Asian Journal of Economics, Business and Accounting

22(10): 23-33, 2022; Article no.AJEBA.85783
ISSN: 2456-639X

The Moderating Role of Green Credit between Business Risk and Financial Performance – A Case Study of Chinese Commercial Banks

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJEBA/2022/v22i1030599

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/85783

Original Research Article

Received 25 January 2022
Accepted 04 April 2022
Published 15 April 2022

ABSTRACT

It attaches great importance to the development of green finance in China, and the bank's green credit business is just the most important link in the green finance project Most of the literature believe that green credit business helps to reduce the business risk of banks and then improve the financial performance of banks. This paper takes the Chinese banking sector from 2011 to 2020 as a research sample, to explore whether the green business in the banking industry can play a mediating role between banks' operational risk and financial performance. The results show that the higher the debt ratio contributes to the ROA and has no significant impact on the ROE, but the higher NPL hurts both ROA and ROE; the more green business also hurts both ROA and ROE; however, the cross term of debt ratio and green business has no significant relationship on ROA, but has a positive significant impact on ROE; the cross term of NPL and green business has a negative significant effect on ROE. We also provide the suggestion for these findings.

Keywords: Green credit; business risk; financial performance; banking.

1. INTRODUCTION

China's economy has experienced decades of rapid growth and has gradually developed into the second-largest economy in the world. The ecological and environmental problems caused by the rapid development of industry and commerce have become one of the most

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important issues to be faced in the current situation, so green finance has been born. Banks and most financial institutions have embarked on green finance business, including green bonds, green credit, etc., which can give sufficient financial support to enterprises of different sizes and improve the social image of the financial institutions to better promote their business. At the same time, the development of green finance business is very important to improve the risk management of banks, reduce risks and help companies to increase their financial performance.

As an important financial industry, the banking sector not only aims to make profits but also plays a key role in the entire capital flow process. With the change of the times, science and technology along with the progress of social civilization, enterprises prefer take more and more social responsibility, and many of them focus on creating a social responsible corporate culture, which requires a large amount of capital investment, and the green loan business is still important support for most enterprises to survive and develop from the current channels of financing for Chinese enterprises, such as credit funds from banks, and other financial institutions. The green credit business according to the social financing scale statistics published by the Central Bank of China in the past ten years, it can be seen that between 2004 and 2012, the social financing of Chinese enterprises mainly consisted of bank loans, which accounted for half or more of the overall social financing structure and was the economic core of exogenous financing for most enterprises. At the same time, in the ranking of financial institutions' loan data from 2004 to 2012, high pollution and high energy-consuming enterprises directly occupy 60% of the top ten in the ranking of credit funds. If the threshold of bank loans is adjusted, it will inevitably have a significant impact on the business behavior of enterprises and the adjustment of industrial structure. Therefore, it is crucial to study the relationship between green credit and debt financing, which reflects the capital financing status of enterprises, in exploring the effect of green credit policy implementation. Nowadays, more and more banks are willing to carry out green credit business, not only gaining profit but also helping enterprises to fulfill their social responsibility, achieving a win-win effect. At the same time, the social responsibility of enterprises and banks can provide investors and all stakeholders with a better social image, thus laying the foundation for the future positive development of enterprises and banks. However, many studies have shown that although the green credit business has a good value at the core ideology and has a positive impact on society as a whole, the profitability of the business is not good and may seriously hinder the development of this business. In this paper, we use the banking sector in China from 2011 to 2020 as a sample to explore whether the green business in the banking sector can play a mediating role between banks' operational risk and corporate financial performance by regression method, to study the impact of green business on the operational risk and financial performance of the banking industry.

