Vol. 19 (2026): Proceedings of 2026 International Conference on Financial Technology, Mathematical Statistics, and Business Analytics (ICFMB 2026)
E-ISSN: 3105-0522 P-ISSN: 3105-0514
DOI: https://doi.org/10.70267/icfmb.2026193240

The Impact of Green Credit on the Net Interest Margin of Commercial Banks: A Comparative Analysis Before and After the Implementation of the Carbon Emission Reduction Support Instrument

Shuyi Wang*

School of Economics, Shanghai University, Shanghai 200444, China

**Corresponding author: Shuyi Wang.*

Abstract

Whether green credit leads commercial banks to "concede profits" or achieve "mutual benefits" remains inconclusive in the academic literature. Based on panel data from sample commercial banks over the period 2019–2024, this paper first examines the baseline effect of the proportion of green credit on net interest margin and then conducts grouped regressions before and after the implementation of the Carbon Emission Reduction Support Instrument to investigate its policy incentive effect. The empirical results show that the proportion of green credit exerts a positive effect on the net interest margin of commercial banks, confirming the "mutual-benefit" nature of green credit. Moreover, the implementation of the Carbon Emission Reduction Support Instrument strengthens this positive effect. The policy dividend is mainly captured by banks with asset sizes below the median, whereas banks with asset sizes above the median do not benefit significantly. This study deepens the understanding of the profitability mechanism of green credit and provides an empirical reference for the expansion decision of the Carbon Emission Reduction Support Instrument in 2026.

Keywords

green credit, net interest margin, carbon emission reduction support instrument, policy incentive effect

1. Introduction

Green credit serves as an important link connecting financial resources with green development. Guided by the "dual carbon" goals, the scale of green credit in China has continued to expand. According to the *Statistical Report on the Loan Allocation of Financial Institutions for Q4 2025* released by the People's Bank of China, by the end of the fourth quarter of 2025, the outstanding balance of domestic- and foreign-currency green loans in China had reached RMB 44.77 trillion, ranking first globally. Tracing the development path of green credit in China, green finance was first incorporated into the G20 communiqué in 2016, after which green credit entered a stage of large-scale development. In November 2021, the central bank introduced the

Carbon Emission Reduction Support Instrument, providing concessional funding at an interest rate of 1.75% for three categories of "pure green" projects, namely clean energy, energy conservation and environmental protection, and carbon reduction technologies. In January 2026, the central bank expanded this instrument to transition finance areas such as energy-saving retrofitting, green upgrading, and the green and low-carbon transformation of the energy sector. The relending interest rate was reduced to 1.25%, with the annual operational quota ceiling set at RMB 800 billion.

Alongside the rapid expansion of green credit, the net interest margin of Chinese commercial banks has continued to narrow, reaching a historic low of 1.42% in the fourth quarter of 2025. Whether green credit causes commercial banks to "concede profits" or realize "mutual benefits" remains unsettled in academia. A substantial body of research shows that green credit can significantly improve bank performance (net interest margin) [1–3]. At the same time, some studies find that the issuance of green credit negatively affects bank profitability [4], while others, from a nonlinear perspective, identify an inverted U-shaped relationship between the two [5]. These divergences suggest that the profitability effect of green credit may be influenced by factors such as the policy environment, sample period, and bank characteristics. The launch of the central bank's Carbon Emission Reduction Support Instrument provides a unique research setting for examining how the policy environment affects the profitability effect of green credit. However, existing studies mainly focus on the effect of green credit itself, and few directly test the moderating role of monetary policy instruments in this relationship. Given that the Carbon Emission Reduction Support Instrument directly reduces banks' funding costs, it should theoretically amplify the positive contribution of green credit. Meanwhile, the policy effect may vary by bank size. Generally, large banks tend to face lower liability costs, leaving limited room for marginal improvement, whereas smaller banks usually bear relatively higher financing costs and are therefore more sensitive to low-cost funds. Accordingly, the following three hypotheses are proposed:

H1: The proportion of green credit has a positive effect on banks' net interest margins.

H2: The implementation of the Carbon Emission Reduction Support Instrument significantly strengthens the positive contribution of green credit to net interest margins.

H3: The policy incentive effect of the Carbon Emission Reduction Support Instrument is more significant among banks with asset sizes below the median and relatively weaker among banks with asset sizes above the median.

