor lead to a very weak formula since the R-square failed to reach even 10% [3]. This finding is extremely meaningful to subsequent studies of banks' profitability and researchers began to focus more on multiple determinants, [4], [6]–[8].

Reference [7] suggests that the market power strongly affects banks' profit in a positive way and meanwhile, the RMP theory claims that only companies with large shares of the market and unique products have the market power to charge higher prices [9]. While reference [3] suggests that banks' profit did not increase with an expansion of scale or an increase in market share, which conflicts with SCP hypotheses respectively.

The assertion of an SCP hypothesis is that a higher market concentration increases profit, But Smirlock tests the structure-conduct-performance hypothesis and found that the market share and profitability are related and the higher concentration is unrelated to banks' profitability after reaching an appropriate proportion of the market [2].

The assertion of SCP hypothesis actually suggests that high concentration ratio increases bank profit, since banks' expenditure is low and they earn monopoly rent (lower deposit rates and higher loan rates). Bourke finds government ownership and long-term bond rates do not appear to affect banks' profitability [10]. This is in contrast to Molyneux and Thornton who find that the government ownership ratio makes a positively significant contribution to high profit, meaning that government-owned banks outperform their competitors in the private sector [4]. He explains this as the fact that government-owned banks can keep a lower capital ratio which suggests that the government underwrites their activities. The results also showed that the growth rate of assets has a negative impact on banks' profitability [4]-[6].

Findings on bank profit determinants suggest that an important factor is Capital ratio and liquidity risk. Reference [10], [11] show that this factor has a positive influence on banks' profitability. Tan and Floros also find credit risk in Chinese commercial bank [12]. However, other research find the contrary result, that a significant negative relationship between liquidity risk and profitability [5]. Molyneux and Thornton find a negative relationship between return on capital and liquidity, implying that liquid assets have low profit or no profit return [4]. Bourke concludes that different findings are due to the period of data collection and country selection [10]. Miller and Noulas also claim that credit risk has an inverse effect on the profitability of banks in the United States. They show that poorly performing banks tend to accept riskier loans leading to higher loan loss and lower profit [13].

It is interesting to note that Reference [14] find that loan to assets ratio has a negative effect on banks' profitability, which is opposite to other studies. This may imply that these Turkish banks could not absorb the risk from loans causing losses [14].

Reference [12] report that the Chinese commercial banks suffer from serious problems of under-capitalization and non-performing loans. This research finds a significantly positive size effect. There is plenty of research examining the influence of banks' size, but there is no certain answer for the direction of this estimator. Reference [5], [13], [14] show significant size effect, Reference [15] show that size is not significant to explain the bank profitability.

Reference [15] test the hypothesis that state-owned banks can achieve better performance using the government's fiscal policy tool [15], [16]. Rahman and Reja study the impact of ownership structure on bank performance [17]. Reference [18], [19] find a significant size effect on profitability of Chinese commercial banks.

Macroeconomic factors like GDP are also found to be significant determinants. Reference [20] find that banks' profitability is a negative function of GDP and a positive function of their inflation [20]. Tan and Floros study Chinese banking sector and find that the growth rate of GDP has a positive relationship with banks' profitability, but the inflation ratio is inversely related to bank profitability [12].

III. Methodology

A large number of researchers who have examined the determinants of banks' profitability set up a linear relationship between banks' profitability and the relevant factors. Also, early researchers found that the linear form performs better than any other functional form [7]. They mainly used two methods to deal with panel data, namely, the GMM model and the fixed (or random) effects models. In earlier literature, the static panel data always applied the OLS, but the GMM model is now increasingly popular in bank profitability research, since it deals with dynamic relationships and overcomes estimator bias.

GMM model uses the lagged and original value of exogenous variable as instruments to address endogeneity. GMM is also tolerant of heteroscedasticity, autocorrelation and allows the error term to correlate with the exoplanetary variables.