2. LITERATURE REVIEW

2.1 The Definition of Green Business and the Current Status of Global Green Business

Green finance refers to economic activities that support environmental improvement, climate change response and resource conservation and efficient utilization, that is, financial services provided for project investment and financing, project operation and risk management in the fields of environmental protection, energy conservation, clean energy, green transportation, green building and so on. Regarding the definition of green finance, Chen and Zhang [1] suggest that there are many different views on the definition of green finance in various countries, there are scholars suggest that green finance is the result of combining the financial industry and the environmental industry, thus helping to achieve a balance between financial development and environmental protection, also other scholars argue that green finance is not only the greening of the financial industry but also requires other aspects such as investment and operation to be Greening. Although scholars from different countries have different views on the definition of green finance, they all essentially relate to environmental protection and sustainable economic development, that is, green finance is a financial model which redefine financial products to achieve a sustainable model integrated with social, economic, and environment. According to Wang [2], green finance is more concerned with providing green promotion for economic development, so that economic development can better avoid environmental pollution and better protect the ecological environment while proposing several

stages of the connotation development of green finance, which are environmental finance, sustainable finance, ecological finance, and carbon finance. Therefore, green finance business is derived from the whole environment of green finance, including green credit, green securities, green credit, green insurance, green products, green technology research, development, etc. Now, the development of green business in China has gone through three stages, the first stage is the initial stage of green finance, mainly providing loans related to environmental protection and guaranteeing the stable operation of environmental protection facilities; the second stage is the rapid development stage of green finance, with important related policies being introduced one after another, green financial products and services having more diversified development, and the business scope of green finance being broader; the third stage is the current stage of green finance development, which needs to focus on improving the quality and efficiency of green finance business, promoting the green transformation of financial products and improving the green share of enterprises [3], so the most important business of green finance in China at present is green credit business [4].

2.2 The Definition of Bank Business Risk and Popular Indicators

Haynes [5] defined risk as a possibility of damage, and he believed that risk means uncertainty and economic loss. Concerning bank operational risk indicators, Alem & Townsend [6] argue that loan loss allowance ratio can be a good measure of bank operational risk by comparing data from various sources, and he believes that the loan loss allowance ratio is to some extent better than the traditional bank risk measures such as non-performing loan (NPL) ratio. Business risk can also be understood as business risk, and various types of enterprises may deviate from the expected revenue due to various unknown factors in the process of operation. In a narrow sense, bank business risk refers to the uncertainty of occurrence of losses and profitability. The non-performing loan (NPL) ratio is an important indicator in the definition of bank risk, and NPL ratio refer to the part of non-performing assets that appear in the financial activities of banks, which is expressed as the interest or even principal if the funds cannot be repaid on time and schedule, generally, traditional banking business is mainly based on loan business, so the NPL ratio becomes one of the important indicators to measure the risk of bank operation. Wang et al. [7] pointed out that the NPL ratio is positively correlated with macroeconomic growth and has a strong connection with GDP and monetary growth, which makes the NPL ratio more valuable to study. Zou and Cai [8] pointed out that the reasonable control of the NPL ratio can optimize the industrial structure and reflect the accumulation of systemic risk, and is the monetary policy can play its positive effect. Regarding the indicators of bank business risk, capital adequacy ratio is also an important item, Admati & Hellwig [9] concluded through their study that capital adequacy ratio has a direct impact on bank profitability, while too high a capital adequacy ratio will make banks need better profits to meet the capital requirements of high capital adequacy ratio, thus making banks' business risk higher, so that capital adequacy ratio has a, Therefore, the capital adequacy ratio has a direct impact on the bank's operational risk. Cheng and Ye [10] point out that the change in capital adequacy ratio has a reverse impact on the size of bank loans, which makes a change in the bank's operational risk. Similarly, the asset-liability ratio is an important risk indicator, and Zhang and Chi [11] point out that the asset-liability ratio has an important significance in the control of interest rate risk, credit risk, and liquidity risk of banks. The debt ratio is the total amount of bank liabilities as a percentage of total bank assets, which reflects the bank's ability to operate with liabilities, so it is also one of the important indicators of the bank's operational risk.