To address the above questions, this study selects 20 A-share listed banks that continuously disclosed green credit balances during 2019–2024 as the research sample (as of the end of 2024, the total assets of the sample banks accounted for 74.59% of the total assets of China's commercial banks, and their green credit balances accounted for 72.15% of the total disclosed green credit of China's commercial banks). It first tests the baseline effect of the proportion of green credit on the net interest margin of commercial banks, then examines the policy incentive effect of the Carbon Emission Reduction Support Instrument through grouped regressions before and after policy implementation, and further tests the heterogeneity of the policy effect by grouping banks according to asset size. The marginal contributions of this study are threefold. First, in terms of research perspective, it focuses on the profitability effect of green credit on the net interest margin of commercial banks and empirically tests the moderating role of the Carbon Emission Reduction Support Instrument in this effect. Second, regarding the timeliness of policy evaluation, the quantitative assessment of the first-stage policy effect of the Carbon Emission Reduction Support Instrument provides a directly comparable benchmark reference for the policy expansion in 2026, highlighting the policy relevance and practical significance of this study. Third, at the theoretical level, this study reveals the heterogeneous distribution of policy effects, showing that the policy effect of the Carbon Emission Reduction Support Instrument is more pronounced among banks with asset sizes below the median.

2. Research Design

2.1 Model Specification

2.1.1 Baseline Model

To examine the effect of the proportion of green credit on banks' net interest margins, this paper follows Lalon et al. [2] and employs an ordinary least squares (OLS) regression model, specified as follows:

$$NIM_{i,t} = \beta_0 + \beta_1 * L.GLR_{i,t} + \beta_2 * L.size_{i,t} + \beta_3 * L.car_{i,t} + \beta_4 * L.ld_{i,t} + \beta_5 * L.npl_{i,t} + \beta_6 * L.cir_{i,t} + \gamma * type2_{i,t} + \delta * type3_{i,t} + \theta_t + \varepsilon_{i,t} \quad (1)$$

To mitigate potential endogeneity concerns in the model, both the proportion of green credit and the bank-level micro characteristic variables are lagged by one period. The definitions of the variables used in the model are presented in Table 1.

Table 1: Definitions of Model Variables

Variable Type	Variable Name	Symbol	Definition
Dependent variable	Net interest margin	NIM	(Interest income − interest expense) / interest-earning assets
Core explanatory variable	Proportion of green credit	GLR	Green credit balance / total loan balance
Control variable	Bank size	size	Natural logarithm of total assets
	Capital adequacy ratio	car	Total capital / risk-weighted assets
	Loan-to-deposit ratio	ld	Total loans / total deposits
	Non-performing loan ratio	npl	Non-performing loans / total loans
	Cost-to-income ratio	cir	Operating costs / operating income
	Bank type	type2	Equals 1 if the sample bank is a nationwide joint-stock commercial bank, and 0 otherwise
	Bank type	type3	Equals 1 if the sample bank is an urban or rural commercial bank, and 0 otherwise

2.1.2 Moderating Effect Model

This study examines the policy incentive effect of the Carbon Emission Reduction Support Instrument through grouped regressions before and after policy implementation. The coefficient α_3 captures the moderating effect; statistical significance of this coefficient indicates the existence of a moderating role.

$$NIM_{i,t} = \alpha_0 + \alpha_1 * X_{i,t} + \alpha_2 * Post2022_{i,t} + \alpha_3 * X_{i,t} * Post2022_{i,t} + \lambda * Controls_{i,t} + \theta_t + \varepsilon_{i,t} \quad (2)$$

Where $X_{i,t}$ represents the core explanatory variable (GLR/size, etc.); $Post2022_{i,t}$ denotes the moderating variable (the Carbon Emission Reduction Support Instrument); $X_{i,t} \times Post2022_{i,t}$ is the interaction term; and $Controls_{i,t}$ denotes the control variables (type2/type3, etc.).