Considering that banks' profitability determinants tend to be consistent over time, a dynamic specification is used to address this problem in this study by using the System GMM estimator to include the lagged value of endogeneity variables as shown below;

$$\prod_{it} = c + \sum_{j=1}^{J} \beta_j X_{it}^{j} + \sum_{m=1}^{M} \beta_m X_{it}^{m} + \varepsilon_{it}$$

$$\varepsilon_{it} = \mu_i + v_{i,t}$$

where $\Pi_{it}$is the profitability ratio of banks. c is the intercept. The explanatory variables are categorized by bank-specific and macroeconomic determinants. X_{it}^{j} are bank-specific explanatory variables and X_{it}^{m} are lagged macroeconomic varables. $\varepsilon_{it}$is the error term and can be divided into an unobserved bank-specific time-invariant effect. $v_{i,t}$ is the idiosyncratic error term that is independent to banks.

Ten variables that are related to banks' profitability are selected for this empirical research. Two of them are dependent variables, representing banks' profitability. The others are bank-specific factors and macroeconomic determinants that are likely to affect banks' profitability. Bank-specific factors are included as endogenous variables in the empirical analysis. As suggested by Heffernan and Fu, all macroeconomic factors are included as exogenous variables

[21]. Following Garcia-Herrero *et al*. [1], this empirical work instrument for all regressors except for those which are clearly exogenous. Furthermore, Roodman also suggests that System GMM is appropriate for cases where the explanatory variables are not strictly exogenous [22]. The chosen variables are shown in Table I below.

TABLE I: DEFINITIONS, NOTATIONS OF EXPLANATORY VARIABLES

	Variable	Measure	Notation
Dependent variable	Profitability	Return on assets=Net profit/Total Assets	ROA
		Net interest income/ Average earning assets	NIM
Bank specific variables	Capital adequacy	Equity/Total Assets	EA
	Credit risk	Total loan/ Total assets	LA
	Assets quality	Non-performing loan/ Total loans	NPLR
	Productivity	Real gross total revenue/ Number of employees	PROD
	Assets size	Natural Logarithm of Total assets	INA
Macroeconomic variables	Interest spread	Legal loan and saving interest spread	Spread
	Inflation	Annual Inflation Rate (consumer price index)	CPI
	Economic development	Annual real GDP growth rate	GDP

Banks' profitability has been measured in many ways in earlier research. The ROE and ROA are the most prevalent proxies for banks' profitability. Net interest margin (NIM) is also widely used in international studies. ROA may be more appropriate in this case when considering Chinese banks' background when bank equity remains at a very low level in the initial years and underwent several enormous recapitalization changes. Therefore, based on the fact that ROA may be the most suitable indicator, it is chosen as the dependent variable in this study. Reference [13] and [20] also chose ROA as the only dependent variable. A high ROA implies that a bank is managed well and is using its assets in a highly efficient way to generate revenue.

Another option is the Net Interest Margin (NIM), which has also been used to measure banks' profitability by researchers like Angbazo [5]. This ratio could be a good indicator of banks' profitability, while the interest rate is closely related to different banks' management and performance.

Eight explanatory variables are used in this study to measures bank-specific factors: (Equity to assets (EA), Loan to Assets (LA), Non-performing loan ratio (NPLR), PRODUCTIVITY, assets in Natural logarithm) and other three macroeconomic variables (Interest spread, CPI, GDP).

A. Bank Specific Factors

The equity-to-assets ratio (EA) is used to measure banks' capital strength [23], [24]. The equity-to-assets ratio is expected to have a positive impact on this variable because a larger percentage of bank equity also suggests that the bank has more funds with a lower cost of capital [4]. Some researchers found an inverse relationship between banks' profit and the EA ratio. A low equity-to-assets ratio means that a bank has more debt, which can save more money by a tax shield [6].

The loan to assets ratio (LA) reflects the bank's loan risk and quality of assets, since a higher LA ratio means that the bank has a greater percentage of loans and a higher default risk as well as higher profit. LA is generally expected to have a positive relationship with banks' profitability [3], since loans are one of the assets that has a very high expected return [6]; however, this ratio may turn negative when a bank takes unacceptable risks and incurs loss as a result.

The quality of assets is the key factor that affects banks' profitability. Another alternative ratio to measure credit risk is the non-performing loans ratio (NPLR), for investigating Chinese banks' profitability [1], [12].

