

# Green Credit, Green Reputation and Corporate Financial Performance: Evidence From China

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## Research Article

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# 2 Green Credit, Green Reputation and Corporate 3 Financial Performance: Evidence from China

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10 **Abstract:** Using green credit to guide the direction of funds is very important for improving the  
11 current social environment and enhancing economic development quality. Through its differential  
12 pricing features, evidence suggests that green credit has limited the flow of capital to highly  
13 polluting and high emission ("two high") industries, allowing more capital to flow to green  
14 industries and improving the quality of environmental and economic development. The article  
15 combines green credit and the performance of listed banks in a theoretical and empirical study to  
16 explore the intrinsic correlation between them and to find the intrinsic motivation for banks to  
17 implement green credit, which effectively improves social welfare and promotes sustainable  
18 economic development. The article first reviews the current status of green credit research and  
19 theories related to green development in China and other countries, and then analyses the dynamics  
20 of green credit development, value creation, as well as the mechanisms by which green credit  
21 improves the financial performance of listed banks. Finally, the article explores the impact of green  
22 credit on the financial performance of listed banks through empirical analysis. Here we have  
23 established a panel data model to sort out and analyze the relevant data of 19 listed Banks in China  
24 from 2008 to 2017 to study the impact of green credit on listed banks' financial performance. This  
25 study has shown that the green credit ratio, as an indicator of the amount of green credit  
26 implemented by listed banks, will positively impact financial performance. But the impact of the  
27 current period and the one-period lag is more significant, while the effect of the two-period lag is  
28 not significant. The second major finding was that when green reputation is used as an indicator to  
29 measure the quality of green credit implementation of listed banks, listed banks' financial  
30 performance can be significantly improved. Besides, this study has also found that green credit  
31 implementation generally has different impacts on different types of banks.

32

33 **Keywords:** green credit; green reputation; financial performance; listed banks

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## 38 1. Introduction

39 In the context of tight environmental constraints, almost all countries are paying attention to  
40 developing a green economy, aiming to grow the economy while considering ecological civilization's  
41 construction. In 1974, The Federal Republic of Germany established the "Ecological Bank", which was  
42 mainly responsible for providing preferential loans for environmental projects that general banks are  
43 unwilling to accept. This bank is the world's first policy-driven environmental protection bank. Since

44 then, environmental issues have received significant attention from financial institutions around the  
45 world. After that, the IFC and ABN AMRO proposed the "Equator Principles" in 2002, which is to  
46 leverage the green finance fund for environmental protection and socially sustainable development  
47 with the help of financial leverage. At the G20 Hangzhou Summit in 2016, green finance was included  
48 in the G20 key topics for discussion for the first time, becoming one of the most frequently mentioned  
49 keywords in the summit. For China, as of the end of 2018, the green credit balance of 21 major banking  
50 financial institutions in China has reached 8.23 trillion yuan, showing a good momentum of green  
51 finance's positive development.

52 Green credit is a financial instrument that originated from environmental financing or  
53 sustainable financing, promoting sustainable development of financing and paying attention to  
54 environmental protection (Nandy and Lodh, 2012 [1]). And the implementation of green credit plays  
55 a critical role in the financial performance of Banks. It has commonly been assumed that when  
56 commercial banks adopt the "equator principle" as their behavior criterion in green credit investment  
57 activities, they can effectively reduce environmental risks and ensure the profitability of commercial  
58 banks (WRIGHT and RWABIZAMBUGA, 2006 [2]). So we can see that green credit is not only related  
59 to the concept of environmental protection, but also related to the economic benefits of banks, and  
60 the final result is that green credit can promote the sustainable development of commercial banks  
61 and improve the economic benefits of commercial banks (Cilliers, et al., 2010 [3]). In addition, the  
62 "green reputation" will also impact the bank's financial performance. "Green reputation" can be  
63 regarded in this thesis as the reputation brought by the bank's practice in green development and  
64 promotion of the achievement of green sustainable goals, so the term "green reputation" can broadly  
65 be defined as the reputation that the implementation of green credit can bring to the bank to establish  
66 a good image of social responsibility. Therefore, there are differences in bank deposit and loan  
67 spreads. Borrowers with environmental or social problems will be required to have higher deposit  
68 and loan spreads because banks pay great attention to their public image. And the public's attention  
69 to their social responsibility will bring certain risks to banks and affect their business performance  
70 (Goss and Roberts, 2011 [4]).

71 Specifically, the contribution of this paper is mainly in the following three aspects. First, the  
72 existing literature focuses mostly on enterprises, analyzing the corporate social responsibility,  
73 financing costs and green credit performance of green enterprises and "two-high" enterprises, and  
74 the game between government banks and enterprises. It is still unknown whether the economic  
75 behaviors in green credit may affect the earnings and costs of all parties of listed companies.  
76 However, this article just makes up for this lack of perspective. Secondly, the current literature does  
77 not engage with the significance, existing problems, and countermeasures and suggestions for  
78 implementing green credit by commercial banks from a qualitative perspective.

79 Moreover, most of the studies lack specificity and pertinence and are only limited to introducing  
80 and analyzing green credit development in China and other countries. What's different is that this  
81 paper uses the green credit ratio and green reputation of China's 19 listed banks as indicators to  
82 measure the amount and quality of their green credit implementation, and quantitatively analyzes  
83 the impact of green credit on the financial performance of listed banks. Finally, this paper creates an  
84 innovative perspective to study the impact of a bank's green reputation on its financial performance.  
85 This article's discussion is critical and meaningful because the implementation of green credit by a  
86 bank can establish a socially responsible image and a green reputation for it, thereby affecting its  
87 performance.

88 This paper has been divided into four parts. It begins by combing and reviewing the current  
89 research status of green credit and related theories of green development. The second part analyzes  
90 the driving force of green credit development, value creation, and green credit mechanism to improve  
91 listed banks' financial performance. It will then establish a panel data model to sort out and analyze  
92 the relevant data of 19 listed Banks in China from 2008 to 2017 to quantitatively study the impact of  
93 green credit on listed banks' financial performance. Finally, combined with the empirical results  
94 analysis conclusions, corresponding countermeasures are proposed to improve listed banks'  
95 performance in implementing green credit.

## 96 2. Existing study and literature review

97 At the outset, the relevant concepts proposed by scholars were 'environmental finance' and  
98 'sustainable finance'. Among them, White and Labatt (2002) [5] argued that "environmental finance"  
99 was a specific market-based financial instrument designed to convey environmental quality and the  
100 transformation of environmental risks. At the same time, they proposed that the frequency of  
101 environmental problems stimulated the innovation of financial products and encouraged banks to  
102 measure environmental issues in the implementation of credit and investment operations. Then  
103 Twidell and Cabot (2003) [6] pointed out the following two functions of "sustainable finance". One is  
104 to provide consulting and lending services for sustainable business projects. It offers investment  
105 advisory services to clients on sustainable projects by designing sustainable financing policies.  
106 Secondly, the bank uses its information advantage to promote the flow of resources and encourage  
107 sustainable development by using various loan placement methods from the market perspective,  
108 market development and regulation. Afterwards, Weber (2005) [7] clearly indicated that green credit  
109 was the main development direction of sustainable finance, that was, banks should implement  
110 preferential lending policies to promote the flow of funds to environment-friendly enterprises, while  
111 restricting the flow of funds to the "two high" enterprises. And in this way, the sustainable  
112 development of financial institutions and environmental protection could promote each other and  
113 develop together.

114 The research on the impact of green credit on banks' financial performance also continues.  
115 Scholtens and Dam (2007) [8] found that the cost of banks adopting the 'Equator Principles' was much  
116 higher than that of banks that did not adopt the 'Equator Principles'. However, the awareness of social  
117 responsibility was significantly higher among 'Equator Principle' banks than among 'non-Equator  
118 Principle' banks. At the same time, the principle reduces the banks' lending risk. Furthermore,  
119 commercial banks that implement green credit with an environmental theme, they may not be the  
120 most costly, but this sustainable green development is essential for commercial banks and to some  
121 extent may even increase revenues (Richardson, 2014 [9]). In analysing the relationship between  
122 green credit and financial performance, studies have also used the 'Equator Principles' to integrate  
123 environmental governance into the business models of financial institutions to measure the impact  
124 of green reputation on financial performance. There is evidence that the commitment of banks to  
125 social responsibility as a central player in the functioning of the economy will promote improved  
126 financial performance (Ruf et al., 2001 [10]; Simpson and Kohers, 2002 [11]). This suggests that a  
127 good green reputation resulting from the implementation of green credit by banks can act as an  
128 intangible asset. It can not only be one of the competitive advantages of the bank, but also bring many  
129 quality resources to the bank and have an impact on the financial performance of the bank. Suppose  
130 a bank disburses funds to a company that has had a major pollution incident. In this case, they would  
131 suffer a very serious loss of green reputation, which would lead to the loss of many high-quality  
132 customers and reduce their financial performance (Thompson and Cowton, 2004[12]). In addition,  
133 Aintablian et al. (2007) [13] concluded that banks could gain the trust of their creditors if they practise  
134 environmental governance and pay attention to green reputation enhancement. However, the  
135 investment in this area was long-term and the return cycle was relatively long. Then, it has been  
136 shown that banks can use green reputation as a key medium. And the green reputation that banks  
137 bring to their social responsibility and green credit operations can improve their business  
138 performance (Eisenbach et al., 2013 [14]).

139 Research on green finance by Chinese scholars started late, with their research on green credit  
140 only beginning in 2007. Some scholars claim that there is a close relationship between banks'  
141 implementation of green credit and banks' financial performance, and research evidence shows that  
142 green credit does have a positive impact on financial performance, and this beneficial relationship is  
143 more pronounced in the long term (Zhu et al., 2017[15]). In terms of green reputation and financial  
144 performance, Qiao and Tan (2009) [16] used an empirical approach to verify that banks' financial  
145 performance was also significantly better when they fulfilled their social responsibility. Based on the  
146 literature review, Zhao and Feng (2010) [17] proposed a theoretical hypothesis model of the impact  
147 of corporate reputation, human resources and customer resources on corporate innovation

148 performance. And the results show that corporate reputation facilitates the acquisition of human and  
149 customer resources and positively affects innovation performance through resource acquisition. It  
150 indicates that companies fulfilling their social responsibility can build a good image and are more  
151 likely to win the trust of stakeholders and society at large, which has a significant positive impact on  
152 their total return on assets (Peng et al., 2011[18]). According to Shen's findings (2011) [19], the green  
153 credit of banks can generate positive reports, thus creating a green reputation and improving bank  
154 performance. This theory can also be seen in the finding of Zhu's study (2015) [20]. Through empirical  
155 analysis, she found that the fulfilment of social responsibility by commercial banks had a significant  
156 positive impact on financial performance. In other words, bank reputation played a mediating role  
157 between banks' social responsibility strategies and financial performance.

158 Li et al. (2013) [21] conducted an empirical study on the data of 16 listed banks in China from  
159 2009 to 2011 and found that whether banks disclose multiple green credit indicators significantly  
160 affected corporate financial performance. And most of these effects exhibited a time lag. Hao et al.  
161 (2016) [22] analysed data from 2007 to 2014 from 12 listed commercial banks in China through grey  
162 correlation and correlation to investigate the relationship between green credit and the performance  
163 and risk of credit to "two high" enterprises in the target banks respectively. The results are reflected  
164 in the following three aspects. Firstly, 66.7% of the banks had higher returns from developing green  
165 credit than the "two high" loans. Secondly, 83.3% of banks had lower risk associated with green credit  
166 than the "two high" loans. Third, in 58.3% of the cases, the development of green credit and the control  
167 of "two-high" loans could improve business performance while reducing credit risk. Besides, banks'  
168 green credit business restricts the supply of funds to the "two high" industries, so their output will be  
169 inhibited to a certain extent (Song, 2016 [23]; Cai, 2013 [24]). For example, Lian (2015 [25]) conducted  
170 an empirical study with a sample of listed companies from 2000-2014. The results show that green  
171 credit can reduce the financing costs of green enterprises, but increase the financing costs of the "two  
172 high" enterprises. This result can greatly promote the development of green enterprises and curb the  
173 development of "two high" enterprises. Wang and Zhu (2017 [26]) empirically analysed the panel  
174 data of 12 commercial banks from 2009 to 2015 and obtained the following two points. First, the  
175 proportion of green credit has a positive but insignificant effect on bank profitability. Second, the  
176 withdrawal of bank lending to the "two high" enterprises has a negative impact on their profitability,  
177 but this effect gradually diminishes. However, in general, the impact of green credit by commercial  
178 banks will improve their profitability in the long-term forecast. A study by Gong et al. (2018) [27] also  
179 came up with similar results that green credit would significantly improve their aggregate operating  
180 performance. And their empirical results also revealed that green credit affected the consolidated  
181 service performance of commercial banks mainly through its impact on profitability and safety. It is  
182 also important to note that the impact of green credit on the performance of different types of  
183 commercial banks nowadays is not the same. The impact of green credit on the improvement of  
184 return on assets is more significant for joint-stock commercial banks, but they have to focus on the  
185 control of short-term liquidity. Relatively speaking, large state-owned banks are more likely to satisfy  
186 the profit maximisation condition (Ren and Zhang, 2018 [28]). Zhang and Lian (2019) [29] empirically  
187 tested the heterogeneous impact of green credit on the financial performance of banks and found that  
188 a rising share of green credit in total loans helped increase the net interest margin of commercial  
189 banks. Moreover, green credit has a stronger effect on improving the financial performance of smaller  
190 and more liquid banks.

