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Research On The Impact Of Green Credit On The Operating Performance Of Commercial Banks

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Abstract:
Based on data from 81 Chinese banks from 2007 to 2023, we measured commercial banks' operational performance in three respects: profitability, safety, and growth capabilities. It uses the PSM-DID model to investigate the effect of green credit on bank performance. The study not only validates the favorable impacts of green credit on bank performance, but it also investigates the cost implications and the moderating role of monetary policy tools. Furthermore, it assures the results' robustness by quantifying green credit and conducting dynamic regression analyses. The findings indicate that green credit has a strong positive influence on commercial banks' operating performance. Second, green credit will enhance commercial banks' cost-income ratios by boosting bank income while decreasing cost expenditures, hence improving commercial banks' operating performance. Finally, loose monetary policy will have a good moderating effect on green credit and boost bank performance.

Key Word: *Green credit; Commercial bank performance; PSM-DID; Monetary policy tools.*

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I. Introduction

China has first success in the building of green finance if it is to reach the objectives of high-quality and environmentally friendly development. As the core component of the green financial system, green credit integrates environmental protection with economic benefits, aiming to promote green development and industrial transformation. Commercial banks, as the main providers of green credit services, are crucial to the development of green credit, and their enthusiasm for carrying out green credit is inseparable from the impact of implementing green credit on their performance. In addition, the implementation of green credit will be affected by the means of national macro-control. For example, commercial banks will have different behaviors and returns when implementing green credit policies under different monetary policies.

Given this, it is imperative to investigate the effect of green credit on the business performance of commercial banks, investigate its impact mechanism, and then advocate the optimization and use of green credit methods by thus exposing this influence. This research uses the data of 81 banks of various types in the Chinese market from 2007 to 2023 as experimental data. Firstly, in terms of bank business performance, the factor analysis method is chosen to measure it from three dimensions: profitability, security ability and growth ability. Secondly, the sample banks are divided into two groups: the experimental group, which includes institutions that have adopted the green credit strategy, and the control group, which does not. The impact mechanism of green credit and the moderating influence of monetary policy in it are examined through the development of the PSM-DID model for empirical study.

II. Literature Review

Business Performance of Commercial Banks

Regarding the research on the operating performance of banks, the key points often focus on how to measure it. Domestic and foreign scholars have used single financial indicators or comprehensive indicators after processing to measure it. Some studies use single indicators to represent the operating performance of commercial banks. Single performance indicators often concentrate on Tobin's Q value, ROA (Return on Assets), and ROE (Return on Equity), etc. Many scholars use Tobin's Q value to represent bank performance (Alnsour et al, 2021; Kalaf et al, 2023; Rehman et al, 2022). Besides, some other studies have used indicators such as ROA and ROE (Li & Cao, 2004; Mao, et al, 2021). However, measuring commercial banks based on a comprehensive indicator system is a trend in research. For example, bank performance can be measured from multi-dimensional indicators such as stage efficiency, system efficiency, fundraising efficiency, and capital utilization efficiency (Xie et al, 2022). Some scholars also adopt the factor analysis method to conduct analysis from four aspects: financial indicators, customer satisfaction, internal management, and enterprise growth (Allet & Hudon, 2015). In the

research of Chinese scholars, using comprehensive indicators to measure performance is also a research trend. The use of measurement models is diversified, and the selection of indicators is relatively concentrated on aspects such as profitability, risk, and growth. For example, bank performance is measured from four aspects: profitability, development, business structure, and risk resistance, and the TOPSIS method improved by the entropy weight method is used for estimation (Zhang & Li, 2013). Focusing on four core aspects, namely liquidity, security, profitability, and sustainable development ability, the analytic hierarchy process is used to assign scientific and reasonable weights to different evaluation indicators (Tang, 2016). There are even studies that use more comprehensive indicator dimensions, including liquidity, risk resistance, profitability, debt-paying ability, and growth ability, and then determine the weight relationships among the indicators through the grey relational analysis method (Cai & Sun, 2016).

Impact of Green Credit on the Performance of Commercial Banks

There are numerous research methods and samples, and their conclusions vary. The majority of academics believe that green financing can enhance bank performance. Green credit will benefit banks more in terms of their reputation and increase their ability to compete with other banks (Luo et al, 2021; Daoud, 2023; Ding et al, 2020; Liu et al, 2017). In addition, banks that implement green credit reduce investment risks by taking environmental factors into consideration, and small banks are particularly affected by this (Chen et al, 2022; Lian et al, 2022; Song, 2019). In recent years' research, some scholars have added some moderating variables in their studies, considering the moderating effect of macro situations on this financial tool. In terms of the choice of moderating variables, there are monetary policy tools (Tao & Li, 2023), fintech (Xiao & Tang, 2024), etc.

For different samples, there may be differences in research results. Different levels of bank development lead to different impacts. In their research, Song et al (2024) discovered that commercial banks will take on more risk when their green credit scale is small. Conversely, when green finance is widely available, commercial banks will be less to take on risk. By examining banks of various kinds, Zhang et al (2021) concluded that green credit significantly improves the performance of state-owned banks, has a detrimental effect on joint-stock banks, and has little effect on city commercial banks.

