

Research on the Influence of Taxation on the Green Credit of Commercial Banks

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Abstract: Green finance, as an important starting point to promote the “double carbon” strategy, is of great significance in the future green development, and green credit, as the main component of green finance, plays an important role. Based on the panel data of 35 listed commercial banks in China from 2007 to 2021, this paper uses the random effect model to measure the impact of taxation on the green credit of commercial banks, and further analyzes the heterogeneity by using the scale level of commercial banks. The results show that the total tax burden rate of commercial banks is negatively related to the green credit rate, and tax has a negative impact on the green credit of commercial banks by reducing the provision rate of non-performing loans. In addition, compared with small and medium-sized banks, the negative impact of taxation on green credit of large banks is more significant.

1. Introduction

1.1 Research Background

At present, China's policies and measures to promote green finance have been introduced one after another, but the implementation of green credit still faces many difficulties and challenges, among which the matching and improvement of tax policies is a key issue. China's current tax policy does not fully consider the particularity of green finance. Some green projects have certain social and environmental benefits, but they are not given sufficient preferential treatment in the tax policy. Tax policy not only affects the profits and investment returns of commercial banks and green projects, but also affects the balance between environmental protection and economic development. In this context, an in-depth discussion on the mechanism and influencing factors of tax policy in green credit can provide a basis for formulating more effective preferential tax policies and promote the development of green finance and the overall promotion of environmental protection in China.

1.2 Research Significance

At present, domestic research on green finance mainly focuses on the impact of tax policy on the development of green finance, green bond market and green credit. Although these studies provide some policy suggestions, most of them lack in-depth empirical research. Therefore, from the perspective of taxation, this paper discusses the influence of tax policy on green credit of commercial banks through empirical research, aiming at providing more scientific and effective policy support and suggestions for promoting the development of green finance and green credit.

Commercial banks and other financial institutions need to consider the impact of tax policies when developing green credit business. The conclusion of this study can provide reference for commercial banks and other financial institutions to formulate green credit products, and can also provide reference for enterprises, so as to make better use of green credit products, reduce carbon emissions of enterprises, and improve their social image and market competitiveness.

2. Summary of Domestic and Foreign Research

With regard to green credit, the International Finance Corporation (IFC) defines it as “a loan for

financing or re-financing green projects or green investment portfolios”. The Green Finance Policy Guidelines issued by China in 2018 defines green credit as a credit business in which banks provide funds to projects and enterprises with sustainable development potential and environmental benefits through loans in order to support green industries and green development, and at the same time assess and manage environmental and social risks. Different scholars have also explained the concept of green credit: Deng Yuwen (2007) thinks that green credit is that financial institutions provide preferential low-interest loans to enterprises engaged in environmental protection, new energy, circular economy and other fields, and impose high-interest loan quotas on polluting enterprises in order to reduce environmental pollution and promote sustainable development [1]. Fan Zhigang (2012) believes that green credit is loans and other financial services provided by banks for the development of low-carbon economy, covering clean energy production, environmental protection equipment manufacturing and sewage treatment to support the development of low-carbon economy [2].

With regard to taxation, China's current green taxation system mainly includes three parts: one is a green tax specially set up for environmental protection, that is, environmental protection tax; Second, other green-related taxes with environmental protection nature in the current tax system are mainly divided into resource-occupying and behavior-oriented green taxes; The third is the preferential tax policies related to environmental protection. Max Franks(2017) pointed out that carbon tax is a feasible green policy, and there will be no green paradox [3].

Ma Haitao (2022) believes that the government can encourage banks to carry out green credit business through tax incentives and other policies, thus promoting the development and sustainable development of green finance. Tax policy can reduce the loan cost of banks, improve the return on investment of green credit, and then increase the enthusiasm and investment of banks to carry out green credit business [4]. Arel (2021) believes that there is no significant correlation between tax policy and green credit, that is, tax policy has no substantial impact on banks' green credit business. In addition, preferential tax policies may also have a certain negative impact on the risk management of banks, leading banks to be more cautious and prudent in developing green credit, thus limiting the scale and benefits of green credit [5].

As one of the hot research fields at present, green credit has been widely discussed and studied by many scholars. Liu Jing (2022), Cao Changtai (2023) and Yang Jianhua (2020) empirically analyzed the impact of green credit on enterprises in the fields of environmental protection, low-carbon technological innovation and circular economy, so as to evaluate the implementation effect and sustainable development effect of green credit policy [6]-[8]. At the same time, Wang Hongtao (2023) and Zheng Jiayu (2023) explored green credit and the performance of financial institutions, risk management of banks and other related issues [9]-[10].