2.3 Literature on the Association between Bank's Operational Risk and Financial Performance

There are many correlations between operational risk and financial performance. Wang [12] suggests that financial performance is the most important concern for managers and investors of most banks and other financial institutions, while financial risk becomes one of the most difficult problems for banks and listed companies in the process of operation, and with the deepening of China's economic marketability, banks and other financial institutions face a lot of financial risk problems, and whether they can properly The ability to properly handle and avoid operational risks has become an important part of preserving the solid growth of financial performance, and in this process, due to the different scale and asset management status of each bank, the increase of risks and the decrease of financial

performance may form a vicious circle that bank managers avoid. Banks with good financial performance have better and better control of operational risk, and invest more in risk regulation and risk avoidance, while banks with poor operational risk handling ability will not be able to improve their risk handling ability as part of the decline in financial performance, and thus their development will be hindered, so that operational risk and financial performance have a very significant correlation. Zhu & Geng [13] found through their research that the operational risk of real estate listed companies and the financial performance of the company become positively related, and the financial risk and the performance of the company show a negative relationship, although the findings are specified for real estate listed companies, the results are also relevant for the study of operational risk and financial performance of banks. Scholtens & Dam [14] selected 50 commercial banks from among commercial banks that adhered to the Equator Principles as the subjects of their study and concluded that banks that adhered to the Equator Principles differed significantly from those that did not, with the former having higher social responsibility ratings, which in turn had a positive effect on their performance. Tripathy [15] concluded through his study that banks' green credit can generate stable cash flow for banks and play a positive role in improving their ROI. In summary, this paper establishes research hypothesis I.

H1: Bank's operational risk has a positive and significant effect on a bank's financial performance.

2.4 Literature on the Association between Green Business and Operational Risk

Through their study, Li et al. [16] concluded that banks' green business has a positive effect on reducing banks' operational risk, in addition to improving their credit structure and thus their competitiveness in the market, thus enhancing the banking industry's risk resistance. Sun et al. [17], in their paper on the impact of green credit on commercial banks' credit risk, obtained empirical results by setting up a static panel model and a dynamic panel model that the increase of green credit can significantly reduce the NPL ratio of commercial banks, which means it has a significant negative impact on commercial banks' business risk. By setting up a panel regression model, Chen & Ouyang [18] demonstrated that for every 1% increase in the share of the green business of banks, the NPL ratio of commercial banks will decrease by 0.18%, indicating that the increase of green business helps to reduce the business risk of banks. In summary, scholars have conducted some research on the effect of green business on commercial banks' NPL ratio, but there are fewer empirical studies on the effect of green credit on another business risk to be discussed in this paper. To sum up, this paper establishes research hypothesis two.

H2: Green business of banks has a negative and significant relationship with banks' operational risk.

2.5 Literature on the Association of Green Business with Operational Risk and Bank Financial Performance

As domestic commercial banks have become more aware of social responsibility, more and more scholars have conducted empirical studies on the impact of banks' green business on their operational risk and financial performance. In Sun and Yao [19], in their paper on commercial banks' operational risk and financial performance - a perspective based on the impact of green business, they analyzed the effect of green credit on banks' financial performance by using a double difference model and obtained that the effect of green credit on banks' financial performance is significantly negative, and due to the public welfare nature of green business and the lag of financial performance, the implementation of green credit policy by banks at this stage does not have any effect on their performance. At the same time, it is argued that the green business of commercial banks can improve their financial performance by reducing operational risks, which has a mutually offsetting effect. Lei and Shi [20] focus on the short- and long-term effects of green credit on commercial banks' performance and liquidity risk, respectively, and argue that the effects of green credit on commercial banks' performance and liquidity risk control are positive and weak in the short term, but in the long term, green credit can help commercial banks improve their performance and also help them control liquidity risk. Using the data of 509 listed companies from 2012-2014 as a sample, Zhu and Zhao [21] concluded through their study that companies can diminish the negative effect of operational risk on financial performance by fulfilling social responsibility, and further, active social

responsibility can also improve financial performance by reducing operational risk. In summary, this paper establishes research hypothesis three.

