Research on the Impact of Green Credit on the Sustainable Development of Commercial Banks

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Abstract: This study examines the effect of green credit on bank financial performance and risk management through empirical data analysis of 10 large commercial banks in China from 2010 to 2021. The findings reveal that the green credit ratio (GCR) significantly improves the bank's return on assets (ROA) and return on equity (ROE), while efficiently reducing the non-performing loan ratio (NPL Ratio), suggesting that green credit has a positive impact on the profitability and risk control of banks. Capital adequacy ratio (CA) is crucial for promoting financial stability and risk management in banks. The leverage ratio (LR) has a more nuanced impact on financial performance, and the interest rate (IR) positively affects profitability. The results of residual analysis show that the model fit is reasonable and the residuals are approximately normally distributed, which further verifies the reliability of the analysis results. This study's findings indicate that green credit, a key tool for promoting sustainable development in commercial banks, effectively reduces risk exposure while enhancing profitability.

Keywords: Green Credit; Financial Performance; Risk Management; Capital Adequacy Ratio; Commercial Bank

1. Introduction

1.1 Research Background and Importance

As global environmental challenges escalate, green finance emerges as a potent instrument to facilitate sustainable development. At the heart of green finance lies green credit, which plays a pivotal role in reducing environmental pollution, accelerating economic transformation, and enabling sustainable social development. Green credit has become one of the main businesses of most financial institutions. It not only boosts the development of the environmental protection industry but also greatly reduces the environmental risks of enterprises, improving the whole structure of economy [1]. In recent years, the Chinese government also vigorously impels green credit policies, asking commercial banks to invest more funds in the project of environmental protection to tie in with the green development strategy of the country [2]. This helps the commercial bank not only to fulfill its social role but also contributes towards strengthening the social image and reputation of banks that support projects contributing to sustainable development [3]. Despite the promotion of green credit, several challenges persist, including the potential for short-term financial performance deterioration in banks, especially smaller institutions [4].

1.2 Research Objectives

This study aims to analyze the impact of green credit on the financial performance and risk management of commercial banks through empirical research. Additionally, the study examines how factors like Capital Adequacy (CA), Leverage Ratio (LR), and Interest Rate (IR) interact with green credit to further influence bank performance and risk. By analyzing the residual distribution, the study also ensures the robustness of the models used. The main objective is to have a complete understanding of how green credit helps commercial banks increase profitability, manage risk effectively, and promote sustainable development.

2. Green Credit and Sustainable Development of Commercial Banks

2.1 Definition and Connotation of Green Credit

Green credit is a financial instrument that supports environmentally friendly projects and enterprises, achieving both economic development and environmental protection.

The concept is proposed to guide funds to low-carbon [5], energy-saving and environmentally friendly industries, promote economic structural transformation and upgrading, and reduce the potential losses of the financial system due to environmental risks[6]. In practice, green credit not only covers traditional environmental protection industries, such as clean energy, environmental protection technology and green buildings, but also gradually expands to various fields including green manufacturing, ecological agriculture and green transportation[7]. Therefore, green credit is not only a reflection of the social responsibility of financial institutions, but also an important means to promote the development of green economy[8].

2.2 Conceptual Framework of Sustainable Development of Commercial Banks

Sustainable development for commercial banks involves three key dimensions: economic, environmental, and social benefits [9]. First, from an economic benefit perspective, in the process of pursuing profit, the sustainable development of banks requires that they can maintain long-term financial stability and growth capacity [10]. They should support, through various financial tools like green credit, environmentally friendly projects and enterprises to reduce the negative effects of their financial operations on the ecological perspective. Last but not least, from the social benefit perspective, the sustainable development of banks also covers an active participation in social responsibilities and encouraging the sustainable development and welfare improvement of society. Therefore, the conceptual framework of sustainable development, in regard to commercial banks, besides requiring the financial health and business expansion of the bank itself, emphasizes its contribution to environmental protection and social responsibility as well [11]. Only by balancing the relationship between these three can banks achieve sustainable development in the true sense [12].

2.3 Impact of Green Credit on Commercial Banks

First, green credit can enhance a bank's social image and reputation. By supporting environmental protection projects, banks can demonstrate their commitment to environmental protection, thereby enhancing the public's trust in their brands[13]. Second, green credit can reduce banks' risk exposure. Especially in the context of increasingly significant environmental risks, green credit helps banks avoid credit risks associated with high-pollution and high-emission enterprises[14]. In addition, green credit can also bring new profit growth points to banks. By developing and promoting green financial products, banks can expand new markets and customer groups [15,16]. Therefore, when promoting green credit, banks need to find a balance between social responsibility and economic benefits and formulate reasonable strategies to achieve long-term sustainable development [17].