A great many researchers in the literature utilize revenue divided employees to reflect the bank's productivity [23].

The size of the bank is also considered to play an important role in its profitability, but there is no consensus on the direction of this factor. Many researchers have found that size has a significant effect on a bank's profitability ([6] and [14]). On one hand, economies of scale may cause a variation in the cost of collecting and processing information for banks of different sizes. On the other hand, large banks are also harder to manage and their size leads to inefficient management (Garcia-Herrero *et al*. [1]). Angbazo [5] finds a significantly positive relationship between size and banks' profitability, whereas Sitroh and Rumble [25] find the opposite. The total assets are included in this study in a natural logarithm represented as LNA.

B. Macroeconomic Profitability Determinants

Chinese commercial banks earn most of their income from spread of savings and loan interest (spread). Therefore, this is a vital factor for bank profit. Ho and Saunders [26] directly build the model to study the relationship between the bank's margin and spread of deposit and lending rates. Observations from the last decade show that percentage of revenue from net interest spread is far larger for Chinese commercial banks than other banks. [2]

The annual real gross domestic product growth rate (GDP) and consumer price index (CPI) are chosen as determinants of the macroeconomic profitability in this study, since macroeconomic factors like inflation and economic development would affect the amount of deposits and borrowers capability to repay [1]. Demirguc-Kunt and Huizinga [27] find that the growth of GDP has a positive relationship with banks' profitability. However, researchers such as Berger *et al*. [28] and Smith.*et al*. [29] report a negative relationship between ROA and GDP and suggest that the competition of interest rates is fiercer in a more developed financial environment leading to lower profit. The consumer price index (CPI) is used in this study to adjust GDP growth rate to reflect inflation. According to Perry [30], inflation rate can be estimated to be either positive or negative, depending on whether inflation is anticipated or unanticipated. Based on the conventional knowledge of banking, banks will increase their interest rates to match the increasing cost when inflation is anticipated, and will be slower to increase them when inflation is unanticipated; hence, the revenue cannot cover the cost and reduction of banks' profitability.

[2] The percentage is 51% for Deutsch Bank, 61% for Hang Seng Bank, 49% for Citi Bank, 60% for Mizuho Bank of Japan and 75% for the big four national banks in China.

IV. Data and Empirical Analysis

A total of 22 commercial banks are listed in China up to January, 2016. Five of them are only listed on the Hong Kong Stock Exchange and their financial reports follow the international financial reporting standards; therefore, they are excluded from the sample. Among the 17 remaining banks, we also take out the Agricultural Bank of China (ABOC), China Everbright Bank (CEB) and the Bank of Jiangsu (JSBC) due to short listed time. Therefore, based on the availability of data and the statistical caliber of the consistency and continuity of the sample data, the quarterly data of 14 listed Chinese commercial banks is examined over the period between 2007 and 2016.

A total of 39 quarters' data from 2007Q3 to 2016Q4 is used to facilitate the GMM estimation. In this case, the "T" is relatively small, but the number of observation is sufficiently large to be appropriate for the System GMM, [22]. A summary of the statistical descriptive data is provided in Table II with detailed information. The results of the GMM estimation are shown in Table IV.

The descriptive statistics of all the variables of the sample banks between 2007q3 to 2016q4 are shown in Table II. The values of ROA, EA, LA, NPLR, Productivity, GDP, CPI and Spread are in percentages and size is the natural logarithm of the total assets (LNA).

TABLE II: Descriptive Statistics

Variable	Mean	St.dev	Min	Max
ROA	1.2046	0.2524	0.1485	2.0112
NIM	36.0879	8.3650	7.7600	58.5600
EA	6.0385	1.3516	2.2041	13.0713
LA	49.5942	7.6230	27.8884	74.6869
NPLR	1.1579	0.6285	0.0340	6.4100
PROD	49.1886	17.2719	16.6977	110.6245
LNA	6.2030	0.7188	4.4680	7.3827
Spread	3.0816	0.1589	2.8500	3.5380
GDP	8.7289	2.0581	6.4000	14.3000
CPI	2.9566	2.2275	-1.5310	8.0910