191 Based on the above findings, this paper argues that green credit is an effective decision to achieve  
192 sustainable development in the context of green growth. On the one hand, it can effectively enhance  
193 the green reputation of listed banks, gain a competitive advantage in the market and provide an  
194 effective way for future sustainable development. On the other hand, green credit can promote the  
195 development of China's economy towards the construction of an environmental economic system,  
196 and promote the development of China's industries and enterprises towards an environmentally  
197 friendly and resource-saving intensive economy, so that a good symbiotic and win-win mechanism  
198 between banks and other enterprises, the whole society and the ecological environment can be truly  
199 realised.

200 Green finance in China started late, and research on green credit only began in 2007. And  
201 Chinese scholars have mainly analysed from the macro level and carried out relevant research on the  
202 current situation, risk management and legal supervision of the implementation of green credit by  
203 commercial banks. The research results, theoretical foundations and methods of previous scholars  
204 are meaningful and provide a research basis for this paper. However, the current research on the  
205 impact of the implementation of green credit on financial performance has some shortcomings as  
206 follows.

- 207 (1) Fewer studies have examined green credit with listed banks as the main subject of research.  
208 Studies related to green credit in China and other countries generally take enterprises as the  
209 main subject of research, ignoring the economic behaviour of listed banks in green credit  
210 that may also affect the benefits and costs of all parties. Some scholars have also studied how  
211 the implementation of green credit by commercial banks affects their overall development,  
212 but they are based on an overall perspective and do not address listed banks.
- 213 (2) There are relatively few studies that quantitatively analyse the relationship between green  
214 credit business and the financial performance of listed banks. Most of the existing studies  
215 describe the meaning, issues and recommendations of green credit implementation by  
216 commercial banks from a qualitative perspective. The majority of these studies lack  
217 specificity and relevance, and are limited to introducing and analysing the development of  
218 green credit in China and other countries. This study attempts to analyse the impact of green  
219 credit on financial performance from a quantitative perspective.
- 220 (3) Quantitative research on the impact of green reputation on financial performance is scarce.  
221 The implementation of green credit by banks can create an image of social responsibility and  
222 green reputation for them, and can also have an impact on performance. Examining the  
223 impact of green reputation on financial performance is a new perspective for the study of  
224 green credit.

### 225 3. Hypothesis formulation and theoretical analysis

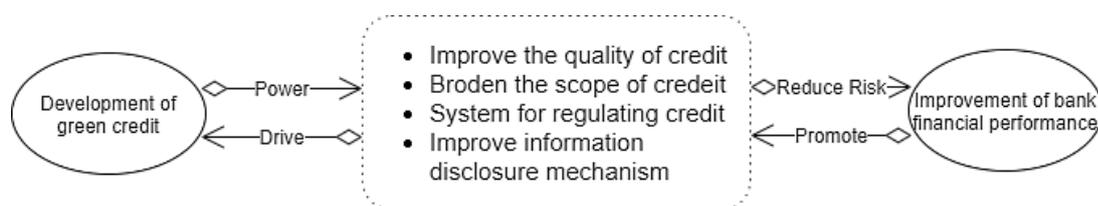
226 **Hypothesis 1.** Green credit is conducive to the sustainable operation of banks, thus promoting the  
227 improvement of bank financial performance.

228 The first assumption is related to the development of green credit. Green credit is fundamentally  
229 credit, which is the loan funds granted by banks to enterprises. This paper examines green credit with  
230 the aim of exploring the intrinsic motivation of listed banks in implementing green credit by  
231 considering the relationship between green credit and financial performance. Certainly in terms of  
232 government policy and social development as a whole, banks will consider carefully whether or not  
233 to access the enterprise in terms of pollution and energy consumption when granting credit. Banks  
234 will also consider the loss of profits if a non-green business is lent to them in the event that it is seized  
235 or has an accident. This means that green credit is a way of controlling the development of highly  
236 polluting and energy-consuming enterprises at the source of lending and promoting the sustainable  
237 and healthy development of banks, enterprises and society.

238 Green credit is one of the main tools for the development of green finance, and the strategy is  
239 viable if the benefits to the bank outweigh the costs and the green credit also brings intangible benefits  
240 to the bank, namely a green reputation. Then, the greater the net benefit of green credit to banks, the  
241 more conducive it is to achieving Pareto optimality. Therefore, banks can determine an optimal level  
242 of credit in order to maximise the net benefit, thereby promoting optimality for society as a whole  
243 and providing a green financial boost to the economy.

244 In addition, within the context of the healthy and stable development of green credit, banks can  
245 make full use of their credit investment expertise, economies of scale and risk control to achieve the  
246 economic goal of maximising profits against the backdrop of green development. The above two  
247 points suggest that the development of green credit can provide an escort for banks to implement  
248 green credit and improve their financial performance. Simultaneously, improved financial  
249 performance of banks can also encourage them to fulfil their social responsibility and actively

250 promote the implementation of green credit. Figure 1 gives the framework of Hypothesis 1, which  
 251 explains how the development of green credit can contribute to the improvement of banks' financial  
 252 performance.  
 253



254  
 255 **Figure 1.** Green credit promotes the improvement of bank financial performance

256 **Hypothesis 2.** Green reputation can enhance the competitiveness of banks and thus improve their  
 257 operating performance.

258 Hypothesis 2 is about green reputation. Fombrun and Riel (2004) [30] argue that a good  
 259 reputation implies that a firm has a better reputation and growth prospects, which will promote  
 260 higher profits with less cost investment. A positive reputation can provide a strategic advantage to a  
 261 firm, leading to many operational conveniences and laying the foundation for improved business  
 262 performance (Philippe and Durand, 2011 [31]). In addition, high profits can motivate firms to place  
 263 greater emphasis on the development of social reputation. This virtuous circle can be seen as an  
 264 outward manifestation of reputation, highlighting the bank's growth potential, which in turn  
 265 stimulates increased public demand for the bank's shares and products. All of this increases the  
 266 market value of the firm, and these are also values of reputation.

267 It is widely accepted that a company's reputation is an important competitive advantage for the  
 268 company. To a certain extent, it facilitates corporate performance (Brammer and Pavelin, 2006 [32];  
 269 Carlisle and Faulkner, 2005 [33]; Roberts and Dowling, 2002 [34]). Furthermore, Tang et al. (2012)[35]  
 270 have demonstrated the correlation between corporate reputation and green reputation. In other  
 271 words, when a company has an excellent green reputation, its corporate reputation also increases,  
 272 which is beneficial to the economic performance of the company. For example, Triodos Bank in the  
 273 Netherlands has focused on developing green finance, offering preferential lending policies to  
 274 companies and projects that bring environmental benefits to society, and has been well received by  
 275 society. Even in the midst of the financial crisis of 2008, Sanko Bank was able to rely on the stability  
 276 and high quality of its credit system, which, together with its good social reputation, led to an increase  
 277 in the bank's performance. It was not significantly affected by the financial crisis and in 2009, the bank  
 278 received the Financial Times "Sustainable Bank Award". As can be seen, a green reputation not only  
 279 ensures that the bank operates at a high quality, but also gains a high level of acclaim and contributes  
 280 to improved financial performance.

281 Furthermore, the spread of a green reputation can win the trust of the public, help banks retain  
 282 and attract talented and highly qualified people, and improve the stickiness of existing customers. It  
 283 can also attract better partners for mutual progress. For example, Industrial Bank, which is the first  
 284 "Equator Bank" in China. It has always fulfilled its social responsibility in specific aspects of the bank's  
 285 business management and pursued a win-win model of profitability and green development.  
 286 Therefore, it also won several green bank awards during this period, such as the "Best Green Bank  
 287 Award 2008" and the "Asian Sustainable Development Bank of the Year Award". At the same time, it  
 288 has also gained a lot of media exposure and earned a good green reputation. This uniqueness has  
 289 attracted more quality customers to join Industrial Bank, creating a huge intangible value and a  
 290 virtuous cycle of sustainable development. Thus, a green reputation can increase the bank's  
 291 confidence through great exposure, thus generating intangible benefits in terms of financial  
 292 performance.

293 **4. Empirical methodology**

294 This chapter designs an empirical study on how green credit and green reputation affect the  
295 financial performance of listed banks, based on the two previous hypotheses. The following four  
296 aspects will be addressed: sample selection and data sources, variable selection and definition,  
297 empirical model setting, and empirical analysis findings.

#### 298 4.1. *Sample selection and data sources*

##### 299 4.1.1. Sample selection

300 This paper selects the annual data of 19 listed banks from 2008 to 2017. Among the 19 listed  
301 banks, there are five large commercial banks, including Bank of China, Agricultural Bank of China,  
302 Industrial and Commercial Bank of China, China Construction Bank, and Bank of Communications.  
303 There are also eight joint-stock commercial banks, including Huaxia Bank, Minsheng Bank, Shanghai  
304 Pudong Development Bank, China Merchants Bank, Ping An Bank, Industrial Bank, Everbright Bank,  
305 and CITIC Bank. And Guiyang Bank, Ningbo Bank, Beijing Bank, Jiangsu Bank, Nanjing Bank, and  
306 Shanghai Bank, a total of 6 city commercial banks.

307 Additionally, the listed banks in China were selected for the research because of the following  
308 reasons. Firstly, the data of listed banks are more complete, realistic and transparent. Compared to  
309 other banks, listed banks have a large number of stakeholders and more comprehensive systems,  
310 which makes their information disclosure relatively timely and reliable. Therefore, for the sake of  
311 data availability and feasibility of the study, this paper selects data from listed banks for the study.  
312 Secondly, listed banks are more environmentally responsible, and are characterised by their strong  
313 capital, extensive investment areas and standardised corporate governance. In fulfilling their social  
314 responsibilities, listed banks are also subject to more public scrutiny, they have more obligations  
315 towards environmental protection, and the impact of social reputation on performance aspects will  
316 be more obvious.

##### 317 4.1.2. Data source

318 The data used for the empirical analysis of the article were obtained from the annual reports and  
319 social responsibility reports disclosed on the official websites of the sample listed banks, and the  
320 financial data of other variables were obtained from wind information and the Banking Regulatory  
321 Commission. This article adopts the green credit ratio as the first measure of green credit. As China's  
322 green credit started with the "Opinions on Implementing Environmental Protection Policies and  
323 Regulations to Prevent Credit Risks" released in 2007, individual banks did not have specific data on  
324 the proportion of loans for environmental protection projects before 2007 and the basic calibre was  
325 not consistent. Therefore, this paper selects the sample data of 19 listed banks from 2008-2017 for  
326 empirical analysis.

327 This paper uses green reputation as the second measure of green credit. The number of positive  
328 social media reports on green credit by listed banks is used to quantify green reputation. The number  
329 of social media reports is based on public media reports on the implementation of green credit by  
330 banks published by the China Economic News Database, while non-public information is not  
331 included in the selected data. Also, publicly available bank annual reports and social responsibility  
332 reports have been removed from this paper, and each listed bank has been searched by name and  
333 year.