3. Evaluation of the Effects of Green Credit on Commercial Banks

3.1 Impact of Green Credit on Operating Performance

Green credit is a significant factor influencing the operational performance of commercial banks. While research indicates that green credit may temporarily impair a bank's financial performance, it ultimately fosters improved financial stability and profitability in the long run [18]. For instance, the research that was based on the Industrial Bank of China showed that green credit has a positive effect on the bank's ROA and mainly because green credit meets not only market demand but also promotes the improvement of internal organizational structure and management level inside the bank in general [19]. Nonetheless, the effect of green credit on bank financial performance is not always straightforward. Some studies have pointed out that the initial implementation of green credit may lead to increased operating costs, especially when banks lack mature green credit products and management systems. These initial costs may negatively affect the bank's short-term profitability [20]. Therefore, when promoting green credit business, banks need to balance short-term financial pressure and long-term strategic benefits to achieve sustainable financial growth.

3.2 The Role of Green Credit in Risk Management

Green credit plays an increasingly important role in the risk management of commercial banks [21]. Research indicates that banks adopting green credit policies exhibit superior credit risk management performance [22], with this effect being more pronounced in large state-owned banks. Furthermore, green credit can enhance the overall risk control capabilities of banks by mitigating the risks associated with non-performing loans [23]. However, different types of banks may face different risk management challenges when implementing green credit. For example, city and regional commercial banks do not have adequate information and expertise to appropriately assess the green credit risk; hence, their risk management would be poor compared to large state-owned banks [24]. Hence, risk management strategies should be tailored to the unique features and market environment of individual banks, and their expertise and information on green credit should be strengthened to enable banks to fully harness the role of green credit in risk management.

3.3 Green Credit Enhances the Social Image of Banks

The concept of green credit holds tremendous value for enhancing the public image of commercial banks. By supporting environmental protection projects and enterprises, banks can demonstrate their commitment to environmental protection and social responsibility, thereby enhancing public trust in their brands [25]. Studies have shown that there is a significant positive correlation between a bank's green credit business and its social image. In particular, in the context of the public's high attention to environmental issues, green credit can significantly enhance the bank's brand value and social reputation[26]. Besides, with green credit, the bank could improve its social image, as it also improves the relationship between the bank and its stakeholders [27]. Therefore, while commercial banks realize the economic benefit of promoting green credit, they simultaneously improve their comprehensive image and influence within society by shouldering their social responsibilities [28].

4. Empirical Research and Analysis

4.1 Data Source and Research Method

This study utilizes annual financial data from 10 large commercial banks in China from 2010-2021, comprising a total of 120 sample datasets. These data encompass key financial indicators such as the green credit ratio, capital adequacy ratio, interest rate, return on assets, return on equity, and non-performing loan ratio. The aim is to analyze the long-term impact of green credit on bank financial performance and risk management.

The following is the specific regression model:

$$\text{ROA}_{it} = \alpha + \beta_1 \text{GCR}_{it} + \beta_2 \text{Size}_{it} + \beta_3 \text{Leverage}_{it} + \grave{o}_{it} \quad (1)$$

Formula 1 represents the financial performance model, which is used to analyze the impact of the green credit ratio (GCR) on the bank's return on assets (ROA). In the formula, α is a constant term, which represents the basic impact of other factors; β_1 is the coefficient of the green credit ratio on the return on assets; β_2 and β_3 are the coefficients of the bank's size and leverage ratio on the return on assets, respectively.

$$\text{NPL Ratio}_{it} = \gamma + \delta_1 \text{GCR}_{it} + \delta_2 \text{Risk}_{it} + \delta_3 \text{Gov}_{it} + \mu_{it} \quad (2)$$

Formula 2 is a risk management model that assesses the effect of the green credit ratio (GCR) on the bank's non-performing loan ratio (NPL Ratio). In the formula, γ is a constant term, which represents the basic impact of other factors; δ_1 is the coefficient of the green credit ratio on the non-performing loan ratio; δ_2 and δ_3 are the coefficients of the bank's risk exposure (Risk) and corporate governance level (Gov) on the non-performing loan ratio.

