

Research on the Impact of Green Credit on the Profitability of Commercial Banks

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Abstract: With the gradual landing of the “two-carbon” goal, green development has become the main orientation of China's economic development. Green finance is an important driving force for the green transformation of China's economy, and green credit, as an innovative financial product issued by banks in response to national industrial policies and environmental economic policies, has played an important role in this process. Based on the relevant statistical data of green credit, starting from the current development of green credit, this paper uses the panel data of 36 domestic listed commercial banks from 2011 to 2020 to analyze the relationship between green credit and commercial banks' profitability. The results show that green credit has a negative impact on commercial banks' profitability in general, and it has passed the robustness test. In the heterogeneity test, it is found that green credit has a positive impact on the profitability of state-owned banks and a negative impact on joint-stock banks and city commercial banks. Based on this, this paper puts forward corresponding suggestions and countermeasures.

1. Introduction

Since the reform and opening up, China has made great efforts to develop economic construction, and has long adopted an extensive social development model characterized by pursuing growth rate and consuming a lot of resources, but it has neglected the natural environment on which we live. Based on this, China's relevant departments have successively issued a series of policies to guide commercial banks to carry out green credit business. In 2007, the State Environmental Protection Administration, the People's Bank of China and the former China Banking Regulatory Commission jointly issued the Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks. Subsequently, major banks formulated green credit policies to promote the development of environmental protection enterprises (Zhang Hui et al., 2022)^[13]. With the strong support of the national policy, the total amount of credit balance in China shows a trend of continuous growth, but from the perspective of the proportion of credit balance, it is still less than 10%, which has not yet become the main business of commercial banks' loan business. Then why does the credit balance account for a low proportion of total loans, and will the commercial banks' green credit affect their profitability? Based on this problem, this paper collected the panel data of the green credit balance and the profitability return on total assets of 36 listed commercial banks in China, explored the influence of the green credit balance of commercial banks on their profitability by using the linear regression model, found out a series of existing problems, and gave corresponding countermeasures and suggestions.

2. Literature Review

On the issue of the relationship between green credit and banks' profitability, domestic and foreign scholars have conducted a series of studies, the results of which are mainly divided into two types:

First, green credit has indeed improved banks' profitability^[4]. Hao Bing (2019) explored the green credit from three aspects, namely, the significance, the current situation and its impact on the profitability of commercial banks, and emphatically analyzed the positive side of green credit on the profitability of commercial banks^[5]. Chen Kun et al.(2021) selected 14 representative commercial

banks for empirical analysis^[1]. The results show that green credit scale can effectively improve the profitability of commercial banks and has a positive impact on the long-term operation of commercial banks. Wu Sainan and Bai han (2021) based on the panel data of the five major state-owned banks, found that green credit can significantly improve the quality of bank assets, which is conducive to the good development of bank operation^[10]. Jin Rong (2022) conducted a research based on the data of 12 A-share listed companies^[6]. The research results show that green credit has a significant improvement effect on the overall business performance of commercial banks, but this effect is not obvious in local commercial banks^[8]. Finger et al. (2018) analyzed the effect of green credit adopted by commercial banks in various countries on their financial performance, and found that banks with lower performance in developed economies are more likely to adopt green credit, which is beneficial to increase the return on assets^[16].

Second, green credit has a negative impact on banks' profitability. Wang Jianqiong and Dong Ke (2019) manually collected panel data of 12 banks according to the social responsibility report disclosed by the banks^[9]. Empirical analysis found that green credit would significantly reduce the profitability of large state-owned banks. Through collecting the data of 13 listed commercial banks from 2011 to 2018, Tang Yalan (2021) found that the green credit business of commercial banks did not make banks profitable in the short term, but in the long term, it was still beneficial to the business development of commercial banks^[7]. Feng Yan and Huang Sigang (2022) conducted an empirical analysis on 14 domestic listed companies, and constructed the bank's operating performance using the principal component analysis method^[2]. The regression results found that green credit had a significant negative impact on the commercial bank's operating performance. Scholtens and Dam(2007) compared 27 banks with green credit with 57 banks without green credit. the results show that the adoption of green credit will increase the operating expenses of banks, thus reducing the profitability of enterprises, which reflects the adverse effect of green credit on the profitability of commercial banks^[17].