There are two types of effects that the introduction of green credit has on commercial banks: short-term and long-term. Zhang et al.'s (2019) research shows that the performance of commercial banks after carrying out green credit will not have a significant impact in the short term, and the long-term lagging impact performance should be observed. Geafferey (2015) studied the long-term impact and found that although banks' investment costs in green credit management increase, they will reduce long-term environmental risks due to previous operations and obtain long-term returns as a result. Dong (2019) examined the immediate and long-term impacts of commercial banks' adoption of green lending, using a number of Chinese listed banks as samples. According to the empirical findings, commercial banks' short-term performance is negatively impacted by the issuance of green credit, but their medium- and long-term performance significantly improves. Cai and Ning (2023) conducted research on 20 commercial banks in China through strongly balanced panel data and added the moderating variable of fintech in the research. The findings demonstrated a non-linear, inverted "U"-shaped relationship between them.

Literature Commentary

Firstly, the above text has sorted out the research related to the banks' performance. Facing a more complex financial environment, measuring the banks' performance from multiple aspects can better meet the needs of the times and reflect the concept of high-quality development. Therefore, more attention will also be paid to measuring the comprehensive performance of commercial banks from multiple perspectives.

Secondly, most scholars start from the green reputation brought to banks by green credit to discuss banks' reputation and risk effects. In this paper, it is hoped to study from the perspective of the cost effect of commercial banks by using more representative samples and more timely data.

Finally, In recent years' research, some scholars have begun to study the moderating role played by certain factors in the economic environment in the process of green credit influencing bank performance. The research on this issue is of great benefit to the academic community's comprehensive understanding of the role played by green credit. Based on this, this paper adds the moderating variable of monetary policy tools in the research, hoping to provide new perspectives and insights for related research.

III. Research Hypotheses

Hypothesis 1

In terms of profitability, the development of green credit has provided commercial banks with new sources of income (Lian et al, 2022). With the deepening of interest rate liberalization and the expansion of the financial field, the profit potential of banks in traditional areas is decreasing. However, the development of green

credit offers new business growth points, bringing direct benefits and helping banks maintain their competitiveness in the highly competitive financial market.

At the level of risk management, green credit plays a significant role. Firstly, it can lower credit risks, optimize the credit structure, and improve the quality of bank assets (Chen et al, 2022). Banks integrate environmental risks into loan decisions and invest in green fields, which can improve the quality of loan assets, accurately handle non-performing assets caused by environmental policies, and prevent financial and bad debt risks. Secondly, it can enhance the reputation of banks and indirectly reduce risks (Ding et al, 2020). Corporate social responsibility requires enterprises to balance economic interests with environmental protection and other aspects. Green credit conforms to this concept. Banks' implementation of this strategy can enhance their reputation, attract high-quality customers, and thus reduce credit risks.

In terms of the growth potential of commercial banks, green credit has created new growth opportunities and business expansion paths for them, bringing about long-term growth (Geafferey, 2015). The demand for corporate green transformation has led to a significant increase in the demand for green credit, strengthening the market position of banks and laying the foundation for sustainable development. Moreover, the correlation between green credit and reputation indicates that its implementation has a long-term impact and is beneficial to the healthy development of banks.

In conclusion, banks' profitability, security, and expansion prospects are all enhanced by green credit. Therefore, **Hypothesis 1**: Green credit improves commercial banks' operational performance.

Hypothesis 2

The improvement of cost efficiency is reflected in multiple aspects.In terms of resource allocation, green credit enables banks to accurately allocate resources to environmentally friendly projects (Chen et al, 2022). This conforms to the long-term trend and can improve the return on assets and cost efficiency.

In risk management and compliance, although the initial implementation will increase costs (Chen et al, 2021), it can reduce non-performing loans and losses in the long term, cut future costs, and enhance efficiency (Dong, 2019).

In terms of brand value and market positioning, green credit can enhance the brand image and reputation of banks (Ding et al, 2020). It can attract customers' funds, increase non-interest income, reduce unit costs, and improve efficiency.

Therefore, **Hypothesis 2**: Green credit will enhance the cost-income ratio of banks, increasing the banks' income while reducing cost expenditures.

Hypothesis 3

Under a loose monetary policy, the market has strong liquidity and banks' capital costs are low. Banks have more funds to invest in green projects to meet the financing needs of enterprises and maintain or increase interest income. This move not only helps banks achieve policy goals but also, as green projects are in line with long-term development and have stable returns, enhances banks' risk resistance (Gu & Shi, 2023).

Conversely, under a tight monetary policy, market funds become tight and banks' capital costs rise. In this situation, banks may reduce their investment in green credit to avoid losses in interest income. Therefore, banks may be more inclined to invest their limited funds in areas with higher returns to maintain their profitability (Zhan, 2018).

In conclusion, monetary policy plays an important moderating role in regulating green credit business. A loose monetary policy environment helps banks increase their green credit investment, improve their cost efficiency and operating performance; while a tight monetary policy often hinders the development of green credit and makes banks face greater liquidity risks.