2.2 Sample Selection and Descriptive Statistics

This study uses panel data of 20 A-share listed commercial banks from 2019 to 2024, covering six large state-owned banks, namely Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, Bank of China, Bank of Communications, and Postal Savings Bank of China; eight joint-stock commercial banks, namely China Merchants Bank, Industrial Bank, China CITIC Bank, Shanghai Pudong Development Bank, China Minsheng Bank, China Everbright Bank, Ping An Bank, and Hua Xia Bank; as well as six leading urban and rural commercial banks, namely Bank of Beijing, Bank of Shanghai, Bank of Jiangsu, Bank of Nanjing, Bank of Hangzhou, and Shanghai Rural Commercial Bank. As of the end of 2024, the total assets of the sample banks accounted for 74.59% of the total assets of China's commercial banks, while their green credit balances accounted for 72.15% of the total disclosed green credit of China's commercial banks, indicating strong representativeness. The banks excluded from the sample are mainly urban and rural commercial banks. During the preliminary data screening process, it was found that some urban and rural commercial banks did not continuously disclose their green credit balances before 2022 (the number of listed banks subject to mandatory ESG disclosure increased to 25 in 2024, but disclosure of green credit balances remains largely voluntary). Since the Carbon Emission Reduction Support Instrument was introduced in November 2021, this study adopts 2022 as the policy implementation year. Regarding data sources, the green credit balance data of the sample banks were manually compiled from banks' annual reports, as well as their separately issued sustainability reports, corporate social responsibility reports, or

ESG reports. All other bank-level data were obtained from the Wind Information database. The descriptive statistics of the variables are reported in Table 2.

Table 2: Descriptive Statistics of Variables

Variable	Observations	Mean	Median	Standard Deviation
NIM	120	1.927	1.915	0.344
GLR	120	8.261	7.960	4.924
size	120	29.572	29.605	1.029
car	120	14.664	13.895	1.957
ld	120	0.874	0.880	0.137
npl	120	1.271	1.310	0.288
cir	120	29.716	28.605	7.984
Post2022	120	0.500	0.500	0.502

3. Empirical Results Analysis

3.1 Baseline Regression Results

Table 3 reports the estimation results of the baseline regression for Model (1). The coefficient of L.GLR is 0.021, which is significantly positive at the 1% significance level. Here, the dependent variable is the net interest margin of commercial banks, and the core explanatory variable is the proportion of green credit, which is lagged by one period to mitigate potential endogeneity concerns in the model. The results indicate that the proportion of green credit has a significantly positive effect on net interest margins. Therefore, Hypothesis H1 is supported.

Table 3: The Impact of the Proportion of Green Credit on Banks' Net Interest Margins

	(1)
	NIM
L.GLR	0.021***
	(0.007)
L.size	0.069
	(0.067)
L.car	0.014
	(0.019)
L.ld	0.419
	(0.362)
L.npl	-0.530***
	(0.120)
L.cir	0.012**
	(0.005)
type2	0.448***
	(0.118)
type3	0.206
	(0.183)
_cons	-0.363
	(2.046)
Observations	100
R^2	0.688

Standard errors in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01.*

3.2 Moderating Effect of the Carbon Emission Reduction Support Instrument on the Relationship Between the Proportion of Green Credit and Banks' Net Interest Margins

Table 4 presents the estimation results of the moderating effect Model (2). Before policy implementation, the coefficient of L.GLR is 0.017 and statistically insignificant. After policy implementation, the coefficient

of L.GLR is 0.021, which is significantly positive at the 5% significance level. These findings indicate that the implementation of the Carbon Emission Reduction Support Instrument significantly strengthens the positive contribution of green credit to net interest margins. Therefore, Hypothesis H2 is supported.

Table 4: Moderating Effect of the Carbon Emission Reduction Support Instrument on the Relationship Between the Proportion of Green Credit and Banks' Net Interest Margins

	(Post-policy period)	(Pre-policy period)
	NIM	NIM
L.GLR	0.021**	0.017
	(0.008)	(0.014)
L.size	-0.006	0.168
	(0.084)	(0.109)
L.car	0.028	0.025
	(0.023)	(0.037)
L.ld	0.825*	-0.129
	(0.458)	(0.565)
L.npl	-0.768***	-0.100
	(0.139)	(0.228)
L.cir	0.013**	0.018**
	(0.006)	(0.008)
type2	0.290**	0.711***
	(0.137)	(0.211)
type3	0.070	0.517
	(0.209)	(0.342)
_cons	1.324	-3.942
	(2.466)	(3.586)
Observations	60	40
R^2	0.705	0.567

Standard errors in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01.*

3.3 Heterogeneity Analysis

A grouped regression for the post-policy period is conducted based on bank size. The heterogeneity analysis reported in Table 5 shows that the coefficient of L.GLR is statistically insignificant for banks with asset sizes above the median, whereas for banks with asset sizes below the median, the coefficient of L.GLR is 0.035, which is significantly positive at the 1% significance level. This suggests that the incentive effect of the Carbon Emission Reduction Support Instrument is significant among banks with asset sizes below the median, but insignificant among banks with asset sizes above the median. Therefore, Hypothesis H3 is supported.