3. Analysis and Assumptions

3.1 Analysis on the Impact of Green Credit on the Profitability of Commercial Banks

As an intermediary institution of bank financing, its main business purpose is to obtain greater profits, and developing green credit business may have positive and negative effects on its profitability.

First of all, there may be some positive reasons: (1) Developing green credit business will bring good reputation to banks. Green credit business is born out of the concept of sustainable development, and it will also boost the sustainable development of economy, environment and society in the future. Therefore, with the increasing demands of social development on the environment, enterprises need to undertake more social responsibilities (Zhang Yu, 2020)^[14]. Green credit business carried out by banks will help enterprises in green transformation and accumulate a good social reputation for themselves, thus attracting more customers to invest and creating a larger profit space^[15]. (2) Expand the business field and get rid of the homogenization problem. As the laws and regulations related to the environment have become stricter in recent years, many enterprises have been given birth to apply for environmental protection projects. Commercial banks can take this opportunity to broaden their internal business scope, get rid of the common homogenization problem among banks, and gradually improve their profitability^[11] (Yu Bo et al., 2021).

Secondly, there may be negative effects due to the following reasons: (1) Green environmental protection projects often require a long payback period. The main reason is that when banks grant loans to these enterprises, they need to check not only their credit level, but also their pollution treatment ability, environmental protection compliance level, etc. In the process, they need to invest a lot of manpower and financial resources, which increases the upfront cost, and thus may lead to a decline in the profitability of commercial banks. (2) Interest rate concessions for specific enterprises applying for green credit will lead to a significant reduction in bank interest income.

Therefore, at present, the industry's conclusions about the relationship between green credit and bank profitability are not consistent. In order to explore the relationship between the two, the following two competitive hypotheses are put forward here:

Hypothesis 1: Green credit has a positive effect on the profitability of commercial banks;

Hypothesis 2: Green credit has a negative effect on the profitability of commercial banks.

3.2 The Heterogeneity of Green Credit Affecting Banks' Profitability

Commercial banks can be divided into state-owned banks, joint-stock banks and city commercial banks according to their size and organizational model.

State-owned banks, because of their strength and large scale, often have more capital and human resources. Therefore, they have more experience in the construction of green credit system and the approval of green credit business. Their efficiency is also significantly higher than joint-stock banks and city commercial banks. Therefore, they can better play the positive role of green credit in banks' profitability. For the smaller joint-stock banks and city commercial banks, due to their own lack of resources, their strength in all aspects cannot be compared with that of the state-owned banks. They are unable to cope with the new type of green credit business that requires higher risk management capability and technical level, and on the contrary, they increase high management costs. Therefore, this paper puts forward the following hypothesis:

Hypothesis 3: Compared with city commercial banks and joint-stock banks, state-owned banks' green credit is more conducive to improving their profitability.

4. Model Construction

4.1 Sample Selection and Data Sources

The sample data selected in this paper are the green credit data of 36 large state-owned commercial banks, national joint-stock commercial banks and city commercial banks, and the daily operation data of banks, which are representative. The sample time interval is 2011-2020, the time span is 10 years, and the data volume is sufficient. The data sources are Wind database and annual reports and social responsibility reports of major commercial banks.

4.2 Model Setting

In order to find out the impact of green credit balance of commercial banks on banks' profitability through empirical methods, this paper constructs the following measurement model, and uses the Stata measurement software to perform regression by using the ordinary least squares method, and tests the above hypothesis:

$$ROA_{it} = \beta_0 + \beta_1 \ln Green_{it} + \beta_2 X_{it} + \gamma + \varepsilon_0 \quad (1)$$

The explained variable ROA_{it} indicates the profitability of commercial banks, referring to the practice of Zhang Hui^[12] et al. (2022) and use return on total assets to indicate it. The explanatory variable $Green_{it}$ represents the green credit balance of the enterprise, which is a well-matched known data in the sample data. Because the value of the credit scale is large, the logarithm processing is unified here. X_{it} is the control variable, γ is the annual fixed effect, and ε_0 is the residual term (random interference term). Regarding the selection of control variables, this paper refers to the existing literature and research, and selects the logarithmic bank size, cost-income ratio, non-performing loan ratio and asset-liability ratio as control variables.

