Research on the Influence of Green Credit on the Profitability of Chinese Commercial Banks

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Keywords: Green credit; profitability; random effects model.

Abstract: With the rapid development of economy, there is a contradiction between environment and economic development, so the green credit mechanism should be born. At the same time, in the increasingly competitive environment, the profitability of commercial banks has become the focus of the Chinese government and the banking industry. Therefore, it is necessary to study the impact of green credit on the profitability of commercial banks in China, so as to have a positive impact on the profitability of commercial banks, and thus promote the development of China's green economy. Taking the data of 20 commercial banks from 2009 to 2018 as samples, the random effects model was used for regression analysis. The empirical results show that green credit has a negative impact on the profitability of commercial banks.

1. Introduction

The proposal and practice of the concept of green finance is considered to be a highlight of the financial industry innovation in the 21st century. The report of the 19th National Congress of the Communist Party of China emphasized the development of green finance, indicating that the concept of green finance has been raised to the level of national strategy. First of all, it conforms to the trend of environmental transformation in the world. Secondly, green finance links the financial industry with the environmental protection industry. According to calculations by the Financial Research Institute of the Development Research Center of the State Council, China's green industry needs more than RMB 2 trillion in investment funds each year, but fiscal funds can only meet 10% to 15% of its needs. Therefore, China's green industry lacks funds and Social capital must be invested in green industries through the development of green finance.

At present, Chinese commercial banks focus on developing green finance through green credit. Since the implementation of the green credit policy, significant results have been achieved. According to the statistics from the China Banking and Insurance Regulatory Commission, the green credit balance of 21 major banks in China has been growing continuously, rising from 4.85 trillion yuan at the end of June 2013 to 8.22 trillion yuan at the end of June 2017. By the end of the first quarter of 2019, the green credit balance has reached 9.23 trillion yuan, representing an annual growth rate of about 14% and achieving a steady growth. The China Banking and Insurance Regulatory Commission rationally adjusted the green credit policy, fundamentally restricting loans to industries with high pollution, high energy consumption, and overcapacity, which strongly promoted the progress of green credit and the protection of the energy environment.

Chinese commercial banks have achieved certain results in developing green credit, but they also face many challenges, such as how to achieve sustainable business development, how to promote green economic development through market behavior, how to incorporate environmental and social investigations into the banks' credit decision-making procedures, etc. The government, regulators and the banking industry should work together to find solutions to these problems.

2. Study design

2.1 Variable Selection

In view of the fact that Chinese commercial banks focus on obtaining profits through deposit and loan spreads, which reflect the profitability of total assets, the average return on total assets is used to represent the profitability of commercial banks. The green credit ratio indicates the proportion of green credit balance in total loan, which can measure the development of green credit of commercial banks. Since the non-performing loan ratio is the most important indicator to measure the quality of a bank's assets, and is fully disclosed in the bank's annual financial report, the non-performing loan ratio is selected to represent the quality of the bank's assets. Since the core capital adequacy ratio can reflect the risk tolerance and debt repayment ability of commercial banks, it is used to represent capital adequacy. The cost-to-income ratio is selected as the proxy variable of the bank's operating efficiency. The lower the cost-to-income ratio is, the lower the proportion of operating cost in operating net income will be, and the higher the profit will be. In the liquidity supervision of commercial banks, liquidity coverage ratio, loan-to-deposit ratio and liquidity ratio are adopted to measure the liquidity of commercial banks. Since the total amount of loans and deposits over the years are counted in the annual financial reports of commercial banks, the loan-to-deposit ratio is taken as the proxy variable of the liquidity status of banks. Total assets are used to represent the size of the bank. Since the value of total assets is relatively large, it is treated logarithmically. Generally, the economic growth rate (GDP growth rate), unemployment rate and inflation rate are used to measure the macroeconomic situation. Since the data of GDP is available, and in order to eliminate the impact of population fluctuations, the growth rate of real GDP per capita is used to represent the macroeconomic performance. Refer to the research of Linlin Zhou [1], Limin Liu et al. [2], and Deyuan Li [3] and other scholars, the banking industry's herfindahl index and the ratio of total assets to GDP are selected to measure the financial structure. Among them, herfindahl index represents the market concentration rate of the banking industry, and the ratio of total assets to GDP represents the status of the banking industry. The calculation method of the heffendahl index is to consider the top 20 domestic commercial banks in terms of brand value in 2019 as the main players in the banking industry, and calculate the sum of squares of the proportion of the assets of these 20 banks in the total assets of commercial banks. To sum up, the selected variables are shown in Table 1.