Therefore, **Hypothesis 3**: A loose monetary policy has a positive moderating effect on green credit in improving the operating performance of commercial banks.

IV. Research Design

Sample Selection

Six state-owned banks, twelve joint-stock banks, twelve rural commercial banks, and fifty-one city commercial banks are among the 81 Chinese commercial banks chosen as samples for this study. Both listed and non-listed banks are included in this group. Joint-stock and state-owned banks are strong and aggressively carry out policies. Despite their relatively modest size, city and rural commercial banks are vital to the local economy and to the funding of small and medium-sized businesses. The research is well supported by the samples, which are quite typical and representative of the state of commercial banks as a whole.

The research data cover the period from 2007 to 2023, which includes the five years before and the eleven years after the release of the "Green Credit Guidelines". During this time span, green credit has

continuously developed from its initial stage to a relatively mature stage, and can well reflect its impact on the banks' performance.

Variable Design and Processing

1.Dependent Variable

Business Performance of Commercial Banks (BP). Referring to the approach of Cai and Ning (2023), this paper adopts factor analysis to reduce the dimensionality of data from multiple indicators in the three dimensions of commercial banks' profitability, security, and growth capabilities.

In terms of the selection of secondary indicators for measuring BP, this paper refers to the research of Tang (2016). For profitability, three indicators are selected, namely Total Asset Turnover (ATR), Return on Equity (ROEa), and Return on Assets (ROAa). For security capabilities, two indicators, namely Non-performing Loan Ratio (LN) and Loan-loss Provision Coverage Ratio (LPR), are chosen. For growth capabilities, three indicators, including Business Revenue Growth Rate (BRR), Net Asset Growth Rate (NR), and Total Asset Growth Rate (AR), are selected.

This work uses the KMO test and Bartlett's sphericity test to validate the linear relationship between the data, thereby meeting the prerequisite for factor analysis. Subsequently, factor analysis is conducted, and the first three factors with eigenvalues greater than 1 are extracted and named a1, a2, and a3 respectively. Their variance explanation rates are 36.516%, 24.072%, and 13.688% respectively, and the cumulative variance explanation rate is increased to 74.275%, approaching the ideal level of explanation. Finally, the component values of each factor are calculated to determine the comprehensive operating performance score of commercial banks (BP).

2.Explanatory Variables

Firstly, in PSM-DID part, the dummy variable $\mathrm{treated}_{it} * \mathrm{t}_{it}$ is used to represent green credit. If Bank i has disclosed the data of green credit, the group dummy variable $\mathrm{treated}_{it}$ takes the value of 1; if not, it takes the value of 0, which is used to distinguish the experimental group from the control group. For the time dummy variable t_{it}, it takes the value of 1 before the critical time point t_{t}, and 0 otherwise. In terms of the definition of the critical time point, referring to the practice of Zhang et al (2019), considering that different banks have differences in asset size, administrative level, and listing time, this study will determine the critical time point of policy change according to the type of bank: for state-owned banks, this time point is set in 2010; for joint-stock banks, it is 2012; and for city banks and rural banks, it is 2014.

In the subsequent robustness tests, this paper specifically quantifies the green credit behavior of commercial banks. Regarding the quantification of green credit, the mainstream practices include taking the logarithm of the green credit balance (Li et al, 2017) and using the proportion of green credit (Tao & Li, 2023; Hu & Zhang, 2016). However, when using the method of taking the logarithm of the green credit balance, the results may be biased when dealing with sample banks with different asset sizes. Therefore, this paper uses the ratio of the green credit balance to the total loan (GLR) as the core explanatory variable.

3.Mediating Variable

To explore the cost effect brought about by banks' implementation of green credit, after refering to the research of Ding et al (2020) the research uses the cost-income ratio (CIR) as the mediating variable.

4.Moderating Variables

To investigate the moderating influence of monetary policy in banks' implementation of the green credit policy and bank performance, this research draws on Tao et al.'s work (2023) and introduces quantitative monetary policy and price-based monetary policy as moderators. Among them, the quantitative monetary policy includes the growth rate of broad money (M2) and the deposit reserve ratio (DRR); the price-based monetary policy includes the 7-day inter-bank offered rate (InterBank) and the 7-day inter-bank pledged repo rate (Repo_R).

5.Control Variables

After referring to the research of Tao et al (2023) and related literature, this paper selects the cost-income ratio (CIR), the relative scale of loans (LAR), the proportion of non-interest income (NIR), the loan-to-deposit ratio (LDR), the liquidity ratio (LR), bank size (Size), and the GDP growth rate (GGDP) as control variables.

Model Construction

1.PSM-DID Model

Before applying the Difference - in - Differences (DID) method for empirical research, due to the significant differences among various types of banks, a direct analysis may not yield valid results. We need to select banks that might theoretically adopt green credit but have not actually done so, and match them with banks that have already implemented green credit. The Propensity Score Matching (PSM) method can effectively

address sample - selection bias and ensure the similarity of the two groups of banks in key characteristics, thereby enhancing the accuracy of the DID analysis. That is, this paper intends to use a combined PSM - DID method to make a more precise estimation of the net effect between green credit and bank performance. This paper selects the Liquidity Ratio (LR), the Relative Scale of Loans (LAR), the Proportion of Non - interest Income (NIR), and the Non - performing Loan Ratio (LN) as covariates (Tao et al, 2023). After the PSM processing of the two groups of samples, the sample - bias problem is well - solved, and the between - group differences are significantly reduced, making the conclusions drawn from the DID - model empirical analysis more realistic and reliable. The number of samples in the experimental group and the control group selected in this paper is close. Therefore, a 1:1 nearest - neighbor matching is performed on the samples, and after eliminating the samples outside the common support area, a DID analysis is carried out.