H3: Green business of banks helps to reduce operational risk and improve financial performance.

3. METHODOLOGY

Based on the findings of previous scholars in the literature review, the research hypotheses are summarized as follows: 1) Business risk in the banking sector is significantly related to financial performance. 2) Green business of banks has a negative and significant relationship with the business risk of banks. 3) Green business of banks helps to reduce business risk and improve financial performance. In this regard, the association between banks' business risk, green business, and financial performance is shown in the following figure.

This section will use the banking industry in China from 2011 to 2020 as the research sample to explore whether the development of green business in the banking sector can play a mediating role between banks' operational risk and corporate financial performance. The sample data in this paper are downloaded from the CSMAR database, and after the sample data are downloaded, those with incomplete information are removed first, and then the extreme values are removed to obtain a total of 110 samples.

According to the research model in Fig. 1, to probe the relationship among operational risk, green business, and corporate financial performance and whether the green business has a mediating role between operational risk and corporate financial performance, this paper establishes a cross term between operational risk and green business to test the impact of the two together, and the Ordinary Least Square (OLS) models are designed as follows.

Model 1-1

$$ROA_{it} = \alpha_0 + \alpha_1 DEBT_{it} + \alpha_2 GLOAN_{it} + \alpha_3 DEBT * GLOAN_{it} + \alpha_4 SCALE_{it} + \alpha_5 SHHOLDER_{it} + \alpha_6 AGE_{it} + \alpha_7 CAPADE_{it} + \alpha_8 REVCOS_{it} + \alpha_9 STATE_{it} + \varepsilon_{it}$$

Model 1-2

$$ROA_{it} = \alpha_0 + \alpha_1 NPL_{it} + \alpha_2 GLOAN_{it} + \alpha_3 NPL * GLOAN_{it} + \alpha_4 SCALE_{it} + \alpha_5 SHHOLDER_{it} + \alpha_6 AGE_{it} + \alpha_7 CAPADE_{it} + \alpha_8 REVCOS_{it} + \alpha_9 STATE_{it} + \varepsilon_{it}$$

Model 2-1：

$$ROE_{it} = \alpha_0 + \alpha_1 DEBT_{it} + \alpha_2 GLOAN_{it} + \alpha_3 DEBT * GLOAN_{it} + \alpha_4 SCALE_{it} + \alpha_5 SHHOLDER_{it} + \alpha_6 AGE_{it} + \alpha_7 CAPADE_{it} + \alpha_8 REVCOS_{it} + \alpha_9 STATE_{it} + \varepsilon_{it}$$

Model 2-2：

$$ROE_{it} = \alpha_0 + \alpha_1 NPL_{it} + \alpha_2 GLOAN_{it} + \alpha_3 NPL * GLOAN_{it} + \alpha_4 SCALE_{it} + \alpha_5 SHHOLDER_{it} + \alpha_6 AGE_{it} + \alpha_7 CAPADE_{it} + \alpha_8 REVCOS_{it} + \alpha_9 STATE_{it} + \varepsilon_{it}$$

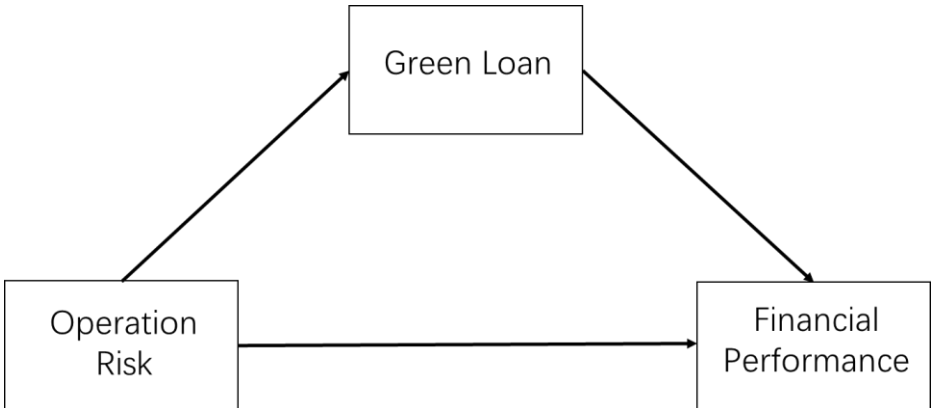

Fig. 1. Association diagram among banks' operational risk, green business and corporate financial performance