Table 1. Definition and measurement of variables.

	Variable	Definition	Symbol
Dependent variable	Average return on total assets	Net profit/Average total assets	ROA
Independent variable	Green credit ratio	Green credit balance/Total loan	GLR
Internal control variable	Non-performing loan ratio	Non-performing loans/Total loan	NPLR
	Core capital adequacy ratio	Core capital/Weighted risk assets	CCAR
	Cost-to-income ratio	Operating cost/Net operating income	CIR
	Loan-to-deposit ratio	Total loans/Total deposits	LDR
	Total assets	The log of total assets	LNTA
External control variable	The growth rate of real GDP per capita	(Reporting level - Base level)/ Base level	GDPG
	Herfindahl index	The sum of squares of the percentage of the assets of the market competitors in the banking industry in the total assets of the industry	HHI
	Banking status	Total assets of commercial banks/GDP	CBGDP

2.2 Sample Selection

According to the "Top 500 Global Banking Brands 2019" list published by the British "The Banker" magazine in collaboration with independent brand evaluation organization Brand Finance, combined with the disclosure of green credit data, the data of the top 20 Chinese commercial banks in the list are selected. The twenty commercial banks ranked by brand value are: Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, Bank of China, China Merchants Bank, Bank of Communications, Shanghai Pudong Development Bank, China CITIC Bank, Industrial Bank, China Minsheng Bank, China Everbright Bank, Ping An Bank, Bank of Beijing, Hua Xia Bank, Bank of Shanghai, Bank of Ningbo, Bank of Jiangsu, Bohai Bank, Shanghai Rural Commercial Bank and Bank of Hangzhou. Because China's commercial banks did not disclose green credit data until 2007, and the data in 2007 and 2008 is missing, we select data from 2009 to 2018 for empirical analysis. The data in this article comes from the China Banking and Insurance Regulatory Commission, National Bureau of Statistics, Shanghai Stock Exchange, annual financial reports, social responsibility reports of commercial banks, etc. and Excel and Eviews are used to process the data.

2.3 Model Building

$$ROA_{i,t} = \alpha_i + \beta_1 GLR_{i,t} + \beta_2 NPLR_{i,t} + \beta_3 CCAR_{i,t} + \beta_4 CIR_{i,t} + \beta_5 LDR_{i,t} + \beta_6 LNTA_{i,t} + \gamma_1 GDPG_t + \gamma_2 HHI_t + \gamma_3 CBGDP_t + \varepsilon_{i,t} \quad (1)$$

Where, ROA (average return on total assets) is the dependent variable, GLR (green credit ratio) is the independent variable, and other variables are the control variables. B and γ are coefficients, α is the constant term, which is not related to other independent variables and ε is the residual term.