334 In addition, bilateral tailing at the 1% level was applied to the data to avoid extreme outliers,  
335 and Excel and Stata 14.0 software were used to store the data, perform preliminary calculations and  
336 process and analyse the panel data.

#### 337 4.2. *Variables selection*

##### 338 4.2.1. Explained variables

339 This paper analyses the impact of green credit on the financial performance of listed banks, so  
340 financial performance is the explained variable in this paper. This paper uses accounting indicators

341 to measure the financial performance of listed banks because there are two indicators in the financial  
342 performance measurement system, market indicators and accounting indicators. Market indicators  
343 reflect the performance of banks by analysing publicly available trading data. However, due to the  
344 speculative nature of China's securities market, the volatility of the data will change over time and  
345 the validity of the data and the effect of trading price discovery will be affected. In contrast,  
346 accounting indicators reflect the performance of listed banks by analysing their financial statements.  
347 As such, they are relatively standardised and uniform, and the data are more realistic and easier to  
348 collect. As mentioned above, accounting indicators are superior to market indicators in empirical  
349 analysis.

350 The ratio of net profit to shareholders' equity is the return on equity (ROE), which reflects the  
351 level of profitability of a listed bank's own assets. The ratio of profit after tax to total assets is the  
352 return on total assets (ROA), which reflects the level of return on total assets of listed banks and  
353 represents the overall profitability. In this paper, return on equity (ROE) and return on total assets  
354 (ROA) are chosen to measure the financial performance of listed banks and are calculated using the  
355 weighted average method. The purpose of choosing ROE and ROA in this paper is to measure the  
356 financial performance of listed banks in terms of both own assets and total assets respectively.

#### 357 4.2.2. Explanatory variables

358 This paper attempts to explain the impact of green credit on the financial performance of listed  
359 banks by measuring both quantitative and qualitative aspects of green credit (green credit ratio on  
360 the quantitative side and green reputation on the qualitative side). The green credit ratio is a direct  
361 measure of the relationship between the two, while green reputation is an intangible benefit. In more  
362 detail, green reputation is the positive social reputation impact that the implementation of green  
363 credit has on listed banks, and can indirectly measure the impact of green credit implementation on  
364 the financial performance of listed banks.

365 **Metric 1:** Green Credit Ratio (GLR) = Green Credit Balance/Total Loan Balance

366 This paper examines whether and to what extent the green credit of listed banks affects their  
367 profitability. For the independent variable, this paper selects the "green credit balance ratio" for  
368 analysis. As the green credit balance changes every year and the total loan balance increases year by  
369 year, the absolute value of green credit balance cannot directly reflect the development of banks'  
370 green credit business. The "green credit balance ratio" can better reflect the implementation of green  
371 credit by listed banks and whether the overall development level of listed banks affects their financial  
372 performance.

373 **Metric 2:** Green Reputation (GR)

374 Foreign scholars believe that media coverage is an effective indicator of reputation because most  
375 of the information when the company's stakeholders evaluate its reputation comes from media  
376 reports (Dyck and Zingales, 2002 [36]; Fombrun and Riel, 2004 [30]). Therefore, this article adopts the  
377 method of Milbourn (2003) [37] and Francis, et al. (2008) [38] to construct green reputation indicators,  
378 that is, the number of positive reports on green credit of listed banks by social media is used as an  
379 explanatory variable to measure their reputation. So as to try to judge the green reputation of listed  
380 banks from an objective perspective.

#### 381 4.2.3. Control variables

- 382 • Bank age (AGE) reflects banks' operating years. Song and Liu (2011) [39] adopted three methods  
383 to divide the life cycle of A-share listed companies in China into three different stages, namely  
384 growth period, maturity period and recession period.
- 385 • Bank size (SIZE) is related to economies of scale. When the bank's scale reaches economies of  
386 scale, it can reduce operating costs and improve financial performance.
- 387 • Financial leverage (FL) is the leverage effect caused by banks using debt to utilize capital  
388 efficiently while the positive leverage effect makes debt management improve bank profits.

- 389 • Growth ability (GA) is the ratio of the main business income this year to the main business  
390 income last year. According to Wang (2009) [40], a company's size, financial leverage and growth  
391 ability have a positive impact on financial performance.
- 392 • The capital adequacy ratio (CAR) is the proportion of a bank's capital in its risk-weighted assets.  
393 It is a manifestation of a bank's ability to resist risks and reflects its final debt repayment ability.  
394 Generally speaking, the higher the bank's capital adequacy ratio, the stronger the bank's  
395 strength, and the greater the deposit opportunities for customers. But it is not that the higher the  
396 better, because too high capital adequacy ratio will increase the bank's capital raising costs and  
397 reduce the bank's profitability.
- 398 • The non-performing loan ratio (NPL) is the ratio of total non-performing loans to total loans.  
399 Non-performing loans are substandard, suspicious, and loss loans, so the proportion of loans  
400 that may be recovered is at a very low probability. It measures the state and quality of bank  
401 assets. When the non-performing loan rate is high, the bank will suffer direct losses, that is, lower  
402 profitability.
- 403 • Net interest spread (NIS) is the nominal interest difference between bank borrowing and  
404 lending. In an interest rate environment, NIS can not only convey important information about  
405 the efficiency of the banking system, but also reflect the efficiency of the bank's transaction prices  
406 and capital utilization.

407 **Table 1.** Variable selection and definition

	<b>Variables</b>	<b>Symbol</b>	<b>Definition</b>
<b>Explained Variables</b>	Bank performance	ROA	Return on total assets = After-tax profit / Total assets
		ROE	Return on equity = Net profit / Net asset
<b>Explanatory Variables</b>	Metric 1: Green credit ratio	GLR	Green credit balance / Total loan balance
	Metric 2: Green reputation	GR	The number of positive media coverage of listed banks on green credit
<b>Control Variables</b>	Bank age	AGE	Represents the length of the bank's operating life, calculated only to the number of years
	Bank size	SIZE	The total assets of listed Banks at the end of the year shall be treated logarithmically
	Financial leverage	FL	Total liabilities / Total assets
	Growth ability	GA	Revenues current year / Revenues last year
	Capital adequacy ratio	CAR	Capital to Risk (Weighted) Assets Ratio
	Non-performing loan	NPL	Non-performing loan balance / Customer

ratio

loan balance

Net interest spread

NIS

Borrowing rate - Lending rate

408 4.3. Empirical model setting

409 4.3.1. An empirical model for measuring green credit with green credit ratio

410 For the purpose of empirically analysing the impact of green credit on the financial performance  
411 of companies, the article proposes model (1) and model (2) to verify the impact of green credit on  
412 ROA and ROE of listed banks. Meanwhile, considering that different types of listed banks have  
413 different operating characteristics, are subject to different levels of government and public  
414 supervision, and face different externalities, the paper introduces bank types as conditional variables  
415 into the panel data model. Finally, whether the impact of green credit on the financial performance  
416 of listed banks is related to the type of bank is investigated.

417 Panel data model with "green credit ratio" as an explanatory variable:

418  $ROA_{it} = \alpha_1 + \beta_1 GL_{it} + \beta_2 AGE_{it} + \beta_3 SIZE_{it} + \beta_4 FL_{it} + \beta_5 GA_{it} + \beta_6 CA_{it} + \beta_7 NPL_{it} + \beta_8 NIS_{it} + \theta_{it}$  (1)

419  $ROE_{it} = \alpha_2 + \gamma_1 GL_{it} + \gamma_2 AGE_{it} + \gamma_3 SIZE_{it} + \gamma_4 FL_{it} + \gamma_5 GA_{it} + \gamma_6 CA_{it} + \gamma_7 NPL_{it} + \gamma_8 NIS_{it} + \varepsilon_{it}$  (2)

420 Among them,  $\alpha$  is the constant term of the model,  $i=1, 2, \dots, N$  represents the sample of listed  
421 banks, and  $t=2008, 2009, \dots, 2017$  represents time. In addition, ROA and ROE are selected as indicators  
422 to measure the financial performance of listed banks in order to obtain robust results. And control  
423 variables include AGE, SIZE, FL, GA, CAR, NPL and NIS. Besides,  $\theta_{it}$  and  $\varepsilon_{it}$  represent the standard  
424 error term, and  $\beta$  and  $\gamma$  represent the estimated coefficient of the corresponding variables.

425 Consider that the implementation of green credit operations may have a lagging impact on  
426 financial performance. That is, the cost and income effects of green credit issued by listed banks  
427 may affect financial performance not only in the current period, but also for one year or longer.  
428 Therefore, this paper introduces a one-period lag and a two-period lag for the "green credit ratio" in  
429 model (1) and model (2) respectively.

430 The panel data model of the "green credit ratio" lagging one period:

431  $ROA_{it} = \alpha_1 + \beta_1 GL_{it} + \beta_2 GL_{it-1} + \beta_3 AGE_{it} + \beta_4 SIZE_{it} + \beta_5 FL_{it} + \beta_6 GA_{it} + \beta_7 CA_{it} + \beta_8 NPL_{it} + \beta_9 NIS_{it} + \theta_{it}$  (3)

432  $ROE_{it} = \alpha_2 + \gamma_1 GL_{it} + \gamma_2 GL_{it-1} + \gamma_3 AGE_{it} + \gamma_4 SIZE_{it} + \gamma_5 FL_{it} + \gamma_6 GA_{it} + \gamma_7 CA_{it} + \gamma_8 NPL_{it} + \gamma_9 NIS_{it} + \varepsilon_{it}$  (4)

433 The panel data model of the "green credit ratio" lagging two periods:

434  $ROA_{it} = \alpha_1 + \beta_1 GR_{it} + \beta_2 GL_{it-1} + \beta_3 GL_{it-2} + \beta_4 AGE_{it} + \beta_5 SIZE_{it} + \beta_6 FL_{it} + \beta_7 GA_{it} + \beta_8 CA_{it} + \beta_9 NPL_{it} + \beta_{10} NIS_{it} + \theta_{it}$  (5)

435  $ROE_{it} = \alpha_2 + \gamma_1 GR_{it} + \gamma_2 GL_{it-1} + \gamma_3 GL_{it-2} + \gamma_4 AGE_{it} + \gamma_5 SIZE_{it} + \gamma_6 FL_{it} + \gamma_7 GA_{it} + \gamma_8 CA_{it} + \gamma_9 NPL_{it} + \gamma_{10} NIS_{it} + \varepsilon_{it}$  (6)

436 Among them,  $GL_{it-1}$  represents the green credit ratio lagging one period, and  $GL_{it-2}$  represents the  
437 green credit ratio lagging two periods.