To explore Hypothesis 1, the Equation (1) of the DID model established in this paper is as follows:

$$\boldsymbol{BP_{i,t} = a_0 + a_1\,treated_{i,t} * t_{i,t} + a_2\,X_{i,t} + \mu_t + \gamma_i + \varepsilon_{i,t}} \quad (1)$$

Where BP_{it} is the dependent variable for measuring the operating performance of commercial banks, $treated_{it} * t_{it}$ is the net effect of green credit, the core explanatory variable, X_{it} represents a series of control variables, μ_t and γ_i represent the control of time and individual fixed - effects respectively, $\varepsilon_{it}$is the random error term, and i and t represent the individual and time respectively.

To explore Hypothesis 2, the cost effect mechanism of green credit, with the cost-income ratio (CIR) as the dependent variable and by creating an interaction term between CIR and $treated_{it} * t_{it}$ the regression model expressions established are shown in Equation (2) and Equation (3) respectively:

$$\boldsymbol{CIR_{i,t} = b_0 + b_1\,treated_{i,t} * t_{i,t} + b_2\,X_{i,t} + \mu_t + \gamma_i + \varepsilon_{i,t}} \quad (2)$$

$$\boldsymbol{BP_{i,t} = c_0 + c_1\,treated_{i,t} * t_{i,t} + c_2\,CIR_{i,t} + c_3\,treated_{i,t} * t_{i,t} * CIR_{i,t} + c_4\,X_{i,t} + \mu_t + \gamma_i + \varepsilon_{i,t}} \quad (3)$$

Among them, $CIR_{i,t}$ represents the cost-income ratio of commercial banks, which reflects the cost efficiency of commercial banks.

To explore Hypothesis 3, the moderating effect of monetary policy, the Equation (4) of the DID model established in this paper is as follows:

$$\boldsymbol{BP_{i,t} = d_0 + d_1\,treated_{i,t} * t_{it} + d_2 treated_{i,t} * t_{i,t} * M_{i,t} + d_3\,M_{i,t} + d_4\,X_{i,t} + \gamma_i + \varepsilon_{i,t}} \quad (4)$$

Among them, $M_{i,t}$ are those moderating variables, including the growth rate of broad money (M2), the deposit reserve ratio (DRR), the 7-day inter-bank offered rate (InterBank), and the 7-day inter-bank pledged repo rate (Repo_R). Since adding moderating variables containing time series into the model will lead to multicollinearity, only individual fixed effect analysis is conducted for Equation (4).

2.Dynamic Regression Model

In the robustness testing section, this article precisely measures commercial banks' green credit behavior. According to Tao et al (2023), the ratio of green credit balance to total loan (GLR) is employed as the primary explanatory variable. Meanwhile, considering that the performance level of the previous period may have an impact on the current period, a dynamic regression model is further established for analysis (Equation 5).

$$\boldsymbol{BP_{i,t} = e_0 + e_1\,BP_{i,t-1} + e_2 GLR_{i,t} + e_3\,X_{i,t} + \gamma_i + \varepsilon_{i,t}} \quad (5)$$

where $BP_{i,t-1}$ is the performance value in the previous period, and $GLR_{i,t}$ is proportion of green credit. Since the implementation of green credit itself involves a time series, controlling the time variable in the model will lead to multicollinearity. Therefore, only individual fixed effect analysis is conducted for Equation (5).

V. Results And Analysis

Descriptive Statistics

Table 1 shows the results of the descriptive statistics of the relevant indicators of commercial banks after grouping. Among them, the performance score of the operating performance (BP) of commercial banks has been normalized. According to the results of the t-test, significant differences exist in all indicators between the two

groups. Therefore, in the following text, propensity score matching will be conducted on the two groups of samples to avoid the endogeneity problem caused by sample selection bias.

Table 1 : Results of the Descriptive Statistics

	treated=0, n=644		treated=1, n=603		t-value
	Mean	SD	Mean	SD	
BP	0.36	0.1	0.32	0.06	9.404***
LAR	0.51	0.12	0.53	0.09	-4.092***
NIR	0.19	0.19	0.22	0.1	-3.465***
LR	0.57	0.19	0.61	0.21	-3.754***
LDR	0.63	0.13	0.76	0.14	-17.823***
CIR	0.35	0.09	0.31	0.06	6.865***
GGDP	8.25	2.34	6.11	2.18	16.732***
Size	4.21	1.12	6.66	1.61	-30.647***

*p < 0.1, **p < 0.05, ***p < 0.01.