However, in the existing research in the field of green credit, most of the research focuses on the influence of government's environmental protection policies and environmental standards on bank lending behavior and whether financial institutions will consider environmental risks in green credit business, and the in-depth exploration of the relationship between taxation and green credit is limited. In terms of research methods, there is also an over-reliance on statistical analysis and descriptive analysis, while there is a lack of research on green credit mechanism. To sum up, the existing research on the impact of tax on green credit of commercial banks is still insufficient, so it is necessary to conduct more in-depth research.

3. Theoretical Analysis and Research Hypothesis

In studying the influence of tax on the credit behavior of commercial banks, Li Wenhong (2005) pointed out that compared with income tax, business tax will distort the banking business behavior [11]. Xu Haoyue (2021) thinks that whether an enterprise will use part of its funds for paying environmental taxes or for green investment depends on the scale of environmental tax burden and green investment. If the funds consumed for paying environmental taxes are greater than the funds needed for environmental investment, the enterprise is more willing to make green investment. And green credit also has the function of environmental tax, which can promote the development of

green enterprises and restrict polluting enterprises at the same time. Therefore, in terms of ecological protection, tax and green credit have a synergistic effect [12]. Liu Chong (2021) thinks that the decrease of income tax rate urges banks to enrich capital and improve capital quality, thus promoting credit expansion [13].

To sum up, the bank's credit behavior will be distorted because of the existence of taxes, and green credit also belongs to a kind of credit behavior of commercial banks. Accordingly, hypothesis 1 is put forward:

H1: Taxation has a negative impact on the green credit of commercial banks.

Section 2 The Impact of Taxation on Commercial Banks' Green Credit -- Based on the Intermediary Effect of Non-performing Loan Provision Rate

The provision ratio of non-performing loans is the ratio of the reserves set by banks to the total amount of non-performing loans in response to possible bad debts, which is used to measure whether the provision for loan losses of commercial banks is sufficient. A high provision coverage ratio means that banks have better risk control and forecasting capabilities and higher risk tolerance. Wang Xiaoyu (2012) pointed out that there is a significant negative correlation between taxation and profitability of commercial banks in China through empirical research [14]. AARON Li (2023) pointed out that commercial banks tend to securitize credit assets for the needs of profitability, liquidity and capital optimization, and the obtained liquidity funds stimulate the bank's credit expansion, but the quality of credit assets selected for asset securitization will affect the bank's non-performing loan ratio [15].

To sum up, green credit is a kind of commercial bank credit, and tax will affect bank credit by affecting the provision rate of non-performing loans. Accordingly, hypothesis 2 is proposed:

H2: Taxation has a negative impact on the green credit of commercial banks by reducing the provision ratio of non-performing loans.

4. Research Design

This paper selects 35 listed commercial banks from 2007 to 2021 as research samples. The relevant data for calculating the green credit ratio and the index of non-performing loan ratio come from the annual reports of sample commercial banks and the national Taian database, and the relevant data such as total assets, capital adequacy, return on net assets, and coverage ratio of non-performing loans come from the Wind database, and the relevant data of GDP year-on-year come from relevant statistical departments.

5. Explained Variables

Green credit (Gload) is the ratio of green credit balance to total loans, which is usually used to measure the proportion of banks' financing in environmental protection. In order to reduce the influence of data skewness and heteroscedasticity, the green credit balance is generally converted by logarithm, that is, $Gload = \ln(\text{green credit balance} + 1) / \text{total loan}$.

6. Explain Variables

According to Wei Mi's (2018) research on tax burden structure and bank performance, the tax burden not only reflects the tax cost level of banks, but also reflects the government's macro-control of the banking system through tax policies [16]. The total tax burden rate (Etr) is taken as an explanatory variable to measure the total level of bank tax burden.

7. Intermediate Variables

The provision coverage ratio of non-performing loans (PCR) refers to the ratio of non-performing loan reserves to non-performing loans of banks, which is a utilization ratio of provision for doubtful debts. The calculation formula is: provision coverage ratio = (general

provision+special provision+special provision)/(subprime loans+doubtful loans+loss loans) *100%.

8. Control Variables

(1) capital adequacy ratio (CAR)

The national regulatory authorities have specific requirements for the capital adequacy ratio of commercial banks, with the purpose of monitoring the financial status of banks and their ability to buffer risks. Basel III stipulates that the minimum capital adequacy ratio of commercial banks is 8%.

(2) return on total assets (ROA)

Considering the influence of commercial banks' profitability on credit risk, return on total assets is used to measure banks' profitability. Return on total assets can remove the influence of various capital changes on the bank's net profit, so as to increase the comparability of profitability among banks.