4.2 Analysis of Empirical Results

Table 1: Sample Statistics of Bank Financial Performance and Risk Management

Year	Bank 1 ROA (%)	Bank 2 ROA (%)	Bank 1 ROE (%)	Bank 2 ROE (%)	Bank 1 NPL Ratio (%)	Bank 2 NPL Ratio (%)
2010	1.0	0.9	9.0	8.5	2.1	2.3
2011	1.1	1.0	9.5	8.9	2.0	2.2
2012	1.2	1.1	10.0	9.2	1.9	2.1
2013	1.3	1.2	10.5	9.6	1.8	2.0
2014	1.4	1.3	11.0	10.0	1.7	1.9
2015	1.5	1.4	11.5	10.5	1.6	1.8

2016	1.6	1.5	12.0	11.0	1.5	1.7
2017	1.7	1.6	12.5	11.5	1.4	1.6
2018	1.8	1.7	13.0	12.0	1.3	1.5
2019	1.9	1.8	13.5	12.5	1.2	1.4
2020	2.0	1.9	14.0	13.0	1.1	1.3
2021	2.1	2.0	14.5	13.5	1.0	1.2

The data shows that with the development of green credit business, the ROA and ROE of banks have shown an upward trend year by year, indicating that profitability has increased; at the same time, the non-performing loan ratio has gradually decreased, reflecting the improvement of risk management capabilities. In particular, Bank 1's ROA increased from 1.0% in 2010 to 2.1% in 2021, indicating stable financial benefits from green credit. Meanwhile, the NPL ratio decreased from 2.1% to 1.0%, showing improved risk control capabilities.
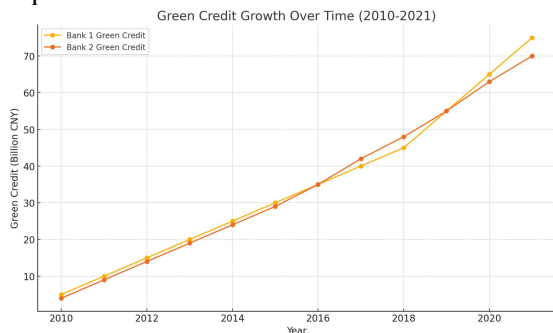

Figure1. Green Credit Growth Over Time

Figure 1 shows the growth of green credit business of the two banks from 2010 to 2021. The data indicates both banks' green credit has exhibited a stable and accelerating growth trend, especially since 2017, when the expansion of green credit significantly accelerated. The green credit of Bank 1 increased from RMB 500 million in 2010 to RMB 7.5 billion in 2021, while that of Bank 2 increased from RMB 400 million to RMB 7 billion. This shows that with the advancement of policies and the increase in market demand, green credit has become an important part of banking business, and the business has grown significantly.

Table 2 shows the capital adequacy ratio and market interest rate trends of the two banks from 2010 to 2021. The data shows that the capital adequacy ratio has increased year by year during this period, reflecting that the bank has maintained a solid capital buffer while expanding its green credit business. The capital adequacy ratio of Bank 1 increased from 10% in 2010 to 17% in 2021, showing an enhanced risk management capability. At the

same time,

Table 2. Trends in Capital Adequacy Ratio and Interest Rates

Year	Bank 1 Capital Adequacy (%)	Bank 2 Capital Adequacy (%)	Interest Rate (%)
2010	10	9	5.0
2011	11	10	5.2
2012	11	10	5.1
2013	12	11	5.3
2014	12	12	5.4
2015	13	12	5.6
2016	13	12	5.5
2017	14	13	5.7
2018	15	13	5.8
2019	15	14	5.9
2020	16	14	6.0
2021	17	15	6.1

the interest rate rose from 5.0% in 2010 to 6.1% in 2021, which had a certain impact on the bank's financing costs.
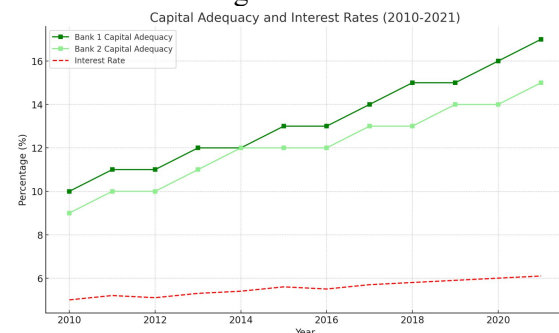

Figure2. Capital Adequacy and Interest Rates

Figure 2 shows the capital adequacy ratio and interest rate trends of the two banks from 2010 to 2021. The figure shows that the capital adequacy ratio of the bank has been rising steadily, indicating that the bank's risk management capabilities have been strengthened while expanding green credit. At the same time, interest rates are on an upward trend, which may have a certain impact on the bank's financing costs and financial performance.