Results of Propensity Score Matching

The propensity score matching method needs to meet the prerequisite assumption of balance. That is, when the absolute value of the standardized bias after matching is less than 20%, the matching is considered effective. Judging from the propensity score matching results shown in Table 2, both groups of samples have excellent performance in terms of the standardized bias of each variable. Among them, the reduction in the standard error of the liquidity ratio (LR) reaches 28.06%, that of the relative scale of loans (LAR) is a significant 70.92%, the proportion of non-interest income (NIR) is also reduced by 43.13%, and the non-performing loan ratio (LN) has achieved a 100% reduction. The absolute values of the standardized biases of these covariates after matching are all far below the key indicator of 20%. This indicates that after propensity score matching, the two groups of samples have become highly similar in all aspects of the variables' characteristics and have successfully passed the balance test.

Table 2 : Results of Propensity Score Matching

Variable	Matched	Bias	|Bias|	t -value
LR	before	20.25%	28.06%	3.319***
	after	14.57%		2.019**
LAR	before	22.64%	70.92%	3.663***
	after	6.58%		0.866
NIR	before	17.75%	43.13%	2.851***
	after	10.09%		1.273
LN	before	11.27%	100.00%	1.799*
	after	0.00%		0.000

*p < 0.1, **p < 0.05, ***p < 0.01.

Analysis of the Empirical Results of PSM-DID

1.Benchmark Regression

Table 3 showcases the benchmark regression outcomes derived from Equation (1), specifically the two-way fixed effects regression results where the operating performance serves as the dependent variable. Notably, the coefficient of treated * t is both significant and positive. This means that green financing helps commercial banks improve their operational performance. The net effect of green credit is calculated as 0.245. In essence, when considering the comprehensive impacts of green credit on the profitability, security, and growth potential of commercial banks, it becomes evident that green credit exerts a pronounced positive influence on their overall operating performance. This finding further corroborates Hypothesis 1.

The regression results also verify the research findings of Ding (2020), Nawazish et al (2022), and Lian et al (2022). Since the establishment of the green credit strategy, commercial banks have experienced increased profitability, security, and growth. After strengthening their risk identification capabilities, commercial banks have grasped higher-quality assets and simultaneously improved their own reputations. This set of beneficial developments is helpful to improving the banks' performance.

Table 3: Results of Benchmark Regression

Variable	Model (1) BP
treated*t	0.245***
	(4.051)
LAR	0.332

	(1.445)
NIR	-0.300***
	(-2.910)
LR	-0.099
	(-1.146)
LDR	-0.653***
	(-3.700)
CIR	-1.260***
	(-4.776)
Size	-0.244***
	(-3.901)
Constant	2.365***
	(5.901)
Time Fixed	Yes
Individual Fixed	Yes
N	792
R^2	0.548

*p < 0.1, **p < 0.05, ***p < 0.01; (t-value).

2.Regression Analysis of the Cost Effect Mechanism

As shown in Table 4, Model (2) presents the regression results with the cost-income ratio (CIR) as the dependent variable based on Equation (2), and Model (3) shows the regression results based on Equation (3), which adds the interaction term treated * t * CIR of the cost-income ratio on the basis of the benchmark regression model. Whether it is Model (1) in the previous section or Model (3) in this section, the coefficients of CIR are significantly negative, indicating that the cost effect has a negative impact on the bank performance. The coefficient of treated * t in Model (2) is negative, suggesting that the implementation of the green credit policy has reduced the bank's income-cost ratio to a certain extent. The coefficient of treated * t * CIR in Model (3) is positive, indicating that green credit has strengthened the impact of the income-cost ratio on the bank performance. Therefore, the implementation of green credit has helped banks strengthen cost management to some extent and can improve the banks' own performance levels to a greater extent. This also verifies Hypothesis 2.

When banks actively fulfill their social responsibilities and increase their investment in green credit, it is not only beneficial for opening up new revenue channels and improving the banks' reputations but also enhances the banks' operational capabilities through the cost effect. It increases revenues while reducing cost expenditures, thereby strengthening the improvement of the banks' operating performance brought about by green credit.

Table 4: Regression Results of the Cost Effect Mechanism

Variable	Model (2) CIR	Model (3) BP
treated*t	-0.026***	0.006
	(-3.021)	(0.041)
CIR		-1.587***
		(-4.988)
treated*t*CIR		0.760*
		(1.831)
LAR	0.133***	0.333
	(4.052)	(1.448)
NIR	0.001	-0.304***
	(0.056)	(-2.959)
LR	-0.025**	-0.09
	(-2.012)	(-1.040)
LDR	-0.100***	-0.638***
	(-3.958)	(-3.616)
Size	-0.025***	-0.243***
	(-2.801)	(-3.899)
Constant	0.479***	2.470***
	(8.743)	(6.111)
Time Fixed	Yes	Yes
Individual Fixed	Yes	Yes
N	792	792
R^2	0.345	0.555

*p < 0.1, **p < 0.05, ***p < 0.01; (t-value).

3. Regression on the Moderating Effect of Monetary Policy

To verify Hypothesis 3, Table 5 presents the benchmark regression results of the moderating effect of monetary policy based on Equation (4).