This table contains the mean, standard deviation, maximum and minimum value. It can be seen that the mean value of ROA is 1.20, which is the average level across the world. Reference [28] report a 1.03 ROA in US banks. It is worth mentioning that this ratio has apparently increased compared to earlier research on Chinese banks (Reference [21] report a ROA of 0.489 during the period from 1999 to 2006). This table also indicates a relatively small gap between the maximum to minimum and the standard deviation. Reference [21] document a level of -10.81 for Min and 7.94 for Max. The standard deviation is 0.25 which has also improved from the earlier level of 0.358 [21]. NIM shows a relatively dramatic change in this time with the min to be 7.76 and max to be 58.56 which suggests that this value is not stable in sample period.

The average loan to assets ratio (LA) is 49.59. According to [6], this value is within the normal range of European Countries, which stands at 54. The mean value of non-performing loan ratios (NPLR) is 1.16. It can be seen that the number of non-performing loans reduced after the Chinese financial reform and bank rectification, since [1] report 13 for the mean value of NPLR over the period from 1997 to 2004. In terms of the efficiency ratio (productivity), the mean value is 0.3104. Chinese bank efficiency is comparatively low compared with the efficiency of Greek banks with the mean value to be 2.27 [23]. The interest spread of savings and loans is relatively stable with a mean value of 3, which mildly fluctuated as the standard deviation is 0.16, with 2.85 being the minimum and 3.534 being the maximum. This is because Chinese government has adhered to policy continuity since China's financial reform and try to create a sound financial environment for banks.

It is worth noting that, although the mean value of GDP growth rate is 8.72, the minimum and maximum values are 6.4 and 14.3 respectively. China is in the high-speed development stage during the sample time. Although it stepped into a medium-high speed stage after 2012, China is still one of the fastest-developing countries in the world. Reference [22] report a mean of GDP growth rate of 4.8 among European countries.

TABLE III: The Correlation Matrix of All the Variables Used in the GMM Model

	ROA	NIM	EA	LA	NPLR	PROD	LNA	Spread	GDP	CPI
ROA	1									
NIM	0.5758	1								
EA	0.5503	0.2561	1							
LA	-0.0181	-0.0817	-0.1103	1						
NPLR	-0.1347	-0.2611	-0.0072	0.1068	1					
PROD	-0.2085	-0.1538	-0.0279	-0.3891	-0.2263	1				
LNA	0.2584	0.0771	0.1323	0.1743	0.1045	-0.2909	1			
Spread	0.1367	0.0863	-0.0487	0.2201	0.3175	-0.4153	-0.2527	1		
GDP	0.0113	0.0696	-0.1081	0.2565	0.2131	-0.3833	-0.2135	0.8059	1	
CPI	0.2724	0.0824	0.0664	0.0113	0.0798	-0.1276	-0.1091	-0.2527	0.1186	1

It can be seen from Table III that the dependent variable ROA is related to other explanatory variables to a certain extent, but NIM is not highly correlated with any other variable. ROA is shown to be correlated with EA (0.55), Lna (0.26), CPI (0.27) and NPLR. NPLR has a significantly negative correlation with ROA. They also report a highly positive correlation between ROA with EA. The only

anomaly is that the degree of correlation between GDP and Spread is 0.8. Although these two factors are not known to have a direct relationship, they are still included here, since both are important factors included in other research [1]. All in all, the correlation matrix shows that there is no strong correlation between these variables which may cause a multi-collinearity problem.

A System GMM estimator is applied to examine the determinants that affect commercial banks' profitability. The empirical results and several robust tests are shown in Table IV.