438 4.3.2. An empirical model for measuring green credit with green reputation

439 Taking green reputation as a measurement indicator, the following regression model is  
440 established to examine the relationship between green reputation and financial performance of listed  
441 banks:

442  $ROA_{it} = \alpha_1 + \beta_1 GR_{it} + \beta_2 AGE_{it} + \beta_3 SIZE_{it} + \beta_4 FL_{it} + \beta_5 GA_{it} + \beta_6 CA_{it} + \beta_7 NPL_{it} + \beta_8 NIS_{it} + \theta_{it}$  (7)

443  $ROE_{it} = \alpha_2 + \gamma_1 GR_{it} + \gamma_2 AGE_{it} + \gamma_3 SIZE_{it} + \gamma_4 FL_{it} + \gamma_5 GA_{it} + \gamma_6 CA_{it} + \gamma_7 NPL_{it} + \gamma_8 NIS_{it} + \varepsilon_{it}$  (8)

444 Similarly, considering that the impact of a bank's green reputation from the implementation of  
 445 green credit may have a lag (a positive green reputation affects financial performance in the current  
 446 period and the resulting positive social reputation impact affects financial performance in one or two  
 447 years thereafter), this paper introduces a one-period lag and a two-period lag for green reputation in  
 448 models (7) and (8), respectively:

$$449 ROA_{it} = \alpha_1 + \beta_1 GR_{it} + \beta_2 GR_{it-1} + \beta_3 AGE_{it} + \beta_4 SIZE_{it} + \beta_5 FL_{it} + \beta_6 GA_{it} + \beta_7 CA_{it} + \beta_8 NPL_{it} + \beta_9 NIS_{it} + \theta_{it} \quad (9)$$

$$450 ROE_{it} = \alpha_2 + \gamma_1 GR_{it} + \gamma_2 GR_{it-1} + \gamma_3 AGE_{it} + \gamma_4 SIZE_{it} + \gamma_5 FL_{it} + \gamma_6 GA_{it} + \gamma_7 CA_{it} + \gamma_8 NPL_{it} + \gamma_9 NIS_{it} + \varepsilon_{it} \quad (10)$$

$$451 )$$

$$452 ROA_{it} = \alpha_1 + \beta_1 GR_{it} + \beta_2 GR_{it-1} + \beta_3 GR_{it-2} + \beta_4 AGE_{it} + \beta_5 SIZE_{it} + \beta_6 FL_{it} + \beta_7 GA_{it} + \beta_8 CA_{it} + \beta_9 NPL_{it} + \beta_{10} NIS_{it} + \theta_{it} \quad (11)$$

$$453 )$$

$$454 ROE_{it} = \alpha_2 + \gamma_1 GR_{it} + \gamma_2 GR_{it-1} + \gamma_3 GR_{it-2} + \gamma_4 AGE_{it} + \gamma_5 SIZE_{it} + \gamma_6 FL_{it} + \gamma_7 GA_{it} + \gamma_8 CA_{it} + \gamma_9 NPL_{it} + \gamma_{10} NIS_{it} + \varepsilon_{it} \quad (12)$$

455 )

456 Among them,  $GL_{it-1}$  represents the green reputation lagging one period, and  $GL_{it-2}$  represents the  
 457 green reputation lagging two periods. Models (9) and (10) examine the impact of the one-period lag  
 458 of green reputation on the financial performance of listed banks. Models (11) and (12) examine the  
 459 impact of the two-period lag of green reputation on the financial performance of listed banks.

#### 460 4.4. Findings of empirical analysis

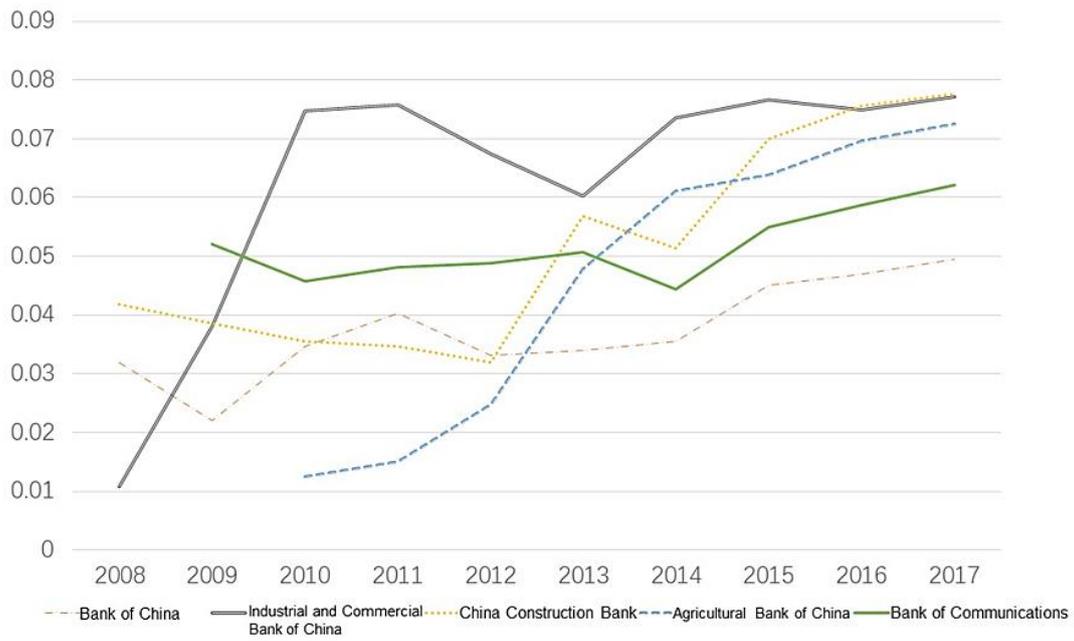
##### 461 4.4.1. Statistical description

462 As shown in Table 2, for the explained variables, the mean values of ROA and ROE of China's  
 463 19 listed banks are 1.0986% and 18.6855%, and the medians are 1.0999% and 18.43%, respectively.  
 464 Because ROA is the ratio of total income to total assets, whereas ROE is the ratio of total income to  
 465 shareholders' equity. And the sum of shareholders' equity of owned assets and liabilities of borrowed  
 466 assets equals total assets. Therefore, it is normal that both the mean and median of ROE in Table 2  
 467 are greater than ROA.

468 For the explanatory variables, the mean value of the green credit ratio is 0.0528 and the median  
 469 value is 0.0377, both of which are relatively small, generally concentrated in the range of 5% to 10%.  
 470 This situation may be due to the late start of green credit in China and the inconsistent timing of the  
 471 introduction of green credit operations across listed banks, resulting in small data results. Industrial  
 472 Bank's green credit scale is much higher than other banks, as it is the first "equator bank" in China  
 473 and ahead of the curve in terms of green credit development. Meanwhile, the average green  
 474 reputation indicator is 1.1316, i.e. the average number of positive media reports on listed banks' green  
 475 credit implementation is 1.1316 per year. Among them, ICBC was reported 12 times in 2010, which is  
 476 the largest number of listed banks, followed by Bank of China, Industrial and Commercial Bank of  
 477 China and China Construction Bank which received 11 reports. For the development of green credit,  
 478 the number of these positive reports is not enough to promote and guide the development of green  
 479 credit. An analysis of the reasons for this may be that the media and the general public have not paid  
 480 enough attention to green credit, and the promotion of green credit needs to be improved.

481 **Table 2.** Descriptive statistical analysis of variables

Variables	Mean	Median	Standard Deviation	Minimum value	Maximum value	Observed value
ROA	1.0986	1.0999	0.2259	0.1485	1.7566	190
ROE	18.6851	18.4300	4.1579	4.1761	35.7715	189
GL	0.0528	0.0377	0.0804	0.0009	0.5991	144

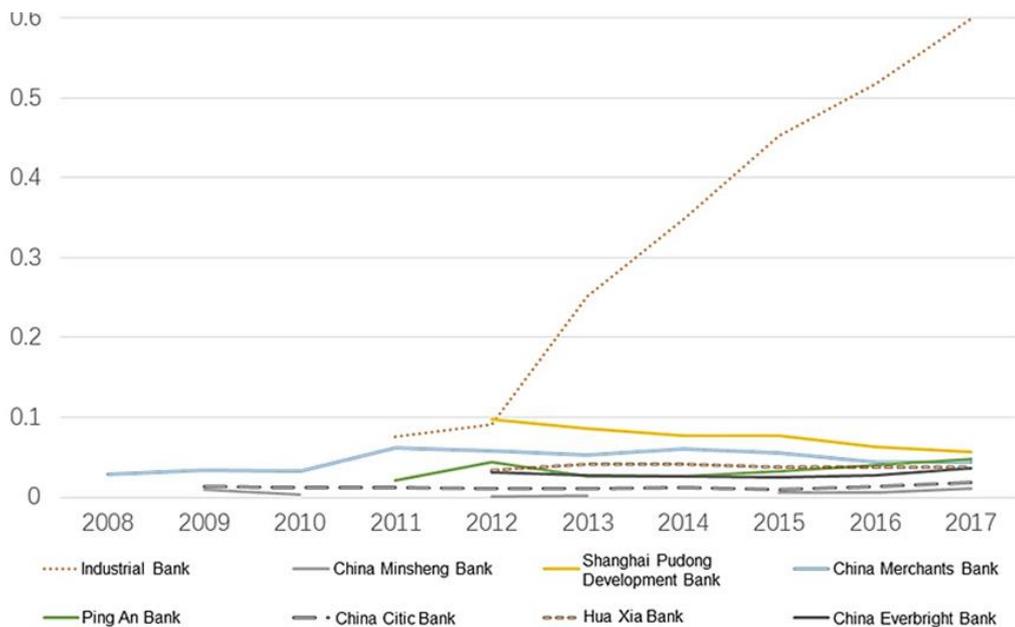
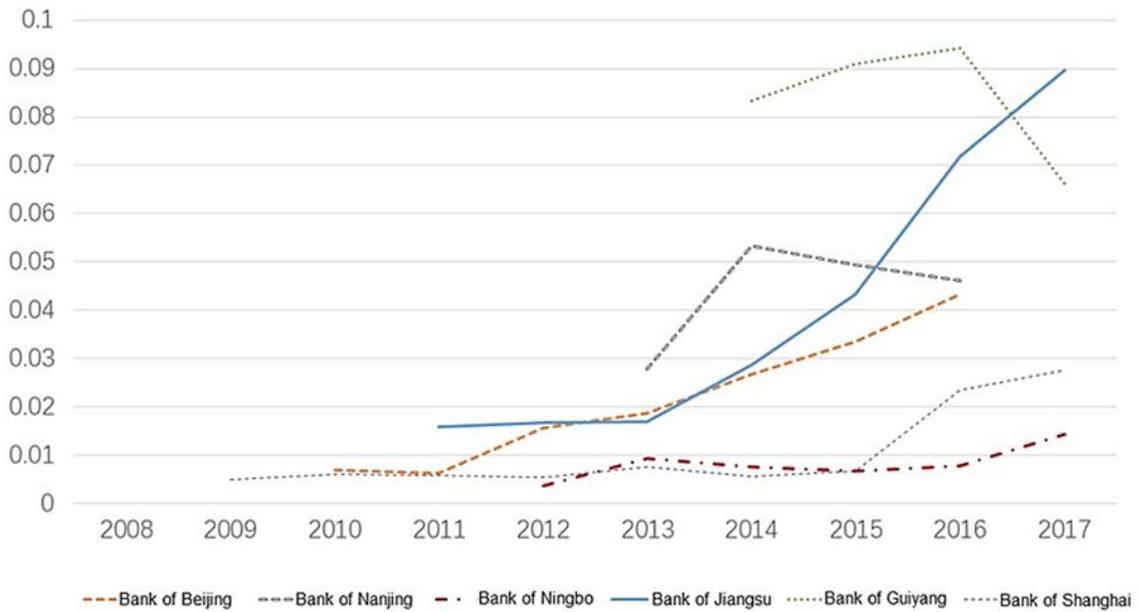


GR	1.1316	0.0000	2.1028	0.0000	12.0000	190
AGE	33.1842	22.0000	27.8648	2.0000	110.0000	190
SIZE	28.4302	28.4824	1.4224	24.3835	30.8925	190
FL	93.8532	93.8211	1.1701	87.8924	96.8153	190
GA	1.1946	1.1860	0.1543	0.8912	1.6740	190
CAR	12.3404	12.0400	1.8175	8.5800	24.1200	184
NPL	1.2092	1.1200	0.5131	0.3800	4.3200	184
NIS	2.3496	2.3900	0.4420	1.3200	4.5900	159

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**Figure 2.** The development trend of green credit ratio of large commercial banks

**Figure 3.** The development trend of the green credit ratio of joint-stock commercial banks



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**Figure 4.** The development trend chart of the green credit ratio of city commercial banks

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From the above statistical description and the graph of the development trend of green credit ratio, we can see that the level of green credit development of listed banks in China is still relatively low, and the development varies greatly among different types of banks. For large commercial banks, the development of green credit has been relatively synchronised and the proportion of green credit has been steadily increasing. There are differences in the start-up time of green credit business for joint-stock commercial banks, but the level is basically the same. Among them, Industrial Bank, as an "equator bank", excelled in the development of green credit. However, there are still relatively large gaps in the development of green credit by urban commercial banks. Among them, Guiyang Bank started green credit later but performed well in green credit overall, and Jiangsu Bank's green credit development improved faster.

497

4.4.2 Empirical estimation analysis

498 Fixed-effects models, random-effects models and mixed OLS are the three approaches to panel  
 499 data estimation. Based on the results of the Hausman test, the fixed effects model is chosen for the  
 500 estimation analysis in this paper. As the financial performance of different types of listed banks are  
 501 affected differently, this paper is divided into two parts in the empirical analysis. One is an empirical  
 502 study of the total sample of listed banks, and the other is an empirical analysis of the types of listed  
 503 banks to obtain more accurate results.