Table 1 is the descriptive statistical results of the above variables. The average return on total assets of the sample banks is 1.01%, of which the ROA of the bank with the best profitability is 1.75% and that of the bank with the worst profitability is 0.51%, indicating that the overall profitability of the sample banks is good. The average scale of green credit of banks after logarithm is 5.87, of which the largest scale is 9.82, and the smallest scale is 0.63, indicating that the scale of green credit varies greatly among different banks. The scale of banks is measured by the total assets of banks. After taking logarithm, the maximum size of banks is 12.71, and the minimum size is 6.23,

which shows that the scale gap of these 36 banks is not small. The average cost-to-income ratio is 31.17, the maximum value is 42.77, and the minimum value is 18.93, which shows that the cost-to-income ratio of different banks also has a certain gap. The average NPL ratio is 1.27%, the maximum is 2.9% and the minimum is 0.44%. On the whole, the NPL ratio of these banks is relatively low and the credit risk is relatively small. The average asset-liability ratio is 92.85%, indicating that these banks as a whole have a high proportion of liabilities.

Table 1: Descriptive Statistics

Variable	observed value	Mean	SD	Min	Max
return on total assets	360	1.01	0.24	0.51	1.75
Green credit scale after logarithm	360	5.87	2.03	0.63	9.82
Bank size after logarithm	360	9.24	1.78	6.23	12.71
Cost-to-revenue ratio	360	31.17	4.73	18.93	42.77
non-performing loan ratio	360	1.27	0.47	0.44	2.90
Asset-liability ratio	360	92.85	1.38	83.47	96.25

5. Empirical Analysis

5.1 Empirical Regression Analysis

Table 2 is the regression result of model (1), in which the first column is the result without control variables, at which time the impact of green credit balance on the bank's return on total assets is significantly negative and significant. The second column is the regression result after adding the control variables, the coefficient remains negative, but the significance is slightly reduced, and finally passed the significance level test of 5%. At the same time, the first column and the second column are the results of adding the year fixed effect and individual fixed effect variables, so we can know that the final result is more credible.

To sum up, we can draw the conclusion that the coefficient of green credit balance is significantly negative, indicating that green credit balance has a negative impact on the profitability of banks, which supports hypothesis 2. Then we can see from the second column of the control variables in the table that the coefficient of the bank's total assets is significantly negative, indicating that when the bank is too large, its profitability will decrease. The non-performing loan rate coefficient is significantly negative, indicating that the higher the non-performing loan rate, the weaker the profitability of the bank will be.

Table 2 Benchmark Regression Results

variable	return on total assets	return on total assets
Ln green credit balance	-0.1312***	-0.0322**
	(0.0092)	(0.0129)
Ln bank total assets		-0.2134***
		(0.035)
Cost-income ratio		-0.0002
		(0.0022)
Bad loan ratio		-0.1425***
		(0.024)
Asset-liability ratio		-0.0131
		(0.0092)
constant term	1.7439***	4.7168***
	(0.0546)	(1.0155)
Year fixed effect	Yes	Yes
Individual fixation effect	Yes	Yes
observed value	240	240
R ²	0.4992	0.6968

Note: “*”, “* *” and “* * *” are significant at the levels of 10%, 5% and 1% respectively. The brackets are the standard. Same as the following table.

5.2 Robustness Test

In the part of robustness test, we consider to use “Yes” or “No” to implement green credit policy as the independent variable to replace the original independent variable of green credit balance value. Therefore, the measurement model is constructed as follows:

$$ROA_{it} = \beta_0 + \beta_1 \ln Green1_{it} + \beta_2 X_{it} + \gamma + \varepsilon_0 \quad (2)$$

In model (2), the explanatory variable is replaced by *Green1*, which represents the green credit policy of commercial banks. If the sample bank implements the green credit policy in the current year, it is assigned 1, and if it does not, it is assigned 0. The other variables remain unchanged.