3.1 The Definition of Variables

3.1.1 Explanatory variables

In this paper, we refer to the study of De Lucia et al. (2020) and use the return on total assets (ROA) and return on net assets (ROE) as proxy variables for financial performance. The data was obtained by downloading from the CSMAR database and the formula is calculated as follows.

Return on total assets (ROA) = net income / average total assets

Return on net assets (ROE) = net profit / average net assets

3.1.2 Explanatory variables

3.1.2.1 Debt ratio (DEBT)

Referring to Ji [22] study, it is pointed out that maintaining the debt ratio within a certain range is effective in reducing operational risk and improving financial performance, but if the debt ratio is too high, it will increase the operating pressure of the bank, so this paper selects the debt ratio as one of the bank's operational risk indicators.

3.1.2.2 Non-Performing Loan Ratio (NPL)

According to Shi [23], the study shows that if the percentage of loans with bad credit is too large, it means that the bank's asset quality and operational risk are poorly controlled, so this paper selects the NPL ratio as one of the banks operational risk indicators.

3.1.2.3 Green business (GLOAN)

Referring to the study of Sun & Yao [19], this paper uses the ratio of the green credit balance of banks to the total loan balance as a proxy variable for green business.

*3.1.2.4 Cross term of debt ratio and green business (DEBT*GLOAN)*

Based on the purpose of this paper to explore the mediating or moderating role of green business in banks' operational risk, the cross term of debt ratio and green business is therefore established to test the impact on banks' financial performance under the joint effect of green business and operational risk.

*3.1.2.5 Cross term between NPL ratio and green business (NPL*GLOAN)*

Based on the research purpose of this paper to explore the mediating or moderating role of green business in banks' operational risk, the cross-sectional term between NPL ratio and green business is therefore established to test the impact of the joint effect of green business and operational risk on banks' financial performance.

3.1.3 Control variables

3.1.3.1 Bank size (SCALE)

Since larger banks have the advantage of economies of scale and greater risk control and resources, they will also have a considerable impact on the financial performance of banks. Therefore, the total assets of the sample companies are used as a proxy variable for bank size, and the natural logarithm of this variable is taken to reduce the absolute difference between this variable and other variables without affecting the relative relationship.

3.1.3.2 Shareholding ratio of the first largest shareholder (SHHOLDER)

Based on the fact that the largest shareholder of a bank is usually the founder and the actual holder of the bank, if the shareholding ratio is larger, the largest shareholder itself will pay more attention to the financial performance of the bank and actively participate in the operation of the bank for its benefit, which will have a better effect on the financial performance of the bank, therefore, this paper includes the shareholding ratio of the first largest shareholder as one of the control variables. Therefore, the shareholding ratio of the first largest shareholder is included as one of the control variables in this paper.

3.1.3.3 Bank age (AGE)

Coad et al. [24] point out that firm age is related to firm performance and suggest that the profitability and productivity of firms vary with age, so this paper uses bank age as one of the control variables. The age of the bank is measured based on the date of establishment of the bank to the end of the study year to which it belongs.

3.1.3.4 Capital Adequacy Ratio (CAPADE)

According to Liu [25], the study shows that a higher capital adequacy ratio hurts the

improvement of banks' business performance, so this paper includes capital adequacy ratio as one of the control variables.