#### 504 4.4.2.1 The impact of green credit on the financial performance of listed banks in the total sample

- 505 • An empirical analysis of green credit ratio as a measurement index

506 To test the impact of green credit on banks' ROA and ROE, ROA and ROE were used as the  
 507 explained variables, and the current, lagged and two-lagged periods of the "green credit ratio" were  
 508 used as the explanatory variables, and the empirical results are shown in Table 3.

509 The results in Table 3 show that the current green credit ratio of listed banks has a positive  
 510 impact on both ROA and ROE of the banks. The effect on ROA is significant at the 10% level with an  
 511 estimated coefficient of 0.2406, indicating that a one unit increase in a listed bank's current green  
 512 credit ratio increases the listed bank's total return on assets by 0.2406 units. The effect on ROE is  
 513 significant at the 5% level with an estimated coefficient of 6.2212, meaning that a one unit increase in  
 514 the green credit ratio in the current period would increase the ROE of listed banks by 6.2212 units. A  
 515 one-period lag in the green credit ratio has a positive and significant impact on the ROA of listed  
 516 banks at the 1% level, and a one-period lag in the green credit ratio also has a positive and significant  
 517 impact on the ROE of listed banks at the 5% level. For the two-period lagged green credit ratios, both  
 518 have a positive impact on ROA and ROE, but neither of them passes the significance test.

519 Based on the empirical results, the green credit ratio, a quantitative measure of green credit for  
 520 listed banks, has a positive impact on financial performance. In other words, the implementation of  
 521 green credit promotes the improvement of banks' financial performance, but the impact is more  
 522 significant in the current period and lagged period one, and insignificant in lagged period two. This  
 523 may be due to the fact that the implementation of green credit by listed banks increases the green  
 524 credit ratio and promotes the green sustainability of their own development while promoting the  
 525 sustainable development of society. At the same time, the positive impact of the positive social image  
 526 and positive news conveyed to the market by the listed banks' active social responsibility in  
 527 conducting green credit business more than compensates for the cost effect necessary to conduct  
 528 green credit business. However, this positive impact is not sustainable and is gradually diminishing,  
 529 as it only significantly improves the financial performance of listed banks in two periods and  
 530 disappears in the third period. This suggests that the implementation of green credit by listed banks  
 531 needs to be sustainable in order to continue to have a significant positive impact on financial  
 532 performance.

533 **Table 3.** The impact of green credit on the financial performance of listed banks: Measured by the  
 534 green credit ratio

Variables	ROA			ROE		
	Current Period	One - period lag	Two-period lag	Current Period	One -period lag	Two-period lag
GL	0.2406* (0.1393)	0.3279** (0.1426)	0.3340** (0.1508)	6.2212** (2.4785)	7.8794*** (2.4005)	7.5229*** (2.5804)
GL-1		0.4094*** (0.1483)	0.4344*** (0.1615)		6.2160** (2.5083)	6.1219** (2.7778)
GL-2			0.179 (0.1633)			1.276 (2.8081)
AGE	-0.0015***	-0.0021***	-0.0020***	-0.0260***	-0.0327***	-0.0328***

	(0.0004)	(0.0005)	(0.0006)	(0.0072)	(0.0085)	(0.0112)
SIZE	0.0542*** (0.0138)	0.0303* (0.0167)	0.0172 (0.0198)	0.8326*** (0.2399)	0.389 (0.2767)	0.333 (0.3317)
FL	-0.0142 (0.0189)	-0.0250 (0.0225)	-0.0263 (0.0307)	1.5313*** (0.3334)	1.1163*** (0.3741)	1.5573*** (0.5066)
GA	-0.0457 (0.1373)	-0.128 (0.1637)	-0.106 (0.1813)	1.526 (2.4523)	0.382 (2.7673)	0.0103 (3.1219)
CAR	0.0566*** (0.0102)	0.0645*** (0.0122)	0.0712*** (0.0153)	0.6205*** (0.1823)	0.6951*** (0.2071)	0.8966*** (0.2642)
NPL	-0.1025*** (0.0378)	-0.0929* (0.0546)	-0.0601 (0.0608)	-2.2073*** (0.6744)	-1.6716* (0.9242)	-1.430 (1.0505)
NIS	0.2654*** (0.0351)	0.2904*** (0.0411)	0.2769*** (0.0468)	4.4567*** (0.5848)	4.5585*** (0.6458)	4.2555*** (0.7328)
Constant C	-0.214 (2.0042)	1.406 (2.3356)	1.757 (3.1076)	-165.6319*** (35.2325)	-114.7140*** (38.7977)	-156.1594*** (51.2397)
Fixed effects	Y	Y	Y	Y	Y	Y
Adj. R-square	0.571	0.617	0.519	0.549	0.554	0.528
Number of samples	121	93	80	122	94	81
F value	22.06***	18.48***	10.44***	20.56***	14.86***	10.86***

535 \*\*\*, \*\* and \* represent significance levels of 1%, 5% and 10%, respectively.

536 Among the control variables, the estimates of bank age (AGE) for both ROA and ROE are  
537 negatively significant at the 1% level. This indicates that the older or more mature a bank is, the more  
538 its growth potential has reached the apex of its life cycle, when performance instead gradually  
539 declines, which is very much in line with corporate life cycle theory. The size of the bank (SIZE) is  
540 estimated to be positively significant at the 1% level for both ROA and ROE in the current period.  
541 This indicates that the larger and stronger a bank is, the higher its financial performance will be.  
542 Financial leverage (FL) is estimated to be positively significant at the 1% level for ROE, but the  
543 estimated coefficient for ROA is negative and neither passes the significance test. This situation may  
544 be due to the fact that high financial leverage brings with it high risk, and the higher total cost of  
545 capital reduces the return on total assets, while the return on free assets is not affected. The estimates  
546 of capital adequacy (CA) for both ROA and ROE are positively significant at the 1% level, indicating  
547 that higher capital adequacy is associated with better financial performance. The non-performing  
548 loan ratio (NPL), which is indicative of asset quality, has a negative impact on both ROA and ROE  
549 and is estimated to be significantly negative at the 1% level for the current period. This indicates that  
550 the higher the NPL ratio of a bank, the lower its financial performance. Net interest margin level  
551 (NIS), which describes the difference between a bank's loan and deposit interest-bearing ratios and  
552 is the main means of bank profitability, is positively correlated with financial performance and the  
553 estimates for ROA and ROE both pass the significance test at the 1% level.

554 • An empirical analysis of green reputation as a measurement index

555 This article uses green reputation as an explanatory variable for the quality of green credit  
556 implemented by banks, measures green reputation in terms of the number of positive reports on  
557 green credit by listed banks on social media, and estimates panel data models (7) to (12).

558 The results in Table 4 show that the estimated coefficients of ROA and ROE for the green  
559 reputation of listed banks in the current period are both positive, and the estimated coefficients are

0.0112 and 0.178, respectively. However, the former passed the significance test at the 10% level, and the latter failed the significance test. Considering that the impact of green reputation on financial performance may be lagging, the estimation results of models (9) and (10) show that the effect of the green reputation lagging one period on ROA is significant at the 1% level, and the estimated coefficient is 0.0202. And the effect on ROE is significant at the 10% level, with an estimated coefficient of 0.2685. Besides, when estimating models (11) and (12), the green reputation lagging two periods has a negative impact on ROA and a positive impact on ROE, but none of them passed the significance test. This result shows that there is no inevitable connection between the green reputation lagging two periods and financial performance. The evidence from this study suggests that green reputation as a measure of the quality of green credit of listed banks can significantly improve the financial performance of listed banks. At the same time, various news media reports on the implementation of green credit by listed banks have aroused public attention and brought positive attention, and established a positive corporate image. These are intangible benefits that listed banks have obtained. On the one hand, the increased exposure of positive green reputation encourages listed banks to optimize their green credit mechanisms and urge them to standardize the development of green credit business, thereby promoting their sustainable development. On the other hand, the improvement of green reputation increases public trust, enhances the competitive advantage and differentiation value of listed banks, and indirectly improves the financial performance of listed banks, thus obtaining higher profits. In general, green credit allows listed banks to acquire higher market value, and this positive impact has a certain lag, which is basically consistent with the theoretical analysis above.

**Table 4.** The impact of green credit on financial performance of listed Banks: Measured by green reputation

Variables	ROA			ROE		
	Current Period	One -period lag	Two-period lag	Current Period	One - period lag	Two-period lag
GL	0.0112* (0.0061)	0.00870 (0.0069)	0.00460 (0.0101)	0.178 (0.1291)	0.160 (0.1499)	0.218 (0.2220)
GL-1		0.0202*** (0.0063)	0.0242*** (0.0073)		0.2685* (0.1374)	0.2829* (0.1620)
GL-2			-0.000500 (0.0074)			0.0240 (0.1669)
AGE	-0.0013*** (0.0005)	-0.0016*** (0.0006)	-0.0016** (0.0007)	-0.0241** (0.0107)	-0.0243* (0.0130)	-0.0270* (0.0154)
SIZE	0.0445*** (0.0149)	0.0337** (0.0154)	0.0315* (0.0182)	0.9297*** (0.3147)	0.7784** (0.3347)	0.7875* (0.4019)
FL	-0.0615*** (0.0173)	-0.0568*** (0.0178)	-0.0581*** (0.0187)	1.5478*** (0.3646)	1.5814*** (0.3855)	1.5352*** (0.4089)
GA	0.0536 (0.1447)	0.0739 (0.1463)	0.0841 (0.1550)	2.074 (3.0456)	2.494 (3.1737)	2.466 (3.3984)
CAR	0.0349*** (0.0110)	0.0358*** (0.0113)	0.0347*** (0.0123)	0.4149* (0.2322)	0.4102* (0.2445)	0.408 (0.2716)
NPL	-0.0412 (0.0320)	-0.0405 (0.0335)	-0.0366 (0.0373)	-1.3761* (0.7983)	-1.5230* (0.8818)	-1.5875* (0.9549)
NIS	0.2430*** (0.0347)	0.2358*** (0.0355)	0.2367*** (0.0372)	3.7113*** (0.7312)	3.5433*** (0.7699)	3.5888*** (0.8157)
Constant C	4.5980**	4.4329**	4.6043**	-	-166.4883***	-162.3787***

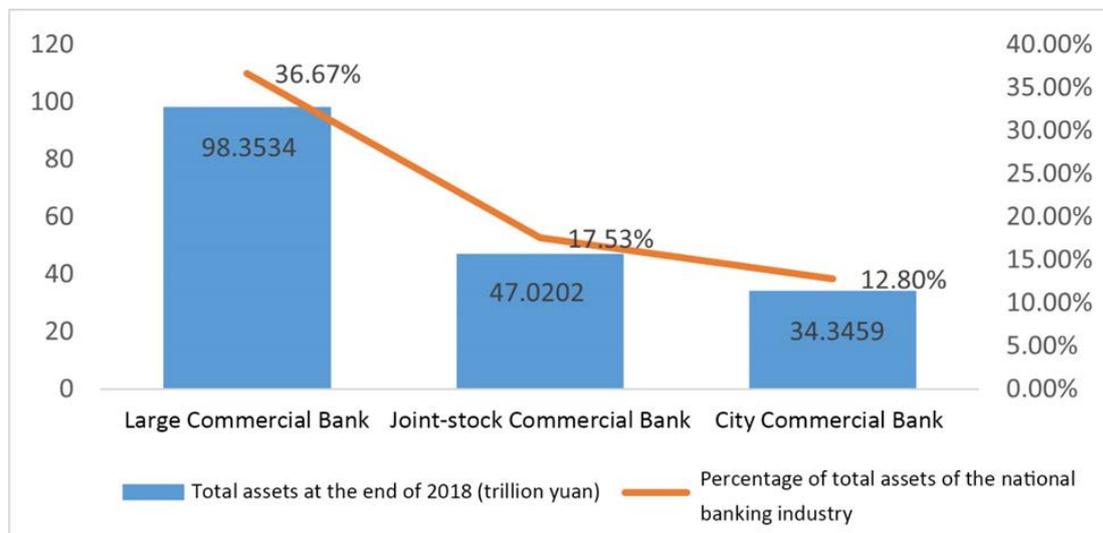
				167.4739**		
				*		
	(1.9033)	(1.9492)	(2.0822)	(40.0635)	(42.2734)	(45.6707)
Fixed effects	Y	Y	Y	Y	Y	Y
Adj. R-square	0.515	0.549	0.504	0.267	0.246	0.226
Number of samples	158	147	136	157	146	135
F value	22.99***	21.74***	15.62***	9.228***	7.251***	5.820***

582 \*\*\*, \*\* and \* represent significance levels of 1%, 5% and 10%, respectively.