(3) Asset-liability ratio (LEV)

Asset-liability ratio is the ratio of the total liabilities of an enterprise to the total assets of an enterprise, which is used to evaluate the solvency of an enterprise. The lower the asset-liability ratio, the smaller the debt risk of the enterprise; On the contrary, it means that the debt risk is greater.

(4) Liquidity ratio (LR)

Liquidity ratio refers to the ratio of current assets to current liabilities of an enterprise, which is used to measure the ability of current assets of an enterprise to be converted into cash to repay liabilities before short-term debts expire.

(5) listed bank or not

In commercial banks, listing is a way to show their scale and strength. Compared with unlisted commercial banks, the issuance of green credit by listed city commercial banks can more effectively improve their green reputation and maintain their image of actively fulfilling social responsibilities. Therefore, it plays an important role to choose whether to go public as a control variable.

Table 1 Variable Declaration

Variable category	Variable name	encode	explain
Explained variable	Green credit	Gload	Ln(Green credit balance +1)
Explanatory variable	Total tax burden rate	Etr	(income tax+business tax and surcharges)/(profit before tax+business tax and surcharges)
Mediator variable	Non-performing loan provision coverage ratio	PCR	Loan loss reserve/balance of non-performing loans, not less than 150%.
Control variable	Capital adequacy ratio	CAR	Net capital/total weighted risk assets at the end of the period, higher than 8%
	Return on total assets	ROA	Net profit/average total assets
	Asset-liability ratio	LEV	Total liabilities/total assets
	liquidity ratio	LR	Current assets/liabilities
	Year	year	Year dummy variable
	Industry	ind	Industry dummy variable

9. Model Setting

In this paper, when studying the influence of the total tax burden rate on the green credit of commercial banks, the provision coverage ratio of non-performing loans is introduced as an intermediary variable, and then the mechanism between them is explored through the analysis of intermediary effect.

This paper refers to the analysis method of intermediate variables by Wen Zhonglin et al. (2014) [17]. The research institute will select three main variables for analysis, namely, the explained variable Y, the explained variable X and the intermediate variable M. First, we will observe whether the explained variable X will cause the change of the intermediate variable M, and if X causes the

change of m , we will see whether the change of the intermediate variable M will affect the explained variable Y .

10. The Main Regression Model of the Impact of the Total Tax Burden Rate on the Green Credit of Commercial Banks

Firstly, make a benchmark regression on the relationship between the total tax burden rate of commercial banks and green credit.

The first step is to regress the total tax burden rate and green credit according to model 4-1, and analyze whether the coefficient is significant. If it is significant, the next step will be tested. If it is not significant, it means that there is no intermediary effect. Make a argument according to the cover effect and stop the analysis of intermediary effect.

$$Gload_{i,t} = \beta_0 + \beta_1 Etr_{i,t} + \beta_2 CART + \beta_3 ROA + \beta_4 LEV + \beta_5 LR + \sum year + \sum ind + \varepsilon_{i,t} \quad (1)$$

In model 4-1, the explained variables $Gload_{i,t}$ represent the green credit/green credit rate of bank I in the t year, β_0 represents the constant term, the explained variables $Etr_{i,t}$ represent the total tax burden rate of bank I in the t year, and $\varepsilon_{i,t}$ are random interference terms. The other variables are capital adequacy ratio, return on total assets, asset-liability ratio, liquidity ratio, year and industry.

11. Regression Model of the Impact of Total Tax Burden Rate on Green Credit of Commercial Banks-Based on the Intermediary Effect of Non-Performing Loan Provision Coverage Ratio

In order to study the influence of the change of non-performing loan provision coverage caused by the total tax burden rate on the green credit of commercial banks, this paper adds model 4-2 and model 4-3 on the basis of the main regression model 4-1, and analyzes model 4-1 in front. If the coefficient of total tax burden rate of green credit is significant, the second step will analyze whether the coefficient of total tax burden rate and non-performing loan rate of model 4-2 is significant, and the third step, The intermediary variable of non-performing loan rate is added to model 4-1 to form model 4-3, and then the coefficient of total tax burden rate to green credit rate in model 4-3 is judged. If the coefficients of intermediary variable and explanatory variable are significant, it shows that there is a complete intermediary effect between total tax burden rate and green credit rate of city commercial banks, and if not, it is a partial intermediary effect.