TABLE IV: SYSTEM GMM MODEL

ROA	Estimated Coefficient	Standard error	z-statistic	P-value	NIM	Estimated Coefficient	Standard error	z-statistic	P-value
EA	0.0677***	0.1078	6.28	0.000	EA	1.6535	2.6156	0.63	0.527
LA	-0.176***	0.0055	-3.21	0.001	LA	-0.9804	0.8158	-1.20	0.229
NPLR	-0.1798***	0.4026	-4.47	0.000	NPLR	-6.1884	5.0864	-1.22	0.224
PROD	-0.0011	0.0014	-0.78	0.438	PROD	0.1938	0.2235	0.87	0.386
LNA	0.2384**	0.7592	3.14	0.002	LNA	6.6761	6.4823	1.03	0.303
Spread	2.5443***	0.6934	3.67	0.000	Spread	38.9644**	15.6158	2.49	0.013
GDP	-0.1096**	0.3167	-3.46	0.001	GDP	-0.9261	0.6969	1.33	0.184
CPI	-0.4256**	0.178	-2.38	0.017	CPI	-1.1608*	0.6951	-1.67	0.095
Wald	180.9	p=0.000			Wald test	96.7	p=0.000		
AR(1)	-0.65	p=0.515			AR(1)	-0.80	p=0.424		
AR(2)	0.47	p=0.640			AR(2)	0.29	p=0.768		
Hanse	2.11	p=0.910			Hansen test	11.26	p=0.096		

Note: The dependent variables are ROA and NIM. *,** and *** denote this estimator are significant at 10%, 5%, and 1% significant level respectively. EA, LA, NPLR, Productivity, Spread, GDP, CPI are measured in percentage, LNA is

A two-step GMM model and a series of robust tests are conducted. Table IV shows the regression results. It can be seen that as a proxy for profitability, ROA is a better dependent variable compare with NIM. At the 10% significance level, the empirical results show that 7 out of the 8 variables have significant relationship with ROA.

It's important that variables show the same direction for ROA and NIM. But only two variables have significant relationship with NIM. Therefore, the results of this study are mainly analyzed based on ROA. The Hansen test for ROA is 2.1 with the Prob > chi2 = 0.910, which is insignificant at a 5% significance level. This test is also insignificant for NIM at 5% significance level. This means that this model cannot reject the null hypothesis that the instrumental variables are effective; therefore, the instrumental variables are not suffering from over-identification in present work. For ROA, the AR (1) is -0.65 with a p value of 0.515, which means that, since the model cannot reject the null hypothesis, there is no first-order serial correlation. The null hypothesis of the second-order correlation also cannot be rejected based on an insignificant AR (2), with a p-value of 0.64. This suggests that the present model did not suffer from a second-order correlation problem.

In terms of explanatory variables, the parameters of all determinants can properly explain banks' profitability. It can be seen that the capital factor EA ratio has positive influence on banks' profitability and at a significant level for ROA. [20] explain that this is because banks with a higher capitalized structure need less external funding. The parameter of EA is estimated to be 0.068. Chinese commercial banks were mainly founded in the 1970s and were transformed from an enterprise system into a stock right system after China's financial reform. The aim of this financial reform was trying to assist Chinese commercial banks to adapt to the modern enterprise management mode. The empirical results of this study reconfirms that banks with a greater percentage of equity achieve higher profit.

It is worth noting that LA, which represents credit risk, has an inverse relationship with profitability. This result is reminiscent of Sufian and Habibullah [31] and Garcia-Herrero *et al*. [1] study in Bangladesh and China. Garcia-Herrero *et al*. [1] report a value of -0.001 for a net loan to assets ratio when studying Chinese commercial banks between 1999 and 2006. There are two reasons for this inverse relationship, the first of which is that Chinese commercial banks made a great many stagnant loans and had bad debts during the sample years. Although this ratio is normally expected to be positive because banks have traditionally made profit by offering loans, the loan to asset ratio may become negative if they take unacceptable risks. In China, the government intervenes in the operation of commercial banks to a certain extent and it issued a huge number of loans after the 2008 financial crisis in order to stimulate economic growth. Since a large proportion of these loans could not be withdrawn afterwards, the banks' profitability tended to decrease when they offered more loans. Secondly, the negative LA also provides a clue that commercial banks are supposed to be making a profit in other ways, such as providing financial services and products. As mentioned above, commercial banks have traditionally earned most income from interest payable on loans. However, since the lending rate continued to decrease after the liberalization of interest rates due to fierce competition among commercial banks, they cannot improve productivity simply by lending.