Here, we directly add the control variables for regression. As can be seen from the regression results shown in Table 3, the regression coefficient of whether to implement the green credit policy is still negative and significant at the level of 5%, indicating that even if the measurement method of independent variables is changed, the green credit policy still has a negative impact on the bank's return on total assets, i.e. profitability, and the robustness test is passed. Moreover, we can see from the control variable coefficients in Table 3 that when the total assets, cost-to-income ratio and non-performing loan ratio of a bank increase continuously, it will have a great negative impact on the profitability of the bank. Different from the benchmark regression, Yes, in the robustness test, the significance of the regression coefficient of cost-to-income ratio is enhanced.

Table 3 Robustness Test

variable	return on total assets
Whether to implement the green credit policy	-0.0502** (0.0202)
Total assets of ln bank	-0.3185*** (0.0211)
Cost-income ratio	-0.0114*** (0.0022)
Bad loan ratio	-0.1659*** (0.0203)
Asset-liability ratio	-0.0063 (0.007)
constant term	5.1649*** (0.7045)
Year fixed effect	Yes
Individual fixation effect	Yes
observed value	353
R ²	0.72

5.3 Heterogeneity Test

Table 4 Heterogeneity Test

variable	State-owned banks	joint-stock banks	commercial banks
Whether to implement the green credit policy	0.0789** (0.0316)	-0.0423* (0.0243)	-0.0413*** (0.015)
Total assets of ln bank	-0.8284*** (0.1064)	-0.2369** (0.0919)	-0.1756*** (0.0383)
Cost-income ratio	0.0092*** (0.0023)	-0.0098* (0.005)	-0.0023 (0.0035)
Bad loan ratio	-0.0624 (0.0381)	-0.1325*** (0.0493)	-0.2413*** (0.0544)
Asset-liability ratio	-0.0852*** (0.025)	-0.0042 (0.02)	-0.0246* (0.0127)
constant term	17.9358*** (3.2715)	4.6082* (2.5298)	5.2743*** (1.233)
Year fixed effect	Yes	Yes	Yes
Individual fixation effect	Yes	Yes	Yes
observed value	57	81	102
R ²	0.865	0.7206	0.7245

In the part of heterogeneity test, we noticed that 36 commercial banks in the sample data have different bank properties. Therefore, with reference to the method of Gao Xiaoyan (2020), the sample is divided into three groups according to the nature of banks: state-owned banks, joint-stock banks and city commercial banks, and then the regression estimation is performed again^[3]. The regression results are shown in the Table 4.

It can be seen that after grouping commercial banks, the policy effect coefficient of state-owned banks is significantly positive, while the regression coefficient of joint-stock banks and city commercial banks is significantly negative. This shows that after considering the heterogeneity of commercial banks, green credit can significantly improve the profitability of state-owned banks, and will have a significant negative impact on the profitability of joint-stock banks and city commercial banks. Hypothesis 3 is confirmed.

6. Research Conclusions and Policy Recommendations

This paper takes the green credit balance and bank operation data of 36 listed commercial banks in China from 2011 to 2020 as research samples. This paper empirically studies the impact of green credit balance on corporate profitability. The results show that: First, from the overall sample, the increase of green credit balance will have a negative impact on corporate profitability; Secondly, after classifying the enterprises by heterogeneity analysis, green credit will significantly improve the profitability of the state-owned banks with large scale and abundant resources, but it has a certain negative effect on the joint-stock banks and city commercial banks. Based on the above research results, this paper puts forward the following enlightenment and suggestions:

First of all, although the empirical results show that banks' green credit business will have a negative impact on their profitability, from the long-term perspective of China's sustainable economic development, the development of green credit business can adjust China's industrial structure and help the transformation and upgrading of the economic development model. Green water and green mountains are the only means to achieve the goal. The state is also strongly advocating the development of economy without harming the natural environment. Therefore, green credit has its necessity and rationality.

Secondly, the state-owned banks have improved their profitability in the process of developing green credit because of their advantages of large scale and abundant funds. This is the advantage that the joint-stock banks and the city commercial banks lack in factor endowments. However, the joint-stock banks and the city commercial banks can learn from the excellent methods and business experience of the state-owned banks in carrying out green credit management and continuously improve their own green credit service level. The relevant banking regulatory authorities should also take certain incentives, such as the implementation of a risk compensation mechanism, to mobilize the enthusiasm of the banks to implement the green credit policy, so as to make them self-driving.

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