$$PCR_{i,t} = \beta_0 + \beta_1 Etr_{i,t} + \beta_2 CART + \beta_3 ROA + \beta_4 LEV + \beta_5 LR + \sum year + \sum ind + \varepsilon_{i,t} \quad (2)$$

$$Gload_{i,t} = \beta_0 + \beta_1 Etr_{i,t} + \beta_2 PCR_{i,t} + \beta_3 CART + \beta_3 ROA + \beta_4 LEV + \beta_5 LR + \sum year + \sum ind + \varepsilon_{i,t} \quad (3)$$

12. Empirical Analysis

Descriptive statistics and correlation analysis results are shown in the following table. Regression analysis shows that green credit ($Gload$) is significantly negatively affected by the total tax burden rate (Etr). This means that with the increase of the total tax burden rate, the ratio of green credit provided by commercial banks will decrease. In terms of control variables, return on total assets has a significant negative impact on $Gload$, that is, the stronger the profitability of commercial banks, the lower the ratio of providing green credit; The liquidity ratio (LR) has a significant positive impact on $Gload$, that is, the better the liquidity of commercial banks, the higher the ratio of providing green credit. According to the correlation coefficient matrix, the maximum correlation coefficient is 0.534, which is less than 0.6, so it can be judged that there is no significant multicollinearity problem.

Table 2 Descriptive Statistics and Correlation Coefficient of Variables

Variables	Mean	SD	1	2	3	4	5	6	7	8
1.Gload	5.026	2.177	1	-	-	-	-	-	-	-
2.Etr	0.296	0.203	-0.174***	1	-	-	-	-	-	-
3.Ptr	0.040	0.040	-0.134***	0.534***	1	-	-	-	-	-
4.PCR	244.371	146.470	0.064	-0.230***	-0.187***	1	-	-	-	-
5.CAR	13.226	5.435	0.018	0.065	-0.052	-0.175***	1	-	-	-
6.ROA	0.992	0.333	-0.120***	0.038	0.344***	-0.063	0.063	1	-	-
7.LEV	93.558	3.077	0.049	0.312***	0.080*	-0.100**	0.151***	-0.418***	1	-
8.LR	124.756	190.066	0.141***	-0.147***	-0.244***	0.123***	0.007	-0.317***	0.126***	1

Note:***, ** and * respectively represent the significance level of 1%, 5% and 10%, the same below.

Then the model selection test is carried out. F test and Hausman test are used to analyze OLS model, fixed effect model and random effect model.

13. Regression Analysis

The benchmark regression results and intermediary effect regression results of the total tax burden rate on the green credit of commercial banks are shown in Table 3. In column (1), taking the total tax burden rate (Etr) as the independent variable and the green credit (Gload) as the dependent variable, after controlling other variables, the regression results show that the total tax burden rate has a negative significant impact on the green credit, with a coefficient of -1.332, which is significant at the significant level of 1%, indicating that the total tax burden rate (Etr) will increase by 1%, and then the green credit of commercial banks will decrease.

Combined with the regression results of columns (2) and (3), the mediating effect is analyzed. (2) Taking the total tax burden rate (Etr) as the independent variable and the provision coverage ratio of non-performing loans (PCR) as the dependent variable, after controlling other variables, the regression results show that the total tax burden rate has a significant negative impact on the provision coverage ratio of non-performing loans at a significant level of 1%. (3) Add the provision coverage ratio of non-performing loans (PCR) as an intermediary variable in column (1), and test the intermediary effect through indirect and direct effects. The results show that the total effect of tax on green credit rate is -1.246, of which the direct effect is -0.102 and the indirect effect is 0.040. Therefore, the provision coverage ratio of non-performing loans has a significant negative intermediary effect on green credit. The result shows that tax has a negative impact on the green credit of commercial banks, and it has a negative intermediary effect on the green credit of commercial banks by reducing the provision ratio of non-performing loans, which supports hypothesis 2.

Table 3 Benchmark and Mediated Regression Results

Variable	Gload (1)	PCR (2)	Gload (3)
Etr	-1.332*** (-4.33)	-105.638*** (-3.03)	-1.246*** (-4.05)
PCR			0.001** (2.46)
CAR	0.037*** (3.69)	-3.903*** (-3.35)	0.041*** (4.02)
ROA	-1.199*** (-6.39)	2.822 (0.13)	-1.208*** (-6.47)
LEV	-0.039** (-2.03)	-5.568** (-2.46)	-0.033* (-1.70)
LR	-0.001** (-1.98)	0.068* (1.87)	-0.001** (-2.18)
Constant	9.833*** (5.35)	836.825*** (3.90)	8.974*** (4.82)
Industry	Control		
Year	Control		

14. Heterogeneity Analysis

Compared with small and medium-sized banks, large banks have larger scale and wider business scope, and because of their closer relationship with the government, they may take measures more actively to meet the government's requirements, so these factors may make large banks more sensitive to the negative impact of green credit in the implementation of tax policies.