Table 5: Heterogeneity Analysis

	(Asset size above the median)	(Asset size below the median)
	NIM	NIM
L.GLR	-0.009	0.035***
	(0.009)	(0.009)
L.size	0.280**	0.080
	(0.110)	(0.173)
L.car	-0.001	0.102**
	(0.019)	(0.045)
L.ld	-0.263	2.321***
	(0.456)	(0.552)
L.npl	-0.798***	-1.019***
	(0.111)	(0.159)
L.cir	0.002	0.013
	(0.006)	(0.021)
2022.year	0.000	0.000
	(.)	(.)
2023.year	-0.289***	-0.399***
	(0.040)	(0.082)

	(Asset size above the median)	(Asset size below the median)
2024.year	-0.468***	-0.683***
	(0.050)	(0.102)
type2	0.465***	0.229
	(0.074)	(0.175)
type3	0.000	0.000
	(.)	(.)
_cons	-5.414	-3.109
	(3.429)	(5.102)
Observations	33	27
R^2	0.937	0.867

Standard errors in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01.*

3.4 Robustness Tests

The robustness test results reported in Table 6 show that the conclusions remain unchanged after excluding the 2020 sample affected by the pandemic. In addition, the results remain consistent when the explanatory variable is lagged by two periods.

Table 6: Robustness Tests

	(Excluding the 2020 sample)	(Two-period lag of the explanatory variable)
	NIM	NIM
L.GLR	0.021***	
	(0.007)	
L2.GLR		0.026***
		(0.008)
L.size	0.058	
	(0.074)	
L2.size		0.083
		(0.074)
L.car	0.009	
	(0.021)	
L2.car		0.018
		(0.022)
L.ld	0.567	
	(0.413)	
L2.ld		0.595
		(0.393)
L.npl	-0.682***	
	(0.127)	
L2.npl		-0.536***
		(0.133)
L.cir	0.010*	
	(0.005)	
L2.cir		0.016***
		(0.005)
type2	0.351***	0.458***
	(0.128)	(0.134)
type3	0.131	0.309
	(0.194)	(0.209)
_cons	0.116	-1.231
	(2.214)	(2.302)
Observations	80	80
R^2	0.697	0.686

Standard errors in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01.*

4. Conclusions and Policy Implications

4.1 Conclusions

This study empirically verifies the effect of the proportion of green credit on the net interest margin of commercial banks, as well as the moderating effect of the Carbon Emission Reduction Support Instrument. The results show that the proportion of green credit has a positive effect on net interest margins. The policy-based grouped regression further indicates that the implementation of the Carbon Emission Reduction Support Instrument significantly strengthens the positive contribution of green credit to net interest margins. The heterogeneity analysis further demonstrates that the policy dividend is mainly captured by banks with asset sizes below the median. The above findings provide several implications for the green credit practices of commercial banks. **First, it is necessary to deepen the implementation of the Carbon Emission Reduction Support Instrument.** The empirical findings of this study show that by reducing banks' funding costs, the Carbon Emission Reduction Support Instrument strengthens the positive contribution of green credit to net interest margins, and its policy incentive effect has been preliminarily validated. In 2026, the central bank expanded the scope of support under the Carbon Emission Reduction Support Instrument from the original three categories of "pure green" projects to six major areas, including energy conservation and carbon reduction, resource recycling, green and low-carbon transformation of the energy sector, ecological conservation and restoration, green upgrading of infrastructure, and green services. This policy adjustment also, to some extent, confirms the practical value of the findings of this study. The next step is to refine implementation details, such as further improving the information disclosure and verification mechanisms for green transition and promoting the dynamic linkage between green loan interest rates and firms' environmental performance, thereby supporting carbon reduction and green transition on a broader and deeper scale. **Second, differentiated preferential risk weights for green loans should be piloted at an appropriate time.** The findings indicate that the proportion of green credit positively affects net interest margins, and the contribution coefficient to net interest margins increases significantly after policy empowerment. However, under the current framework of the *Administrative Measures for the Capital Management of Commercial Banks*, green credit is still subject to the general corporate credit risk weight of 100%. It is therefore recommended, with reference to the policy precedent in inclusive finance, that green loans falling within the scope of the Carbon Emission Reduction Support Instrument be piloted with a preferential risk weight of 75%, so as to continuously guide credit resources toward green and low-carbon sectors. **Third, the precision and response efficiency of the incentive effect should be improved.** The findings show that the policy incentive effect is heterogeneous, with commercial banks whose asset sizes are below the median being the primary beneficiaries. From the perspective of policy design, attention should be paid to differences in bank size to avoid a "one-size-fits-all" approach. It is recommended to explore mechanisms such as tiered pricing or targeted quotas in the operation of structural monetary policy instruments. From the perspective of commercial banks, small and medium-sized banks should improve the organizational structure and process management of green credit, for example, by establishing cross-departmental ESG risk management teams and embedding green fast-track channels into the credit approval process, thereby improving their policy response efficiency in a targeted manner.