3. Empirical analysis

3.1 Comparison of Profitability of Commercial Banks before and after the Implementation of Green Credit

China's commercial banks began to implement green credit in 2007, so taking 2007 as a cut-off point, the impact of green credit on the profitability of commercial banks can be intuitively drawn by comparing the trend of the profitability of commercial banks around 2007. Three commercial banks with relatively high green credit ratios were selected from the 20 sample banks, namely Industrial and Commercial Bank of China, Shanghai Pudong Development Bank, and Industrial Bank. Then, the average return on assets (ROA) data of the three banks from 1999 to 2018 were collected from the annual financial reports to make a line chart (Fig. 1) to compare the changing trend of ROA before and after 2007.
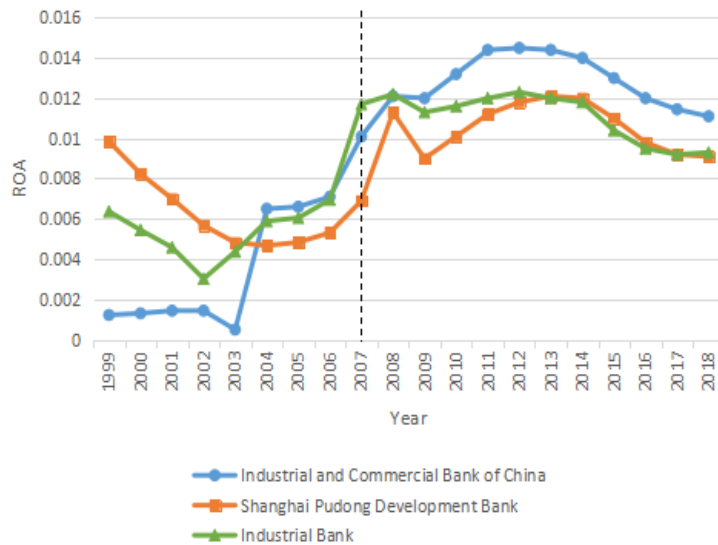

Fig 1. Line chart of ROA of three commercial banks from 1999 to 2018.

As can be seen from Fig. 1, the average return on assets (ROA) of Industrial and Commercial Bank of China, Shanghai Pudong Development Bank and Industrial Bank increased significantly in 2007, and the average return on assets in 2007-2018 was generally higher than that in 1999-2006. On the one hand, when commercial banks began to implement green credit in 2007, their profitability increased rather than decreased, indicating that commercial banks can bear the cost of implementing green credit. While keeping up with the green transformation situation, they can control their own financial indicators and continuously improve their profitability. On the other hand, the proportion of green credit in the total loans of commercial banks is low, so the implementation of green credit will not have a significant negative impact on the profitability of commercial banks. However, green finance has become a trend in the development of the financial industry. If commercial banks want to expand green credit in the future, they should innovate green credit products, strengthen cost management and risk control, and truly make green credit play the dual role of environmental protection and improving the profitability of commercial banks.

3.2 Descriptive Statistics

Table 2. Descriptive statistics of variables.

Variable	Minimum	Maximum	Mean	Standard Deviation
ROA	0.0041	0.0147	0.0104	0.0019
GLR	0.0004	0.2880	0.0397	0.0427
NPLR	0.0011	0.0239	0.0118	0.0043
CCAR	0.0663	0.1519	0.0967	0.0139
CIR	0.2052	0.5117	0.3185	0.0519
LDR	0.5387	1.0998	0.7242	0.0919
LNTA	25.7338	30.9524	28.6460	1.2793
GDPG	0.0643	0.1783	0.1043	0.0384
HHI	0.0361	0.0669	0.0482	0.0104
CBGDP	2.2601	3.1383	2.6714	0.3173

It can be concluded from Table 2 that the average ROA is 1.04%. According to the "Core Indicators for the Risk Management of Commercial Banks", the return on assets should not be less than 0.6%. Therefore, the average ROA of sample banks meets the regulatory requirements, so the profitability of sample banks is good. Secondly, the green credit ratio of the sample commercial banks is relatively low, with an average of only 3.97%. Moreover, there is a large gap among banks, with the highest green credit ratio being 28.8% and the lowest less than 0.1%, indicating that the overall development level of green credit in China's commercial banks is relatively low and uneven.

In addition, according to the "Core Indicators for the Risk Management of Commercial Banks" published by the China Banking and Insurance Regulatory Commission, the non-performing loan ratio should not be higher than 5%, the core capital adequacy ratio should not be lower than 4%, and the cost-to-income ratio should not be higher than 45%. According to Table 2, the highest non-performing loan ratio of the sample banks is 2.39% less than 5%, the lowest core capital adequacy ratio is 6.63% greater than 4%, and the average cost-to-income ratio is 31.85% less than 45%. Therefore, the indicators of asset quality, capital adequacy and profitability of sample banks all meet the regulatory requirements, that is, the sample banks are relatively strong in resisting risks.

3.3 Unit Root Test

The result of unit root test shows that the variables ROA, GLR, LDR and CBGDP are not stable, but they become stationary variables after the first-order difference. Therefore, the new variables after the first-order difference are named dROA, dGLR, dLDR and dCBGDP.