583 In terms of control variables, AGE's estimates of ROA and ROE have passed the significance test,  
 584 and the estimated coefficients are all negative, which is in line with the enterprise life cycle theory.  
 585 SIZE has also passed the positive significance test of ROA and ROE, which once again shows that the  
 586 larger the bank, the more beneficial it is for the improvement of its financial performance. Both CAR  
 587 and NIS have passed the positive significance test at the levels of 1%, 5%, and 10%, respectively,  
 588 indicating that CAR and NIS are positively correlated with financial performance.

589 4.4.2.2 The impact of green credit on the financial performance of listed banks in the total sample

590 It is almost certain that different types of banks have different levels of development and the  
 591 external effects they face are also different. According to statistics in the 2018 annual report of the  
 592 China Banking Regulatory Commission, as of the end of 2018, financial institutions in the Chinese  
 593 banking industry included 12 joint-stock commercial banks, 6 large commercial banks, and 134 city  
 594 commercial banks. The total assets of these three types of banks in 2018 accounted for 36.67%, 17.53%  
 595 and 12.8% of the assets of all financial institutions in the banking industry respectively, accounting  
 596 for almost three-quarters of the entire banking industry. Therefore, the robustness of the three types  
 597 of banks is crucial to the robustness of China's financial system and the steady growth of the



598 economy.

599 **Figure 5.** The total assets and proportions of the three types of bank assets at the end of 2018

600 Large commercial banks have extremely high credibility in China. As state-owned financial  
 601 enterprises, their client resources are extremely rich, and they undertake different functions of  
 602 national economic construction. The Bank of China, which specializes in the foreign exchange  
 603 business, the Agricultural Bank, which is dedicated to "agriculture, rural areas and farmers" issues,  
 604 the Industrial and Commercial Bank of China, which specializes in urban savings and industrial and

605 commercial credit, the China Construction Bank which serves national infrastructure projects, and  
 606 Bank of Communications, which is a universal bank, are all powerful. On February 11, 2019, the  
 607 China Banking Regulatory Commission listed Postal Savings Bank of China as a "large state-owned  
 608 commercial bank" in the "List of Banking Financial Institutions (as of the end of December 2018)",  
 609 which injected fresh impetus into large commercial banks.

610 In the reform of the economic system, joint-stock commercial banks have developed rapidly and  
 611 are superior to large commercial banks in terms of operational efficiency, asset quality, and financial  
 612 management. They have become an important part of ensuring the operation of China's economy  
 613 and have great institutional competitive advantages.

614 City commercial bank is committed to serving local small and medium-sized enterprises and  
 615 has special advantages in operation. Its various businesses are more adapted to the development of  
 616 the local economy, and can quickly reflect and make rapid decisions on changes. However, compared  
 617 with large and medium-sized banks, it has a higher non-performing loan ratio and poorer asset  
 618 quality.

619 According to the availability and completeness of the data, this paper selects the annual data of  
 620 19 listed banks, including 5 large commercial banks, 8 joint-stock commercial banks and 6 city  
 621 commercial banks, to analyze the impact of green credit on the financial performance of different  
 622 types of listed commercial banks.

623 The table 5 below illustrates that the estimated coefficients of ROA and ROE of large commercial  
 624 banks in the current period are both positive, but they do not pass the significance test. When the  
 625 one-period lag of green credit is processed, the current green credit's estimates of ROA and ROE both  
 626 pass the positive significance test. Initial observations suggest that the current positive impact is the  
 627 strongest, which can improve the financial performance of large commercial banks to a large extent.  
 628 However, the one period lagging green credit has a positive impact on ROA and a negative impact  
 629 on ROE, and neither of them passes the significance test. The estimated coefficients of ROA and ROE  
 630 for two-period lagging green credit are both negative. A possible explanation for this might be that  
 631 large commercial banks have strong strength and abundant customer resources. So the positive  
 632 benefits and green reputation brought about by the implementation of green credit can make up for  
 633 the current cost effect.

634 However, over time, the cost effect of large commercial banks has become increasingly  
 635 prominent due to the loss of loans from the "two-high" enterprises, as well as their complicated  
 636 operations and low efficiency. As a result, the green credit business has caused more and more losses  
 637 to the large commercial banks, so the positive effects of it have been gradually reduced. Even in the  
 638 two-period lag, this cost effect has exceeded the positive impact, that is, the implementation of green  
 639 credit will do not promote the improvement of financial performance, but will lead to the decline of  
 640 financial performance. Among the control variables, for large commercial banks, SIZE's estimates of  
 641 ROA and ROE pass the positive significance test. This result indicates that in general, the larger the  
 642 scale of large commercial banks, the higher their financial performance. Besides, CAR's estimates of  
 643 ROA and ROE also pass the positive significance test. One possible implication of this is that the  
 644 higher the CAR, the better its financial performance can be improved.

645 **Table 5.** The impact of green credit on the financial performance of listed banks: Large commercial  
 646 banks

Variables	ROA			ROE		
	Current Period	One - period lag	Two-period lag	Current Period	One -period lag	Two-period lag
GL	0.698 (0.6907)	2.3355** (0.8697)	1.762 (1.8513)	6.752 (11.1386)	31.1755** (12.5523)	38.3363 (23.9813)
GL-1		0.503 (0.9037)	2.4383* (1.2453)		-12.03 (13.0442)	18.9177 (16.1317)

			-5.073 (2.7639)			-43.1235 (35.8028)
GL <sub>2</sub>						
AGE	-0.0010* (0.0006)	0.00220 (0.0022)	0.0132 (0.0194)	-0.0292*** (0.0092)	0.0474 (0.0311)	0.6672** (0.2515)
SIZE	0.1069*** (0.0329)	0.2914* (0.1456)	0.771 (0.8892)	0.860 (0.5307)	5.3593** (2.1021)	32.3825** (11.5183)
FL	-0.0488* (0.0281)	-0.0457 (0.0354)	0.0136 (0.0511)	1.5023*** (0.4537)	1.3352** (0.5107)	2.7869*** (0.6621)
GA	-0.6965** (0.3226)	-0.566 (0.4099)	0.164 (0.5618)	-5.258 (5.2026)	-6.0471 (5.9170)	-7.1784 (7.2779)
CAR	0.0563*** (0.0197)	0.0669** (0.0261)	0.0220 (0.0617)	0.6460* (0.3173)	0.8827** (0.3774)	1.7165* (0.7992)
NPL	-0.1645*** (0.0437)	-0.1133* (0.0588)	-0.0349 (0.0730)	-1.8506** (0.7047)	-0.7858 (0.8482)	1.2730 (0.9453)
NIS	0.2856*** (0.0588)	0.131 (0.0869)	0.0611 (0.1526)	3.8047*** (0.9475)	1.1906 (1.2538)	4.0871* (1.9769)
Constant C	2.143 (3.2280)	-4.020 (4.6759)	-24.78 (29.8098)	-155.0483*** (52.0555)	-278.1490*** (67.4895)	-1.29e+03** (386.1435)
Fixed effects	Y	Y	Y	Y	Y	Y
Adj. R-square	0.858	0.895	0.914	0.830	0.846	0.9011
Number of samples	46	35	26	46	35	26
F value	36.14***	34.33***	28.57***	29.59***	22.67***	24.6831***

647 \*\*\*, \*\* and \* represent significance levels of 1%, 5% and 10%, respectively.

648 Table 6 shows that for joint-stock commercial banks, the estimated coefficients of ROA and ROE  
649 are positive for the current green credit implementation, but none of them passes the significance  
650 test. When estimating models (3) and (4) of joint-stock commercial banks, the estimated coefficient of  
651 ROA for the current period is 0.186, which fails the significance test, but the estimate of ROE is  
652 significantly positive at the 5% level. When estimating models (5) and (6), the estimated coefficient of  
653 ROE for the current period is 6.8217, and it has passed the significance test at the 5% level, while the  
654 effects of one-period and two-period lag on ROA and ROE are both negative and pass the significance  
655 test. That is to say, for joint-stock commercial banks, the current period of green credit has the  
656 strongest positive impact on financial performance. In contrast, the green credit lagging one and two  
657 phases have a negative effect on financial performance. There is a possibility that the good image and  
658 good news delivered to the market by joint-stock commercial banks when implementing green credit  
659 can make up for the withdrawal of "two-high" corporate loans and the cost of environmental  
660 protection issues. However, the strength of joint-stock commercial banks and other customer  
661 resources excluding the "two-high" enterprises are not comparable to large commercial banks.  
662 However, the strength of joint-stock commercial banks and other customer resources excluding the  
663 "two-high" enterprises are not comparable to large commercial banks. Therefore, the lasting strength  
664 of the positive impact of green credit is relatively weak, showing that the one-period lag and two-  
665 period lag have a negative effect on financial performance, that is, the implementation of green credit  
666 can reduce financial performance. The NIS in the control variables passes the positive significance

667 test on ROA and ROE at the levels of 1%, 5%, and 10% respectively, indicating that for joint-stock  
 668 banks, the improvement of NIS is conducive to improving the level of financial performance.

669 **Table 6.** The impact of green credit on the financial performance of listed banks: Joint-stock  
 670 commercial banks

Variables	ROA			ROE		
	Current Period	One - period lag	Two-period lag	Current Period	One - period lag	Two-period lag
GL	0.0541 (0.1405)	0.186 (0.1541)	0.223 (0.1420)	4.058 (2.9315)	6.5419** (2.8129)	6.8217** (2.6952)
GL-1		0.0194 (0.1497)	-0.0402 (0.1468)		-1.293 (2.7317)	-3.0155 (2.7868)
GL-2			-0.114 (0.1471)			-4.1394 (2.7926)
AGE	-0.0117*** (0.0037)	-0.0196*** (0.0052)	-0.0218*** (0.0051)	-0.3008*** (0.0773)	-0.4386*** (0.0950)	-0.5030*** (0.0976)
SIZE	0.2972*** (0.0526)	0.3187*** (0.0630)	0.3505*** (0.0679)	4.9628*** (1.0962)	5.1683*** (1.1498)	6.3538*** (1.2888)
FL	-0.0293 (0.0342)	-0.0951** (0.0449)	-0.1125** (0.0424)	1.2217* (0.7123)	-0.299 (0.8188)	-0.6200 (0.8049)
GA	-0.0638 (0.1863)	0.217 (0.2486)	0.5423* (0.2681)	4.763 (3.8864)	7.386 (4.5375)	14.0844** (5.0888)
CAR	0.0169 (0.0245)	0.00560 (0.0268)	-0.0475 (0.0387)	0.0991 (0.5116)	-0.139 (0.4884)	-1.1052 (0.7346)
NPL	-0.0691 (0.1155)	-0.0910 (0.1429)	0.0618 (0.1452)	-4.7074* (2.4100)	-6.1337** (2.6081)	-3.2279 (2.7571)
NIS	0.2268*** (0.0593)	0.2535*** (0.0623)	0.1936*** (0.0608)	2.9521** (1.2377)	3.4319*** (1.1368)	2.6573** (1.1534)
Constant C	-5.023 (3.8550)	0.458 (4.6850)	1.399 (4.4705)	-240.2422*** (80.4074)	-100.0 (85.5202)	-100.9173 (84.8703)
Fixed effects	Y	Y	Y	Y	Y	Y
Adj. R- square	0.510	0.604	0.509	0.391	0.552	0.559
Number of samples	52	41	38	52	41	38
F value	8.774***	8.440***	5.438***	6.222***	7.136***	6.280***

671 \*\*\*, \*\* and \* represent significance levels of 1%, 5% and 10%, respectively.

672 The results in Table 7 show that the estimated coefficients for the ROA and ROE of listed banks  
 673 in the current period, one lag period, and two lag periods of city commercial banks are all negative,  
 674 and none of them passes the significance test. This phenomenon shows that the implementation of  
 675 green credit by city commercial banks has a negative impact on their financial performance, but it is  
 676 not a significant reason for lowering financial performance. The reasons for the insignificant  
 677 estimated coefficients maybe that city commercial banks are small in scale and dedicated to serving  
 678 small and medium-sized enterprises, with poor asset quality and high non-performing loan ratios.