3.1.3.5 Revenue-to-cost ratio (REVCOS)

Refer to the study of Li & Zhang [26] that the cost-to-income ratio of banks is an important indicator of banks' profitability, so this paper includes the cost-to-income ratio as one of the control variables.

3.1.3.6 Nature of property rights (STATE)

Refer to the study of Tang et al. [27], which pointed out that the heterogeneity of property rights, i.e., the difference between state-owned enterprises and non-state-owned enterprises, has a significant correlation effect on the financial performance of enterprises, so this paper sets the nature of property rights as one of the control variables, this is a dummy variable, if it is a state-owned enterprise set as '1 ", otherwise it is set to "0".

4. RESULTS

In this section, the empirical results are analyzed, and before the analysis, a preliminary understanding of the distribution of the overall sample data is made. The descriptive statistics results are detailed in Table 1.

The sample size from 2011 to 2020 was 110. From Table 1, we can see the overall operating conditions and operating conditions of the sample during the research period. The mean value of DEBT is 0.934, which indicates that the overall total liabilities of the sample banks as a percentage of their total assets is high, and also indicates that the overall operating pressure of the sample banks is high, with a value range is from 0.911 to 0.978, indicating that there is no obvious difference in DEBT ratio levels among the sample banks. The mean value of NPL is 0.013, the value range is from 0.003 to 0.024, which do not exceed the international standard of 10%, indicating that the overall performance of the sample banks' NPL ratio is good, the risk control ability of the sample banks' asset quality and operational risk is good. The mean value of GLOAN is 0.050, and the value range is from 0.005 to 0.178, which indicates that there are some differences in the development of green business among the sample banks, but the overall differences are not significant. For the overall performance of the return on total assets (ROA) and return on net assets (ROE), the ROA is better than ROE, which indicating that the sample banks are more efficient in utilizing their assets in general.

Next, since this paper conducts the Ordinary Least Squares (OLS) method, we have to make a preliminary judgment to confirm the rationality of the models. The first is to examine whether there is excessive homogeneity in the selection of variables in the model. From the VIF values in Tables 2 to 5, the highest value does not exceed 6.274 and is not higher than 10. The second is the judgment of F-value, which is to examine the predictability of the linear regression model. The F-values from Table 2 to Table 5 are 9.104 to 12.726, which are all significant, so the linear regression models of this paper are judged to be predictable. The third is the explanatory power of the regression model, i.e., the adjusted

Table 1. The descriptive statistics of each variable (N=110)

	Min.	Max.	Ave.	Stdv.
ROA	0.000	1.470	0.836	0.431
ROE	0.000	0.248	0.135	0.066
DEBT	0.911	0.978	0.934	0.014
NPL	0.003	0.024	0.013	0.004
GLOAN	0.005	0.178	0.050	0.037
DEBT*GLOAN	-0.002	0.001	0.000	0.000
NPL*GLOAN	0.000	0.000	0.000	0.000
SCALE	27.066	30.952	29.349	1.022
SHHOLDER	0.000	0.689	0.348	0.183
AGE	7.827	106.975	33.916	24.371
CAPADE	0.000	0.172	0.126	0.024
REVCOS	0.000	0.646	0.304	0.102
STATE	0.000	1.000	0.682	0.468

Note: For the definition of each variable code, please refer to 3. Methodology.

Table 2. The empirical results of model 1-1 (N=110)

	Coef.	t	p	VIF
Con_	-16.313	-2.903	0.005***	
DEBT	12.978	2.478	0.015**	6.274
GLOAN	-5.009	-3.404	0.001***	3.426
DEBT*GLOAN	108.284	1.259	0.211	1.384
SCALE	0.144	2.860	0.005***	3.044
SHHOLDER	0.065	0.278	0.781	2.147
AGE	0.002	0.917	0.361	2.176
CAPADE	12.379	5.142	0.000***	3.911
REVCOS	-1.092	-1.879	0.063*	4.087
STATE	-0.313	-3.904	0.000***	1.626
Adj R^2	0.492			
F value	12.726	Sig.	***	