Considering the heterogeneity of bank size, the sample is divided into two groups according to whether the bank size is greater than the median of the sample: large banks and primary and secondary banks. The regression results in Table 4 show that the coefficient of total tax burden rate (Etr) is negative but not significant in small and medium-sized banks, but negative and significant in large banks, which shows that the tax of large banks has a greater negative impact on green credit.

Table 4 Heterogeneity Test Results

Variable	(1)	(2)
	Small and medium-sized banks	Large banks
Etr	-0.004 (-0.01)	-1.788* (-1.67)
CAR	-0.005 (-0.39)	0.418*** (6.24)
ROA	-0.289 (-1.03)	0.594 (1.27)
LEV	0.092*** (3.03)	0.089 (1.41)
LR	0.000 (1.12)	0.002*** (2.74)
Constant	-4.741 (-1.65)	-7.577 (-1.15)
Industry	Control	
Year	Control	

15. Robustness Test

In this paper, the method of replacing explanatory variables is used to test the robustness. Select the variable turnover tax burden rate close to the total tax burden rate to replace it, and regress the previous model. The regression results are shown in Table 5.

In the regression, (1) the results show that the total tax burden rate has an obvious negative correlation with the logarithm of green credit balance, which has been verified at the significance level of 1%; (2) The results show that the total tax burden rate is negatively correlated with the provision coverage ratio of non-performing loans, and it is significant at the level of 1%; (3) The results show that there is a negative correlation between the total tax burden rate and the logarithm of the green credit balance, and it is confirmed at a significant level of 1%. To sum up, we can think that the research results are robust to some extent.

Table 5 Robustness Test

Variable	Gload'	PCR'	Gload'
	(1)	(2)	(3)
Ptr	-10.527*** (-7.23)	-548.860*** (-3.16)	-10.129*** (-6.92)
PCR			0.001** (2.09)
CAR	0.030*** (3.02)	-4.174*** (-3.55)	0.033*** (3.31)
ROA	-0.773*** (-3.96)	22.881 (0.98)	-0.796*** (-4.08)
LEV	-0.027	-6.089***	-0.021

	(-1.47)	(-2.78)	(-1.18)
LR	-0.001**	0.070*	-0.001**
	(-2.33)	(1.91)	(-2.51)
Constant	8.405***	859.838***	7.707***
	(4.76)	(4.07)	(4.30)
Industry	Control		
Year	Control		

16. Research Conclusions and Suggestions

16.1 Research Conclusion

Taking 35 commercial banks as research samples, this paper studies the influence of the total tax burden rate on the green credit rate of commercial banks, and studies the path mechanism of the influence of the total tax burden rate on the green credit rate of commercial banks by introducing the intermediary variable non-performing loan provision coverage ratio. This paper further studies the differential influence of tax on the green credit rate of commercial banks, and draws the following concrete conclusions:

First, in terms of the relationship between the total tax burden rate and the green credit rate of commercial banks, the total tax burden rate is negatively related to the green credit rate of commercial banks, that is, when the total tax burden rate increases, the green credit rate of commercial banks will decrease.

Secondly, in the study of the relationship among tax burden rate, non-performing loan rate and green credit rate of city commercial banks, the provision coverage ratio of non-performing loans is taken as an intermediary variable. The results show that tax has a negative impact on the green credit of commercial banks by reducing the provision ratio of non-performing loans.

Thirdly, this paper further studies the influence of the total tax burden rate on the green credit rate of commercial banks of different scales. The results show that compared with small and medium-sized banks, the negative impact of taxation on green credit of large banks is more significant.

16.2 Policy Advice

According to the above research, the following suggestions are put forward:

First, deepen the preferential tax policies: the government can combine the preferential tax policies with the standards such as green rating, and give tax incentives to bonds that meet the green standards, so as to promote the market's recognition and acceptance of green financial products. This will help reduce the tax burden of green financial institutions and promote economic transformation and sustainable development.

Second, improve the risk management of bank loans: according to the research results, taxes have a negative impact on the green credit of commercial banks by reducing the provision rate of non-performing loans, so the government can strengthen the supervision and management of commercial banks, standardize bank lending behavior, improve the risk management level of loans, and reduce the provision rate of non-performing loans and non-performing loans. This will help banks to increase credit investment in green projects while maintaining good loan quality.

Third, support the development of small and medium-sized green financial enterprises: the government can provide financing support and technical support for small and medium-sized green financial enterprises by increasing financial support, encourage them to participate in green financial business, improve their green credit capacity, and then promote the development of the whole green financial industry.

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