The regression results of Models (4) and (5) provide evidence for the moderating influence of quantitative monetary policy tools. These two columns show the regression results for the interaction factors between the deposit reserve ratio (DRR), the growth rate of broad money (M2), and the green credit effect (treated * t). Among them, the coefficient of treated * t * DRR is significantly negative (-4.097), indicating that a higher deposit reserve ratio has a negative moderating effect on the improvement of commercial banks' operating performance by green credit. The coefficient of treated * t * M2 is considerably positive (3.021), showing that increasing the amount of money supply has a positive moderating effect on improving bank performance through green lending. That is, a loose monetary policy has a positive moderating effect on the improvement of bank performance through green credit.

Regarding the moderating effect of price-based monetary policy tools, we can observe the regression results of Model (6) and Model (7). These two columns respectively represent the regression results of the interaction terms between the 7-day inter-bank offered rate (InterBank) and the 7-day inter-bank pledged repo rate (Repo_R) and the green credit effect (treated * t). Among them, the coefficients of the product terms treated * t * InterBank and treated * t * Repo_R are significantly negative (-21.041 and -20.275 respectively), indicating that both of them have a negative moderating effect on the improvement of commercial banks' operating performance by green credit.

In addition, the above empirical results reflect that the moderating effects of the two types of monetary policy tools are different in magnitude. The absolute value of the coefficient of the interaction term between quantitative monetary policy and green credit is much smaller than that of the interaction term between price-based monetary policy and green credit. Quantitative monetary policy tools are aimed at long-term regulation. For example, in order to maintain policy stability, the central bank will adjust the reserve ratio only after a certain time interval. Once the signal of raising the reserve ratio is sent out, banks will tighten their credit scale to some extent. During this process, the response speed and degree of banks are relatively small. Price-based monetary policy tools will change frequently in the short term, and banks are more sensitive to them and will make credit adjustments more quickly and to a greater extent.

To sum up, a loose monetary policy has a positive moderating effect on the improvement of bank performance by green credit. Under a loose monetary policy, banks can obtain sufficient funds to support enterprises' green loans, which in turn will bring more substantial interest income for banks. Meanwhile, when the market has relatively abundant funds, banks will, in accordance with the policy orientation, actively develop innovative green financial products and guide market consumers to participate in the consumption of green products. Therefore, Hypothesis 3 is fully verified.

Table 5: Regression Results of the Moderating Effect of Monetary Policy

Variable	Model (4) DRR	Model (5) M2	Model (6) InterBank	Model (7) Repo_R
treated*t	0.704***	-0.331***	0.724***	0.684***
	(5.081)	(-3.032)	(5.680)	(5.319)
LAR	0.623***	0.590**	0.794***	0.799***
	(2.716)	(2.427)	(3.522)	(3.515)
NIR	-0.486***	-0.505***	-0.442***	-0.449***
	(-4.662)	(-4.654)	(-4.280)	(-4.350)
LR	0.030	-0.057	-0.02	-0.015
	(0.350)	(-0.643)	(-0.240)	(-0.184)
LDR	-0.715***	-0.785***	-0.888***	-0.889***
	(-3.905)	(-4.118)	(-4.936)	(-4.934)
CIR	-1.491***	-1.521***	-1.226***	-1.244***
	(-5.599)	(-5.393)	(-4.605)	(-4.682)
Size	-0.259***	-0.219***	-0.229***	-0.224***
	(-4.211)	(-3.558)	(-3.861)	(-3.804)
GGDP	0.028***	0.027***	0.020***	0.020***
	(3.984)	(3.468)	(2.912)	(2.823)
DRR	6.197***			
	(8.357)			
treated*t*DRR	-4.097***			
	(-4.995)			
M2		-1.156**		
		(-2.237)		
treated*t*M2		3.021***		
		(3.534)		

InterBank			20.140***	
			(9.384)	
treated*t* InterBank			-21.041***	
			(-5.694)	
Repo_R				19.857***
				(9.356)
treated*t* Repo_R				-20.275***
				(-5.279)
Constant	1.001***	2.615***	1.809***	1.806***
	(3.047)	(9.339)	(7.094)	(7.075)
Individual Fixed	Yes	Yes	Yes	Yes
N	792	792	792	792
R^2	0.618	0.588	0.627	0.627

*p < 0.1, **p < 0.05, ***p < 0.01; (t-value).

Robustness Tests

In the previous text, the PSM-DID model was used, with the dummy variable treated * t representing green credit. In this section, green credit will be quantified in a more specific manner.

This paper uses the proportion of green credit to the total loan (GLR) to quantify green credit. According to Equation (5), the regression results are shown in Table 6. The results indicate that the coefficient and significance of treated * t after adjusting the sample period have not changed much compared with those before, which further verifies that the research results of this paper are robust and valid.

Table 6: Regression Results of Replacing the Core Explanatory Variable

Variable	Model (8) BP
GLR	0.676**
	(2.533)
BP（t-1）	0.549***
	(21.636)
LAR	0.512***
	（3.293）
NIR	-0.016
	(-0.199)
LR	0.077
	(1.258)
LDR	-0.404***
	(-3.131)
CIR	-1.012***
	(-4.820)
Size	-0.182***
	(-7.662)
GGDP	0.023***
	(4.756)
Constant	1.170***
	(6.180)
Individual Fixed	Yes
N	748
R^2	0.786

*p < 0.1, **p < 0.05, ***p < 0.01; (t-value).