Note 1: For the definition of each variable code, please refer to 3. Methodology.
*Note 2: Significance is *** for p<=0.01, ** for 0.01<p<=0.05, and * for 0.05<p<=0.1.*

Table 3. The empirical results of models 1-2 (N=110)

	Coef.	t	p	VIF
Con_	-2.943	-2.223	0.028**	
NPL	-16.685	-1.852	0.067*	1.782
GLOAN	-5.049	-3.300	0.001***	3.699
NPL*GLOAN	-45951.218	-2.352	0.021**	1.593
SCALE	0.124	2.466	0.015**	3.038
SHHOLDER	0.069	0.282	0.778	2.349
AGE	0.001	0.313	0.755	2.279
CAPADE	7.646	4.954	0.000***	1.606
REVCOS	-0.520	-1.151	0.253	2.467
STATE	-0.306	-3.689	0.000***	1.743
Adj R^2	0.491			
F value	12.701	Sig.	***	

Note 1: For the definition of each variable code, please refer to 3. Methodology.
*Note 2:Significance is *** for p<=0.01, ** for 0.01<p<=0.05, and * for 0.05<p<=0.1.*
0.05<p<=0.1

Table 4. Empirical results of model 2-1 (N=110)

	Coef.	t	p	VIF
Con_	-0.745	-0.794	0.429	
DEBT	1.125	1.286	0.201	6.274
GLOAN	-0.078	-0.318	0.751	3.426
DEBT*GLOAN	34.095	2.373	0.020**	1.384
SCALE	-0.011	-1.319	0.190	3.044
SHHOLDER	-0.117	-2.984	0.004***	2.147
AGE	0.000	-0.832	0.407	2.176
CAPADE	1.681	4.181	0.000***	3.911
REVCOS	0.041	0.424	0.672	4.087
STATE	-0.015	-1.116	0.267	1.626
Adj R^2	0.401			
F value	9.104	Sig.	***	

Note 1: For the definition of each variable code, please refer to 3. Methodology.
*Note 2:Significance is *** for p<=0.01, ** for 0.01<p<=0.05, and * for 0.05<p<=0.1*

R-squared value. The adjusted R-squared from Table 2 to Table 5 ranged from 0.401 to 0.491, indicating good explanatory power. Next, the empirical results of the effect of the performance

of each explanatory variable on the return on total assets (ROA) and return on net assets (ROE) are further analyzed.

As can be seen from Table 2, the regression results show that there is a significant positive relationship between the bank's debt ratio (DEBT) and total return on assets (ROA) performance, indicating that the higher the bank's loan business, the better its ROA performance. Whereas, green business has a negative and significant correlation with the performance of ROA, which indicates that the bank's ROA decreases with more green business. In other words, green business does not contribute significantly to ROA, furthermore, the quality of green business are worse than non-green business.

The regression results in Table 3 show that both the bank's non-performing loan (NPL) and green business (GLOAN) have a negative relationship with the performance of total return on assets (ROA), even the negative impact of green business is more obvious than NPL, indicating that the situation is similar as Table 2, the quality of the green business is not good. Thus, the cross term of NPL and green business (NPL*GLOAN) is also negatively correlated with total return on assets (ROA) performance.

The results of Table 4 shows that there is no significant relationship between banks' debt ratio (DEBT) and return on net assets (ROE), and banks' green business and return on net assets (ROE). However, the cross-section of debt and green business (DEBT*GLOAN) is positively correlated with ROE. according to the formula of ROE, at the same profit level, the larger the ROE, the smaller the number of net assets, that is, the smaller the scale of the bank. Referring to the results in Table 2 and Table 4, although the quality of the green credit business is not good, the smaller the scale of the bank, the more cautious the risk assessment will be. Therefore, when both the business volume and green credit business increase, it can improve the ROE of the bank.

The findings of this paper are in line with the previous literature which found that (Table 5).