Regression results for ROA, NPL Ratio, and ROE (TABLE3).

The regression results, shown in Table 3, reveal that the green credit ratio (GCR) has a significant positive impact on both ROA and ROE. Additionally, the GCR is seen to reduce the non-performing loan ratio (NPL Ratio), suggesting that as the level of green credit

increases, the profitability of the bank strengthens and the risk decreases. The impact of the leverage ratio (LR) is more complex, with a smaller negative impact on ROA, while the interest rate (IR) has a positive impact on ROA and ROE, but little impact on the NPL Ratio.

Table3. Regression results for ROA, NPL Ratio, and ROE

| Variable	ROA Coefficient	ROA Standard Error	NPL Coefficient	NPL Standard Error	ROE Coefficient	ROE Standard Error
Green Credit Ratio (GCR)	0.015	0.003	-0.020	0.005	0.025	0.007
Capital Adequacy (CA)	0.012	0.002	-0.015	0.004	0.020	0.006
Leverage Ratio (LR)	-0.007	0.004	0.008	0.006	-0.010	0.008
Interest Rate (IR)	0.005	0.001	-0.002	0.002	0.007	0.003
Constant	-0.050	0.020	0.080	0.030	-0.100	0.050
R-squared	0.75		0.68		0.72	
Adjusted R-squared	0.73		0.65		0.70	
F-statistic	32.50		25.80		28.20	
Prob(F-statistic)	0.0000		0.0000		0.0000	
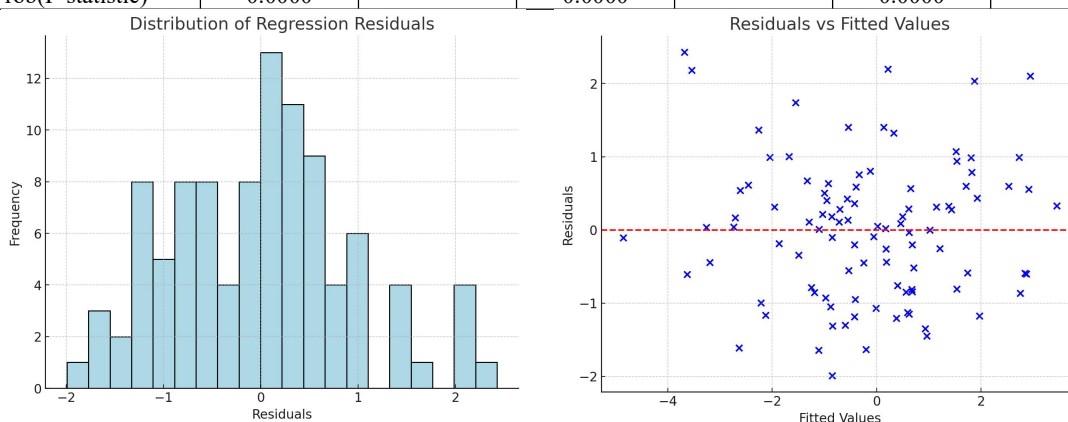
Figure 3. Distribution of Regression Residuals

Figure3 shows that most residuals are concentrated around zero, displaying a near-normal distribution, which indicates that the model fits the data reasonably well. Meanwhile, the residuals versus fitted values scatter plot demonstrates that the residuals are randomly distributed around the fitted values, with most points close to the zero line, suggesting no systematic bias in the model.

5. Conclusion

This study examines the effect of green credit on bank financial performance and risk management through an empirical analysis of 10 large commercial banks in China from 2010 to 2021. The panel data regression model reveals that the green credit ratio (GCR) has a significant positive impact on the bank's return on assets (ROA) and return on equity (ROE), and can effectively reduce the non-performing loan ratio (NPL Ratio).The capital adequacy ratio (CA) is also instrumental in promoting financial stability in banks and lowering the non-performing loan ratio. Banks with more adequate capital perform better in financial performance and risk management. The

leverage ratio (LR) has a more complex impact on the financial performance of banks. Although it has a slight negative impact on ROA, its impact is not significant. The beneficial effect of interest rate (IR) on ROA and ROE indicates that an increase in market interest rates enhances bank profitability, but has a minimal impact on risk management.

The analysis of residual distribution shows that the residual of the model is approximately normally distributed and randomly distributed around the fitted value, which further verifies the rationality and robustness of the model. Green credit serves as a critical tool to promote the sustainable development of banks. It not only brings about higher financial benefits for banks in the short term but also effectively reduces risks and improves competitiveness in the long term. Banks should further enhance the promotion of green credit and its positive role in financial and risk management.

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