VI. Conclusion

Based on the research three main conclusions are drawn:

Firstly, green credit has a significant positive impact on the bank performance. After strengthening their risk identification capabilities, commercial banks have grasped higher-quality assets and simultaneously improved their own reputations.

Secondly, green credit will improve the cost-income ratio of banks, increasing bank revenues while reducing cost expenditures. When banks actively fulfill their social responsibilities and increase their investment in green credit, it is not only beneficial for opening up new revenue channels and improving the banks' reputations but also enhances the banks' operational capabilities through the cost effect. It increases revenues while reducing cost expenditures, thereby strengthening the improvement of the banks' operating performance brought about by green credit.

Thirdly, a loose monetary policy has a positive moderating effect on the improvement of bank performance by green credit. Under a loose monetary policy, banks can obtain sufficient funds to support enterprises' green loans, which in turn will bring more substantial interest income for banks. Meanwhile, when the market has relatively abundant funds, banks will, in accordance with the policy orientation, actively develop innovative green financial products and guide market consumers to participate in the consumption of green products.

Data Availability Statement

The data that support the findings of this study are openly available in CSMAR at https://data.csmar.com/.

References

[1]. Alnsour, E., Dahiyat, A., & Weshah, S. (2021). Intellectual Capital And Tobin's Q As Measures Of Bank Performance. Accounting, 7(7), 1695-1700.

[2]. Kalaf, K. A. M., & Hilo, S. H. (2023). Using The Tobin Q Model To Evaluate The Impact Of Credit Risks On The Bank's Market Value During The Corona Pandemic. Journal Of Islamic Accounting And Business Research, 14(6), 973-988.

[3]. Rehman, A. U., Aslam, E., & Iqbal, A. (2022). Intellectual Capital Efficiency And Bank Performance: Evidence From Islamic Banks. Borsa Istanbul Review, 22(1), 113-121.

[4]. Li, W. A., & Cao, T. Q. (2004). Ownership Structure, Governance Mechanism And The Performance Of City Banks: Survey Evidence From Shandong And Henan Provinces. Economic Research Journal, (12), 4-15.

[5]. Mao, H. L., Guo, G., & Chen, Z. Y. (2021). Research On The Influencing Factors Of The Performance Of Listed Commercial Banks In China: Analysis And Comparison From ROA And ROE. Economy And Management, (15), 43-44.

[6]. Xie, Q. W., Xu, Q. F., Chen, L. F., Jin, X., Li, S. Q., & Li, Y. J. (2022). Efficiency Evaluation Of China's Listed Commercial Banks Based On A Multi-Period Leader-Follower Model. Omega, 110, 102615.

[7]. Allet, M., & Hudon, M. (2015). Green Microfinance: Characteristics Of Microfinance Institutions Involved In Environmental Management. Journal Of Business Ethics, 126(3), 395-414.

[8]. Zhang, H., & Li, C. (2013). Research On The Comprehensive Performance Evaluation Of Commercial Banks Based On The Improved TOPSIS Method. Industrial & Science Tribune, 12(10), 116-118.

[9]. Tang, W. Z. (2016). Research On The Performance Evaluation Of Commercial Banks Based On The Analytic Hierarchy Process. Journal Of Chongqing University Of Technology (Natural Science), 30(11), 167-170, 184.

[10]. Cai, Y. P., & Sun, X. (2016). The Performance Evaluation System Of Listed Commercial Banks Based On BP Neural Network. Systems Engineering, 34(12), 24-30.

[11]. Luo, S. M., Yu, S. H., & Zhou, G. Y. (2021). Does Green Credit Improve The Core Competence Of Commercial Banks? Based On Quasi-Natural Experiments In China-Science Direct. Energy Economics, 100.

[12]. Daoud. (2023). Bibliometric Analysis Of Sustainability Papers: Evidence From Environment, Development And Sustainability. Environment Development And Sustainability, 26(4), 21-27.

[13]. Ding, N., Ren, Y. N., & Zuo, Y. (2020). Does The Green Credit Policy Lose More Than It Gains Or Achieve Its Desired Results? ——PSM-DID Cost Efficiency Analysis From The Perspective Of Resource Allocation. Journal Of Financial Research, (04), 112-130.

[14]. Liu, Y., Wang, Y. Y., Lu, N., Et Al. (2017). Research On The Social Responsibility And Performance Of Commercial Banks——From The Perspective Of Green Finance. Times Finance, (26), 133-135.

[15]. Chen, Z. L., Mirza, N., Huang, L., & Umar, M. (2022). Green Banking—Can Financial Institutions Support Green Recovery? Economic Analysis And Policy, 75, 389-395.

[16]. Lian, Y. H., Gao, J. Y., & Ye, T. (2022). How Does Green Credit Affect The Financial Performance Of Commercial Banks? — Evidence From China. Journal Of Cleaner Production, 344.