3.4 Model Test

1) Analysis of variance-covariance

The null hypothesis of the analysis of variance-covariance is that the individual effect is not significant. If the null hypothesis is accepted, the mixed regression model is set; otherwise, the fixed effects model is set. The F statistic is used to test whether the null hypothesis is true, which is defined as follows:

$$F = \frac{(R_u^2 - R_r^2)/(n-1)}{(1-R_u^2)/(nT-n-K)} \sim F(n-1, nT-n-K) \tag{2}$$

Where R_u^2 and R_r^2 respectively represent the goodness of fit of the fixed effects model and the mixed regression model (Table 3).

Table 3. Goodness of fit.

Model	R-squared
Fixed effects model	0.618045
Mixed regression model	0.527526

According to Table 3 and (2), the value of the F statistic is 2.13. The critical value of the F statistic obtained by looking up the table is 1.63. Since 2.13 is greater than 1.63, the null hypothesis is rejected and the individual effect is considered significant. Therefore, the variable intercept panel data model should be set.

2) Hausman test

The null hypothesis of Hausman test is that there is no correlation between individual effect α_i and other independent variables. If the null hypothesis is accepted, the random effects model is set; otherwise, the fixed effects model is set.

Table 4. Results of Hausman test.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d. f.	Prob.
Cross-section random	10.146827	9	0.3387

According to table 4, the p value of the Hausman test statistic is 0.3387 > 0.05, so the null hypothesis is accepted and the random effects model should be established.

3.5 Model Regression

Table 5. Regression results of random effects model

Variable	Coefficient	Standard Deviation	t value	p value
dGLR	-0.0044	0.0039	-1.1246	0.2625
NPLR	-0.0840	0.0207	-4.0664	0.0001
CCAR	-0.0034	0.0041	-0.8343	0.4054
CIR	0.0037	0.0014	2.5615	0.0114
dLDR	0.0012	0.0015	0.7865	0.4328
LNTA	0.0001	0.0001	2.2268	0.0274
GDPG	0.0056	0.0031	1.7841	0.0764
HHI	0.0095	0.0161	0.5879	0.5575
dCBGDP	-0.0018	0.0007	-2.6245	0.0096
F-statistic	20.7962			
R-squared	0.5535			
Adjusted R-squared	0.5269			

As can be seen from Table 5, the coefficient of green credit ratio growth rate (dGLR) is negative, indicating that the higher the growth rate of green credit ratio is, the lower the growth rate of commercial banks' profitability will be. This is related to the actual situation in China. At present, the "high pollution, high energy consumption, and overcapacity" industry loans are the main profit

sources of commercial banks, so the withdrawal of "high pollution, high energy consumption, and overcapacity" enterprise loans will have a negative impact on the profitability of commercial banks in a short period of time, indicating that commercial banks have not found a profit model of green credit business, and the government's green credit incentive is not enough.

4. Conclusion

The empirical results show that the growth rate of green credit ratio has a negative impact on the growth rate of commercial banks' profitability, which is related to the development level of green credit in China. Due to the relatively low operating costs of "high pollution, high energy consumption, and overcapacity" enterprises and the Chinese government's insufficient punishment of enterprises with high pollution, high energy consumption, and overcapacity, compared with green enterprises, enterprises with high pollution, high energy consumption, and overcapacity can obtain higher profits and lower loan default rate. Therefore, the loan targets of Chinese commercial banks are still concentrated in the "high pollution, high energy consumption, and overcapacity" industries. With the development of green credit, commercial banks' loans are gradually withdrawing from the "high pollution, high energy consumption, and overcapacity" industry and turning to low-profit and high-risk environmentally friendly companies, which will have an adverse impact on the profitability of commercial banks in a short period of time.

How to solve short-term problems encountered in the development of green credit, improve the effectiveness of green credit, and gradually develop into long-term benefits is the most critical task at this stage. It is believed that as the government issues relevant policies and improves laws and regulations, commercial banks will pay more attention to green development, and green credit will have a more positive impact on the profitability of Chinese commercial banks. Eventually realize the adjustment of China's economic structure and the transformation of economic growth mode.

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