4.2 Research Limitations and Future Prospects

This study mainly has the following limitations, which need to be addressed in future research. First, the research sample mainly covers large state-owned banks, joint-stock commercial banks, and several leading urban and rural commercial banks. As mandatory ESG disclosure expands and the green loan information disclosure system continues to improve, future studies may extend the sample to a larger number of small and medium-sized banks as data availability improves, so as to test the applicability of the conclusions across a broader banking population. Second, this study is unable to examine the implementation effect of the policy expansion in 2026. Future research may, based on further data accumulation, use data from 2026 and subsequent years to test the incentive effect of the second-stage policy and compare it with the conclusions of this study, thereby quantifying the marginal contribution brought about by policy optimization.

References

[1] Mirza, N., Afzal, A., Umar, M., & Skare, M. (2023). The impact of green lending on banking performance: Evidence from SME credit portfolios in the BRIC. *Economic Analysis and Policy*, *77*, 843–850. https://doi.org/10.1016/j.eap.2022.12.024

[2] Lalon, R. M., Faruk, M. O., & Amir, K. B. (2025). Investigating the impact of green banking initiatives on bank performance: Empirical evidence from emerging economy. *Discover Sustainability*, *6*(1), 453. https://doi.org/10.1007/s43621-025-01279-6

[3] Chen, J. (2025). Impact of green credit on the performance of commercial banks: Evidence from 42 Chinese listed banks. *Economics*, *19*(1). https://doi.org/10.1515/econ-2025-0131

[4] Riyanti, S. R., Wulandari, P., Prijadi, R., et al. (2025). Green loans: Navigating the path to sustainable profitability in banking. *Economic Analysis and Policy*, *85*, 1613–1624. https://doi.org/10.1016/j.eap.2025.01.028

[5] Lin, Z., & Wang, T. (2024). Green credit, fintech, and commercial bank performance: Evidence from a multiple chained nonlinear mediating effect model. *Wuhan Finance*, *8*, 32–42.

[6] Oláh, J., Popp, J., Khan, M. A., et al. (2025). How do green banking practices impact banks' profitability? A meta-analysis. *Journal of Risk and Financial Management*, *18*(6), 320.

[7] Gebhardt, S., Hou, Y., & Yarime, M. (2026). Directing environmental innovation toward radical clean technologies for sustainable transitions: Market-based vs. command-and-control policies. *Research Policy*, *55*(4), 105446. https://doi.org/10.1016/j.respol.2026.105446

[8] Liang, Q., Li, W., & Yu, F. (2025). Commercial banks' green governance and the credit premium effect. *Economic Research Journal*, *2*, 192–208.

[9] Zhang, L., & Lian, Y. (2019). Green credit, bank heterogeneity, and bank financial performance. *Research on Financial Regulation*, *2*, 43–61.

[10] Sun, J., Chen, W., & George, Y. S. (2025). Green credit and bank risk-taking: Evidence from China. *International Journal of Managerial Finance*, *21*(1), 157–184. https://doi.org/10.1108/IJMF-03-2024-0144

[11] Alcarva, P., Pinto, J., Pacheco, L., et al. (2026). Green bonds and green banking loans: A systematic literature review. *Sustainability*, *18*(2), 898. https://doi.org/10.3390/su18020898

[12] Li, J., Kim, J. R., & Adegbite, E. (2026). The impact of green credit guidelines on green lending and environmental outcomes: Evidence from Chinese banks. *Ecological Economics*, *242*, 108900.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

Open Access