679 On the one hand, they focus on the development of urban and small and medium-sized businesses,  
680 and they have weak awareness of environmental responsibility. Therefore, green credit business still  
681 can not form economies of scale. On the other hand, due to the weak foundation of city commercial  
682 banks and fewer customer resources, the cost effect of the implementation of green credit is greater,  
683 which far exceeds the positive impact of the implementation of green credit. Among the control  
684 variables, all NIS have passed the positive significance test on ROE, indicating that the level of NIS  
685 of city commercial banks can positively and significantly affect their financial performance.

686 **Table 7.** The impact of Green Credit on Financial performance of listed Banks: Urban commercial  
687 Banks

Variables	ROA			ROE		
	Current Period	One -period lag	Two-period lag	Current Period	One -period lag	Two- period lag
GL	-0.792 (1.4181)	-2.213 (2.1146)	-3.709 (4.2069)	-6.388 (24.5039)	-45.93 (27.6345)	-80.64 (33.7370)
GL <sub>-1</sub>		-3.826 (2.2086)	-6.421 (5.7759)		-28.66 (26.4891)	-87.73 (44.9548)
GL <sub>-2</sub>			-4.633 (8.4353)			-112.8 (69.8821)
AGE	0.0141 (0.0105)	0.0510 (0.0242)	0.0709 (0.0507)	0.188 (0.1766)	0.155 (0.2498)	0.566 (0.3681)
SIZE	-0.0668 (0.1111)	-0.0195 (0.1594)	0.0907 (0.3190)	1.143 (1.9354)	-0.0754 (2.1490)	2.802 (2.6773)
FL	0.00980 (0.0403)	0.0396 (0.0472)	-0.123 (0.2904)	0.823 (0.6285)	0.524 (0.5159)	-2.898 (2.4021)
GA	-0.0170 (0.3198)	-0.110 (0.3948)	-0.189 (0.6103)	-0.0682 (5.8002)	5.469 (5.3477)	3.475 (5.1229)
CAR	0.0376 (0.0315)	0.0184 (0.0435)	-0.0644 (0.1603)	-0.181 (0.5568)	0.486 (0.5871)	-1.109 (1.3466)
NPL	0.3411* (0.1602)	0.7725* (0.2952)	1.051 (0.6790)	2.275 (2.5922)	7.2117* (3.2582)	13.39 (5.0225)
NIS	0.224 (0.1400)	0.221 (0.1884)	0.300 (0.3127)	6.8526** (2.1772)	5.8327* (2.3875)	7.7591* (2.5219)
Constant C	0.404 (4.8128)	-4.240 (7.0803)	8.692 (25.5874)	-108.9 (86.5520)	-62.57 (90.3768)	192.3 (208.2511)
Fixed effects	Y	Y	Y	Y	Y	Y
Adj. R-square	0.782	0.822	0.586	0.788	0.909	0.924
Number of samples	23	17	16	23	17	16
F value	11.75***	9.638***	3.524***	12.55***	20.31***	20.94***

688 \*\*\*, \*\* and \* represent significance levels of 1%, 5% and 10%, respectively.

689 **5. Conclusions**

690 Taking the 19 listed banks in China as the research objects, their annual public reports and social  
691 responsibility reports from 2008-2017 were collected and analyzed. In this paper, the green credit  
692 ratio and green reputation of listed banks are used as indicators to measure the quantity and quality  
693 of green credit. And the panel data model is used to study the impact of green credit on the financial  
694 performance of listed banks, and relevant conclusions are finally drawn. And there are three main  
695 possible innovations in the article: Firstly, the impact of green credit on financial performance is  
696 studied mainly by listed banks. Secondly, it measures the impact of green credit on the financial  
697 performance of listed banks from both quantitative and qualitative aspects. Third, it examines the  
698 impact of green credit on the financial performance of different types of listed banks. This paper thus  
699 also fills a gap in the existing literature where there are fewer studies that quantitatively analyse the  
700 relationship between green credit operations and the financial performance of listed banks.

701 There are also some limitations to this article. Firstly, this paper collected data in 2018. There  
702 were 26 listed banks in 2018, but as the disclosure of green credit business by these listed banks varied  
703 and the disclosure caliber was not uniform. Therefore, for the sake of continuity and availability of  
704 the data selected for the variables, only data from 2008-2017 for 19 listed banks were selected for  
705 analysis in this paper, and the small sample data may have an impact on the research results. Next,  
706 the treatment of green reputation measurement indicators needs further improvement. As China's  
707 green finance started late, the implementation of green credit by listed banks has not yet formed a  
708 long-term and stable green reputation. In addition, there is a time lag in the green reputation brought  
709 about by green credit, and more scientific and reliable indicators need to be adopted for the  
710 measurement of green reputation.

711 Moreover, the following conclusions can be drawn from the results of the above empirical  
712 analysis.

713 First, the green credit ratio, as an indicator of the amount of green credit of listed banks, will  
714 have a positive impact on financial performance. That is to say, the implementation of green credit  
715 will promote the improvement of the financial performance of banks, but the impact of the current  
716 and lagging one period is more significant, and the impact of the two periods lag is not significant.  
717 This situation may be because there exists a phenomenon of "short-term" in current bank loans.  
718 Moreover, green credit started late, and green credit pol-icies are mostly short-term policies, lacking  
719 long-term mechanisms. At the same time, the listed banks develop green credit business to assume  
720 their social responsibilities actively. And the positive impact of delivering positive social images and  
721 positive news to the market is sufficient to offset the cost-effectiveness of green credit business in the  
722 early stages. However, the results show that this positive impact is not lasting and gradually  
723 weakens. It can only significantly improve the financial performance of listed banks in the first two  
724 periods, and the significance of this impact will disappear by the third period. It can be seen that the  
725 implementation of green credit of listed banks needs to ensure sustainability to continue to have a  
726 significant positive impact on financial performance.

727 Second, as an indicator of the quality of green credit of listed banks, green reputation can  
728 significantly improve the financial performance of listed banks. News media reports on listed banks  
729 implementing green credit have aroused public attention and brought positive attention, and has  
730 helped banks establish a positive corporate image. These are all intangible gains for listed banks.  
731 Besides, the positive effects of green reputation on listed banks are mainly reflected in the following  
732 two aspects. Firstly, the increased exposure of positive green reputation encourages listed banks to  
733 optimize their green credit mechanisms and urges them to standardize the development of green  
734 credit business, thereby promoting their sustainable development. Secondly, the improvement of  
735 green reputation has increased public trust, enhanced the competitive advantage and differentiation  
736 value of listed banks, and indirectly improved the financial performance of listed banks, thereby  
737 obtaining higher profits. Also, this positive influence has a certain lag, which is basically consistent  
738 with the theoretical analysis above. It is important to note here that the green reputation that comes  
739 from supporting green development and being featured in the media is only one of the factors behind

740 the bank's better performance. More importantly, the financial performance of the bank is enhanced  
741 by a series of factors such as lower non-performing assets, a higher green image and higher public  
742 acclaim as a result of green credit implementation.

743 Third, the implementation of green credit has different impacts on different types of banks. For  
744 large commercial banks, they are strong and have abundant customer resources. The positive benefits  
745 and green reputation brought about by the implementation of green credit can make up for the bank's  
746 current cost effect. However, as time goes by, the cost effect of large commercial banks has become  
747 increasingly prominent due to the loss of "two-high" corporate loans and their own complicated and  
748 inefficient operations. As a result, the green credit business has caused more and more losses to large  
749 commercial banks, and the positive effects brought about by it are gradually reduced. Even in the  
750 two-period lag, this cost effect has exceeded the positive impact, that is, the implementation of green  
751 credit will lead to a decline in financial performance. For joint-stock commercial banks, the good  
752 image and good news that joint-stock commercial banks convey to the market when they implement  
753 green credit and their own high-efficiency operating capabilities can make up for the withdrawal of  
754 "two-high" corporate loans and investment in environmental protection issues. However, the  
755 strength of joint-stock commercial banks and the customer resources other than the "two-high"  
756 enterprises are not comparable to large commercial banks. Therefore, the sustainability of the positive  
757 impact of green credit is not as good as that of large commercial banks, showing that the impacts of  
758 one period lag and two periods lag on financial performance are negative, that is, the implementation  
759 of green credit will reduce its financial performance. For city commercial banks, they are small in  
760 scale and dedicated to serving small and medium enterprises, with poor asset quality and high non-  
761 performing loan rates. First of all, they focus on the development of urban and small and medium-  
762 sized enterprises' businesses, with weak awareness of environmental responsibility, less green credit  
763 business, and cannot form economies of scale. Secondly, due to the weak foundation of city  
764 commercial banks and fewer customer resources, the cost effect of the implementation of green credit  
765 is greater, which far exceeds the positive impact of the implementation of green credit.

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772 research methodology and providing access to the data collection, is the lead author of this paper. Yaran Wang,  
773 who conducted the empirical analysis and drew the conclusions related to the study, is the second author of the  
774 paper. Mingqian Yang is responsible for writing the perspective statement and searching for relevant literature  
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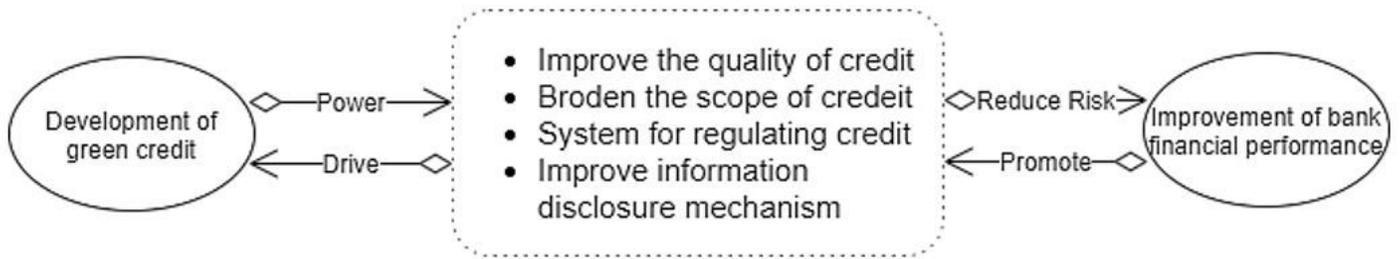
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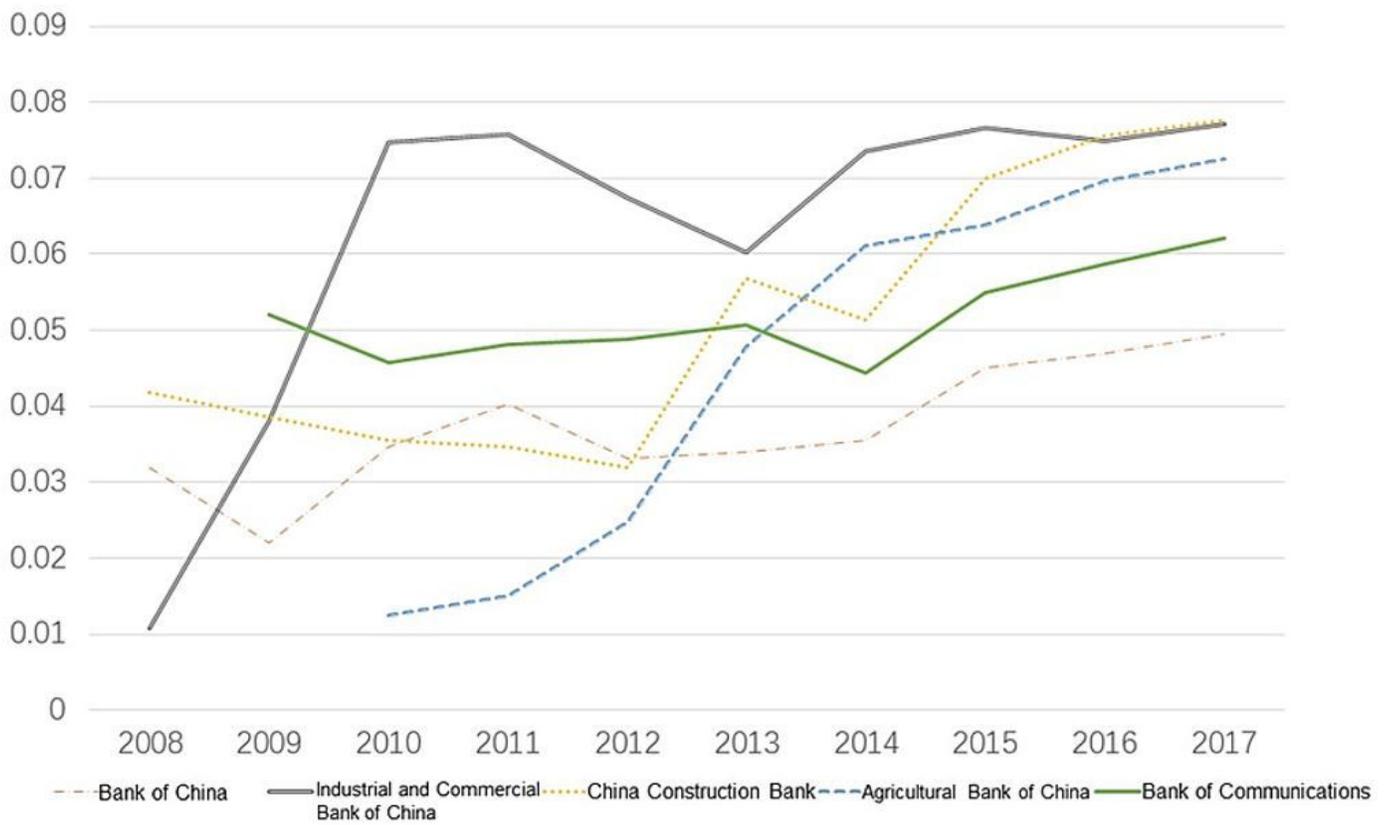
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# Figures