[17]. Song, Y. W. (2019). Analysis On The Influence Mechanism Of Green Credit On The Financial Performance Of Commercial Banks. New Finance, (09), 42-47.

[18]. Tao, Y., & Li, H. (2023). Green Credit And Commercial Banks' Risk-Taking——Based On The Moderating Effect Of Monetary Policy. Research On Development-Oriented Finance, (04), 35-49.

[19]. Xiao, F., & Tang, G. J. (2024). Fintech, Commercial Bank Performance And Green Credit Growth. Journal Of Gannan Normal University, 45(02), 102-108.

[20]. Song, J., Cao, W., & Shan, Y. G. (2024). Green Credit And Bank's Risk-Taking: Evidence From China. International Journal Of Managerial Finance.

[21]. Zhang, H., Zhu, W. W., Xu, Y. Y., Et Al. (2021). Does Green Credit Really Reduce The Performance Of Commercial Banks? Research On Financial Economics, 36(01), 94-107.

[22]. Zhang, L., Lian, Y. H., & Zhao, H. T. (2019). The Dynamic Interactive Influence Relationship Between Green Credit And Bank Financial Performance——Based On The Empirical Research Of 29 Commercial Banks In China. Shanghai Finance, (04), 31-39, 16.

[23]. Geafferey Heal. (2015). Corporate Social Responsibility: An Economic And Financial Framework. Geneva Papers On Risk And Insurance: Issues And Practice, 30(3), 387-409.

[24]. Dong, L. (2019). Regulatory Policies, Green Credit And The Performance Of Commercial Banks. Qilu University Of Technology.

[25]. Gu, H. F., & Shi, Q. Q. (2023). Will Green Credit Affect The Risk-Taking Of Commercial Banks?——Based On The Channels Of Social Responsibility And Green Reputation. The Theory And Practice Of Finance And Economics, 44(01), 2-10.

[26]. Zhan, X. Y. (2018). The Practice And Institutional Innovation Of China's Green Finance Development. Macroeconomic Management, (1), 41-48.

[27]. Cai, Y. P., & Ning, J. Y. (2023). Research On The Impact Of Green Credit On The Operating Performance Of Commercial Banks——Based On The Moderating Effect Of Fintech. Contemporary Economics, 40(08), 70-79.

[28]. Li, S., Jia, Y. Y., & Da, T. F. (2017). The Impact Of Green Credit On The Performance And Risk Of Commercial Banks——Based On The Panel Data Analysis Of 16 Listed Commercial Banks. Research On Financial Development, (09), 72-77.

[29]. Hu, R. C., & Zhang, W. Q. (2016). Will The Implementation Of Green Credit Affect The Profitability Of Commercial Banks? Financial Regulation Research, (07), 92-110.

[30]. Oral, M., & Yolalan, R. (1990). An Empirical Study On Measuring Operating Efficiency And Profitability Of Bank Branches. European Journal Of Operational Research, 46(3), 282-294.

[31]. Wanke, P. (2022). Revisiting CAMELS Rating System And The Performance Of ASEAN Banks: A Comprehensive MCDM/Z-Numbers Approach. IEEE ACCESS, (10).
[32]. Nizam, E., Ng, A., Dewandaru, G., Et Al. (2019). The Impact Of Social And Environmental Sustainability On Financial Performance: A Global Analysis Of The Banking Sector. Journal Of Multinational Financial Management, 49, 35-53.
[33]. Finger, M., Gavious, I., & Manos, R. (2018). Environmental Risk Management And Financial Performancein The Banking Industry, A Cross-Country Comparison. Journal Of International Financial Markets, Institutions&Money, 52.
[34]. Biswas, N. (2011). Sustainable Green Banking Approach: The Need Of The Hour. Business Spectrum, 1(1), 32-38.
[35]. Acemoglu, D., Akcigit, U., & Hanley, D. (2016). Transition To Clean Technology. Journal Of Political Economy, 124(1), 52-104.
[36]. Tombe, T., & Winter, J. (2015). Environmental Policy And Misallocation: The Productivity Effect Of Intensity Standards. Journal Of Environmental Economics And Management, 72(6), 137-163.
[37]. Priya, P. (2012). Banking On The Equator. Are Banks That Adopted The Equator Principles Different From Non-Adopters? World Development, 34(2).
[38]. Shi, Y. C., Zhang, R. Z., & Yang, C. H. (2021). Carbon Emission Reduction And Green Credit: Discussion On The Development Path Based On International Experience. International Finance, (07), 12-16.
[39]. Xu, Q. Y., & Liu, H. D. (2024). Green Credit, Industrial Structure Optimization And Green Total Factor Productivity. Modern Economic Research, (02), 93-108.
[40]. Lu, J., Yan, Y., & Wang, T. X. (2021). A Study On The Micro Effects Of Green Credit Policy: From The Perspective Of Technological Innovation And Resource Reallocation. China Industrial Economy, (01), 174-192.
[41]. Chen, K., Sun, X. B., & Yu, H. L. (2021). The Impact Of Green Credit On The Operating Performance Of Commercial Banks. Regional Finance Research, (03), 13-20.