As expected, the quality of assets ratio (NPLR) shows an inverse relationship with ROA at 1% significance level. The parameter of NPLR is -0.18 with a p-value of 0.00. These results are consistent with other findings such as Staikouras and Wood [6] and Athanasoglou *et al*. [23]. Therefore, NPLR has an inverse relationship with bank profit.

The average of all ratios of these 14 banks in the period of

2007 to 2016 is shown in Table V below.

TABLE V: THE AVERAGE OF ALL RATIOS OF THESE 14 BANKS FROM 2007 TO 2016

	ROA	NIM	EA	LA	LNA	PROD	NPLR
ICBC	1.38	41.35	6.50	50.29	7.19	28.97	1.43
CCB	1.49	39.67	6.66	53.21	7.09	31.14	1.43
BOC	1.21	34.72	6.46	53.42	7.06	31.05	1.48
BOCOM	1.15	36.07	6.28	54.02	6.66	39.30	1.31
CMBC	1.36	35.23	5.84	55.17	6.48	52.96	1.04
CNCB	1.18	33.86	6.66	56.19	6.41	54.60	1.08
CIB	1.21	39.07	5.12	41.80	6.39	53.84	0.85
CMSB	1.22	31.26	5.68	52.16	6.38	53.71	1.01
HXBC	0.77	27.64	4.55	50.78	6.09	52.18	1.33
BOB	1.26	43.83	6.60	44.44	5.94	71.14	0.98
BNJ	1.30	39.13	7.61	36.70	5.47	58.80	1.06
NBCB	1.28	37.51	6.63	42.42	5.46	43.49	0.76
SPDB	1.08	36.77	5.02	51.77	5.28	67.73	0.96
Ping An Bank	0.96	29.14	4.95	51.95	4.94	49.75	1.48

The only variable that is insignificant for ROA is productivity. Although this variable is rejected at a 5% significant level, it is still worth noting that the coefficient of productivity is negative. It is common knowledge that higher productivity improves banks' profitability. However, the negative sign implies a special environment for Chinese banks. It is well-known that big commercial banks have relatively low profitability, but the negative effect of low productivity should have been eliminated by the size effect. It can be seen in Table V that major state-owned commercial banks (such as ICBC, CCB, and BOC) have quite low productivity and colossal sizes. As for size effect, the positive relationship can be seen from the table. The estimation of the natural logarithm of total assets (LNA) reached a 0.1% significance level represented by 0.24 when the dependent variable is ROA. This finding is consistent with most research on foreign banks and implying that the bigger Chinese commercial banks are, the higher the profitability they could achieve. Based on Chinese background, those banks that account for a large share of the market are mainly state-owned. Therefore, the significant positive size effect is quite reasonable. The finding of the size effect is quite different among vast literatures, from La Porta *et al*. [32], who find a negative effect and Molyneux and Thornton [4], Heffernan and Fu [21], who find a positive effect using a fixed-effect model and Eichengreen and Gibson [21] who suggest that size and profitability have a non-linear relationship.

Government-owned banks in China generally do not just play the role of financial intermediaries. Apart from financial services, they have other objectives like regional development and social responsibility [1]. La Porta *et al*., [33] also report that government-owned banks are less efficient and perform poorly. Moreover, [1] show that foreign investors prefer non-state-owned banks, who are more independent and are able to avoid government interference. In early years of Chinese commercial banks, the domestic financial sector was still controlled by the government. After financial reform, commercial banks have become increasingly independent and in pursuit of high profit. However, state-owned commercial banks have a better relationship with the government and closer business contacts so that the big commercial banks in China can make huge profit from large-scale and highly profitable projects awarded to them by the government. These findings are consistent with study on developed countries such as Staikouras and Wood [6].

The significant and positive effect on legal savings and lending interest spread in both ROA and NIM show that most of commercial banks' profit comes from interest spread. It can be seen that the coefficient of spread is 2.54 at a 1% significance level for both ROA and NIM. The estimator of spread is 38.95 for NIM because the net interest margin is directly correlated with interest spread.

An important finding of this study is that the GDP growth rate is inversely related to banks' profitability ROA at a 1% significance level. This finding is consistent with Staikouras and Wood [6] and Berger *et al*. [3]. Although Demirguc-Kunt and Huizinga [27] and Williams [34] find that GDP has a positive effect on banks' profitability. There is no consensus on the direction of GDP.