**Figure 1**

Green credit promotes the improvement of bank financial performance



**Figure 2**

The development trend of green credit ratio of large commercial banks

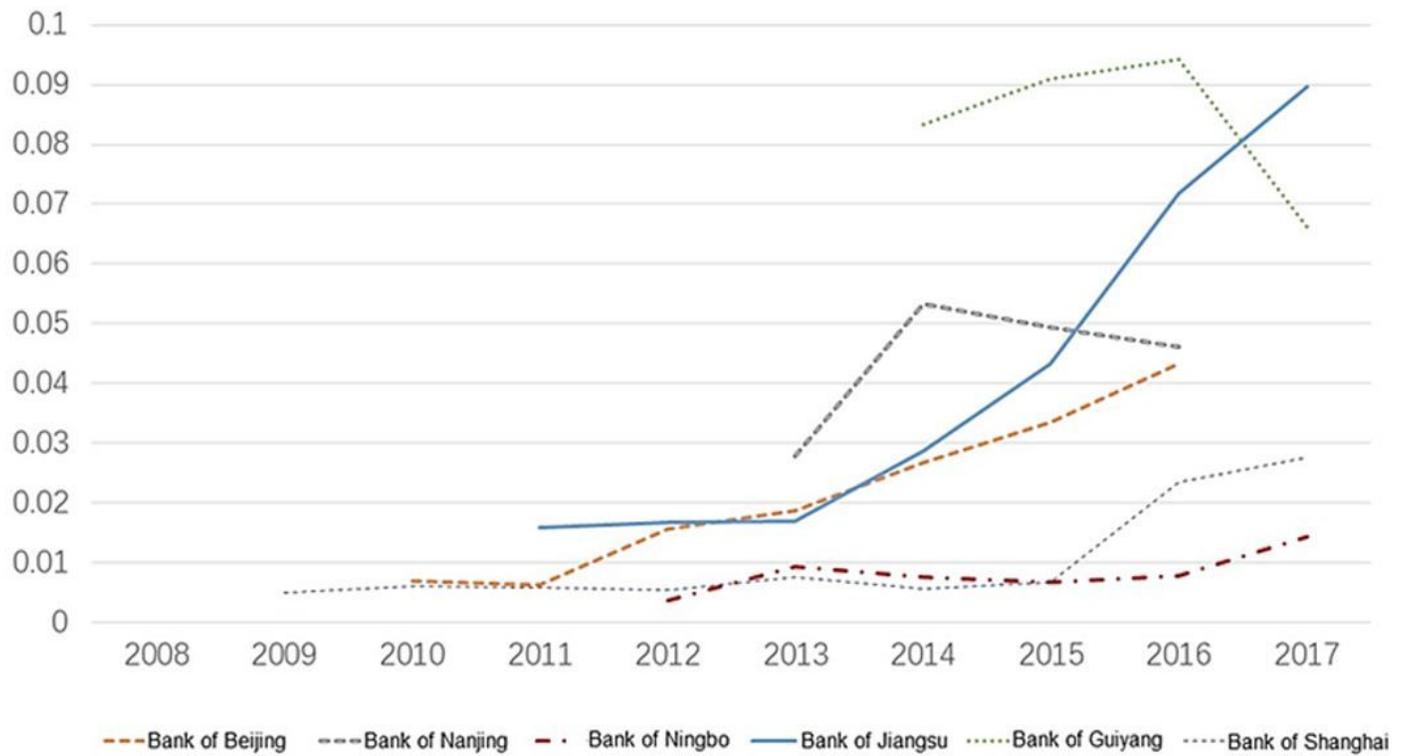


Figure 3

The development trend of the green credit ratio of joint-stock commercial banks

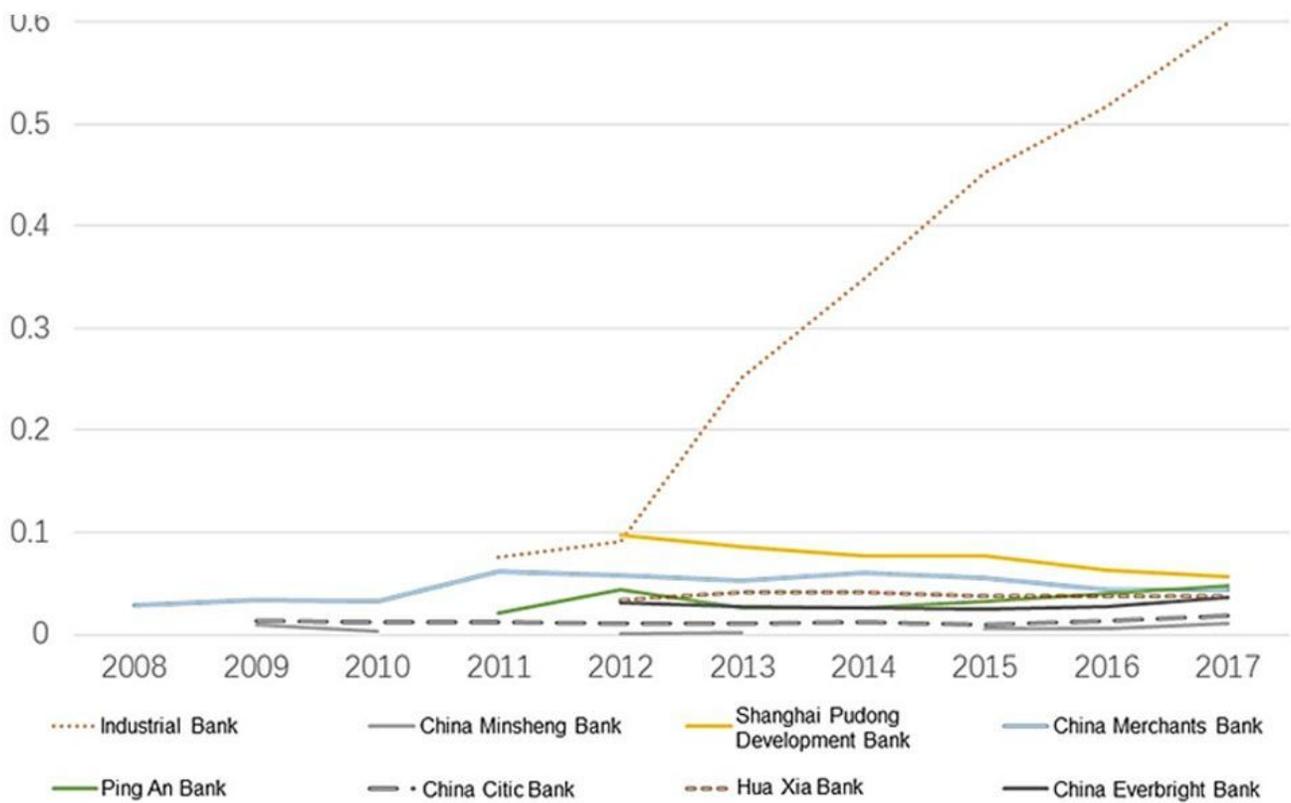


Figure 4

The development trend chart of the green credit ratio of city commercial banks

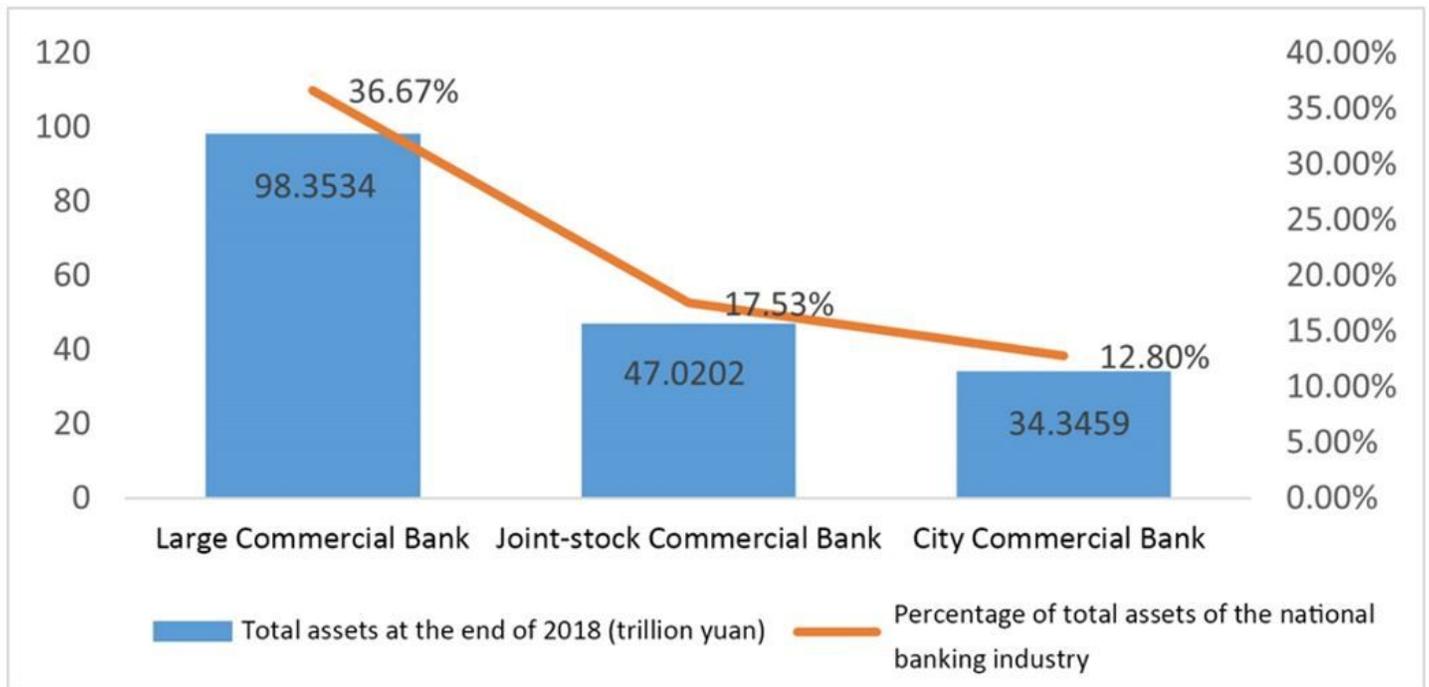


Figure 5

The total assets and proportions of the three types of bank assets at the end of 2018