The result of Table 5 shows that the non-performing loan on assets (NPL) has a negative relationship with the performance of net return on assets (ROE), and the green business has no significant impact on ROE. As for the cross term of NPL and green business has a negative effect on ROE. Combined with the results in Table 4, small-scale banks are more cautious about risk control, so the quality of the green credit business they undertake is relatively good and will not have a negative impact on ROE. However, if the non-performing loan rate is high, it means that the bank has poor risk control ability. Therefore, if they undertake more green credit business without paying attention to risk control, it will have a negative and significant impact on ROE. Combined with the results in Table 4, small-scale banks are more cautious about risk control, so the quality of the green credit business they undertake is relatively good and will not have a negative impact on ROE. However, if the NPL is high, it means that the bank has poor risk control ability. Therefore, if they undertake more green credit business without paying attention to risk management, it will have a negative and significant impact on ROE.

Table 5. Empirical results of model 2-2 (N=110)

	Coef.	t	p	VIF
Con_	0.431	2.036	0.044**	
NPL	-3.330	-2.309	0.023**	1.782
GLOAN	-0.264	-1.080	0.283	3.699
NPL*GLOAN	-12002.096	-3.839	0.000***	1.593
SCALE	-0.012	-1.446	0.151	3.038
SHHOLDER	-0.116	-2.953	0.004***	2.349
AGE	0.000	-1.553	0.124	2.279
CAPADE	1.270	5.141	0.000***	1.606
REVCOS	0.031	0.424	0.672	2.467
STATE	-0.010	-0.769	0.443	1.743
Adj R^2	0.449			
F value	10.883	Sig.	***	

Note 1: For the definition of each variable code, please refer to 3. Methodology.
*Note 2:Significance is *** for p<=0.01, ** for 0.01<p<=0.05, and * for 0.05<p<=0.1*

5. CONCLUSION AND DISCUSSION

The research findings show that the higher the debt ratio contributes to the ROA and has no significant impact on the ROE, but the higher NPL hurts both ROA and ROE; the more green business also hurts both ROA and ROE; however, the cross term of debt ratio and green business has no significant relationship on ROA, but has a positive significant impact on ROE; the cross term of NPL and green business has a negative significant effect on ROE. Compared with the previous literature, the results that there is a positive and significant association between operational risk and financial performance is consistent with the research findings from Zhu and Geng [13], but as to whether the green business can reduce operational risk, our findings are different from most scholars who believe that green credit business can effectively reduce operational risk because of the high quality and stable recovery of loans (Bert & Lammertjan, 2007); [15, 16, 17, 18]. However, the research finding from Wang [12] is similar to this study, which argues that banks' financial performance depends on risk management abilities.

In the research findings of this study, taking the Chinese banking sector as a sample, it is the same as Wang [12], we find that risk management abilities are the crucial factor for financial performance. In addition, the smaller scale banks have the more cautious risk management and the larger the business volume, the better ROA. This reflects that China's financial supervision has a good effect. However, the task of green finance development in the current stage is to promote green business, when the green business is not popular now, and the quality of green business is not good enough now. So, how to promote the green business and keep good risk management at the same time are both the priorities for the bank sector and financial supervision in China.

Based on the findings of this paper, the following suggestions are made. First, it is necessary to improve the overall awareness of green finance among the public. The main national media, government departments at all levels, schools, and economic portals should pay attention to the dissemination of green finance-related knowledge and information, and make more financial institution managers and investors aware of the good risk avoidance and financial performance benefits of developing green finance business. Secondly, we suggest that the relevant national departments should improve the laws and regulations related to green finance, and sound policies and regulations are the basis for the good development of green finance. And some special subsidy policies for green finance business should be introduced to encourage more investors to invest in green finance projects. On the other hand, it is important to promote the digitalization of green finance, as China are in the stage of rapid development of the Internet economy, and actively explore the digitalization model applicable to different financial institutions to further improve and enrich the green finance credit system.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/85783