There are two reasons that can explain the inverse relationship between GDP and banks' profitability. On one hand, there is fierce competition among Chinese commercial banks (also fierce competition between banks and Alipay-based financial products) during booming years, which may have caused individual banks to scramble to reduce lending rates and increase deposit rates. This greatly shrinks banks' profit. On the other hand, China's GDP grew at a very high speed between 1979 and 2007, but the government adopted a pattern that only focused on speed rather than quality during this rapid economic development. The main source of income of commercial banks at that time was offering loans. Moreover, unlike highly profitable industries like real estate, manufacturing and heavy industry, banking sector has a low financing threshold and a huge capital demand, which directly led to high credit risk, especially after the 2008 financial crisis when the government issued loans of 4 trillion RMB to stimulate economic growth. [3] This caused serious overcapacity in these industries and banks were left holding a large amount of non-performing loans.

To summarize, GDP is inversely related to banks' profitability and there is a statistically positive relationship between both inflation (CPI) and ROA and NIM.[4] Generally, inflation and expected future inflation may prompt central banks to tighten monetary policy (i.e. raising interest rates and the legal deposit reserve rate). This can reduce enterprises' demand for loans and available lending reserves of commercial Banks. Therefore, CPI is inversely related to banks' profitability.

Compared with previous literatures, our research shows several findings: first, the impact of EA, LA, NPLR and spread on banks' profitability is consistent with studies of other economies ([6], [10], and [11]). Second, market intervention from the Chinese government is relatively more prevalent compared with others. Large banks are more often than not state-owned banks with more connections to the government. Third, Chinese banks are more sensitive to

[3] In 2009, up to 9.58 trillion RMB of new credit and more than 60% credit flowed into industries that are correlated to real estate, such as the iron and steel, cement and glass industries.

[4] Perry (1992) suggests that a negative estimator on CPI implies unanticipated inflation.

interest spreads, which is their main source of profit, implying lower efficiency in intermediary services and off-balance-sheet (OBS) services.

V. Conclusion

The GMM model is applied in this study to identify the bank-specific and macroeconomic determinants of Chinese listed commercial bank's profitability. The significance of almost all variables except productivity also prove that our results are interesting and important. ROA and NIM are chosen as indicators of profitability. Many other factors that may affect banks' profitability are also included. These factors included capital adequacy, credit risk, assets quality, bank efficiency, size effect, interest spread, inflation, and economic development index.

This study has several important findings. Firstly, the significantly negative values of the LA and NPLR estimators suggest that, when banks issue more loans, their profitability is lower. This finding suggests that Chinese commercial banks may have taken unnecessary risks by issuing inferior loans, which has left them with a great many non-performing loans.

Secondly, the size of Chinese commercial banks has a significantly positive effect on profitability, which suggests that big banks, most of which are state-owned, can be more profitable than their smaller peers. This may be because the big banks can take advantage of better relationship with the government to be awarded profitable contracts like construction projects.

Thirdly, the empirical results show that GDP has negative relationship with banks' profitability. This is because the Chinese government promotes a high GDP growth rate rather than natural economic development. Therefore, when the government invests more, the banks are left with more non-performing loans. Fourthly, commercial banks' profit largely comes from the interest spread.

This research examines the determinants of commercial banks profitability and provide feasible advices to bank managers as well as financial policy makers. Compared to the earlier study of Chinese commercial banks, this paper focuses on factors that affect profitability of listed commercial banks. It also includes latest data and extends sample time of earlier researchers from 2007 to 2016. However, the study is somewhat limited due to time constraint. Furthermore, as demanded by the Chinese anti-trust authorities, banks must offer more loans to small and medium enterprises (SMEs). Our future work will be about the impact of these regulations on banks' performance, which is a new concern of both researchers and the industry.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Zhilin Wu and Hui Song conducted the research; Zhilin Wu analyzed the data; Hui Song examined the methodology. Zhilin Wu and Hui Song wrote the paper; all authors had approved the final version.

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