Can the Term Structure of Credit Promote the Green Innovation in China?

Yongtu Wang

Sanpailou Campus of Nanjing University of Posts and Telecommunications, Nanjing, China

1638057752@qq.com

Abstract. The term structure of credit is significant to the cultivation of green innovation ability and high-quality economic development in each province. Using panel data for thirty Chinese provinces from 2005 to 2019, this paper analyzes how the extending term structure of credit impacts the development of green innovation in each province and its internal mechanism. The results are as follows. Firstly, the extending term structure of credit has promoted green innovation, which is more remarkable in innovative provinces. Secondly, the mechanism analysis shows that the extending term structure of credit improves green innovation activities in provinces to a certain extent, thus reducing environmental pollution by mitigating emissions of carbon dioxide and sulfur dioxide. According to regulating effect analysis, the provincial competition for scientific and technological innovation and environmental protection helps to boost the positive effect of the extending term structure of credit on the development of green innovation. The conclusion of this study provides empirical evidence and policy suggestions for advancing the transmission mechanism of the term structure of credit, which optimizes the relevant governmental policies about green innovation promotion to further develop green innovation in various provinces.

Keywords: Term Structure of Credit; Green Innovation and Development; Financial Credit; Energy Saving; Emission Reduction.

1. Introduction

With the rapid development of the economy promoted by traditional enterprises, ecological environment pollution is getting worse and worse. The report of the 19th National Congress of the Communist Party of China pointed out that green innovation must be the top priority in high-quality economic development. Besides, *the Action Plan for Carbon Peak before 2030* emphasized accelerating the cultivation and formation of new kinetic energy for green development. Therefore, up against green innovation and development, enterprises, as market players, actively seek to reduce their carbon emissions through scientific and technological innovation and achieve environmental protection. Optimizing energy utilization structure and improving resource utilization efficiency through green innovation will promote win-win results featuring high-quality economic development and an ecological environment [1]. At present, high-quality economic development with "green innovation" as the engine has been highly valued by the whole society. As the market's main body of economic transformation, it is increasingly an imperative issue for enterprises to fully play their potential for green innovation development.

Some researchers have held that green innovation will have a positive effect on enterprises' competitiveness and pollution control ability, but enterprises need to invest more productivity resources as support. The upfront investment cost of green innovation is large with a long operation cycle, which cannot generate benefits for enterprises due to excessive green innovation expenditure [2]. Thus, timely financial support is crucial for promoting the green innovation of enterprises. According to research results of Wangxin [3], under the current policies of green financial credit, enterprises have comparative advantages in easy access and convenience to obtain relevant green credit financing. In the long run, such policies will improve the economic benefits of banks, so long-term financial support is a win-win measure for both enterprises and banks.

From the perspective of the modern financial system's policy on green innovation, as for whether bank credit can release the financial constraints of enterprises and guide them to invest more resources in the green R&D and production, the banks' term structure of credit has greatly affected green

innovation capability of enterprises. Although some scholars have paid attention to the relationship between financial credit and green innovation, there is relatively little literature on the positive effect of the term structure of credit in green innovation. Therefore, how to adjust the banks' term structure of credit, formulate a more perfect economic system, and seek high-quality economic development is worthy of scholars' deep consideration. On this basis, focusing on the relationship between green innovation and term structure credit, this paper will analyze and adjust the mechanism as well as its internal logic, so as to provide a new path for financial credit to affect enterprise green innovation. Selecting 30 provinces' data about the term structure of credit and green patents from 2005 to 2019, this paper describes the mechanism of the term structure of credit and green innovation in detail to fill the gap in previous literature.

The possible marginal devotion of this paper is as follows.Firstly, this paper explores the impact of the new credit maturity structure on green innovation from the perspective of Besides, no existing article further explores the shock and impact on China's macro-economy. Secondly, it provides a new way of thinking for the formulation of China's macroeconomic policies. At this stage when it is still necessary to strengthen the financial policy incentives and innovate the medium and long-term credit service mechanism, this study provides a reference for enhancing the green innovation ability of enterprises and deepening the financial system reform.

2. Literature Review

2.1 Influencing Factors of the Green Innovation Development of Enterprises

At present, there have been studies to explore the internal and external factors that drive the green innovation of enterprises. Internal factors of enterprises can affect their green innovation [4]. He Ying (2019) [5] pointed out that the scale and organizational structure of enterprises can affect their strategy formulation and future development from the enterprise architecture. Zhang Jinfan (2017) [6] found that the governance structure and incentive mechanism of listed enterprises in the stock market industry will significantly affect the innovation ability of enterprises. According to Wang Xu (2019) [7], there exists threshold effect in the relationship between enterprise scale and green innovation. The exterior environment of enterprises will also play a positive role in the green innovation of enterprises [8]. From the perspective of the policy system, Liu Jinke (2022) proposed [9] to give enterprises certain independent rights through reasonable environmental regulation tools and encourage enterprises to reduce environmental costs through green innovation. It has been considered that the moderating measures of external punishment can improve enterprises' green innovation. However, the promotion of green development still needs source power. A certain financial incentive mechanism will also optimize resources allocation and guide enterprises to green innovation through capital allocation.

Regarding the impact of financial credit on enterprise innovation, Huang Tingting (2023) [10] pointed out that vigorously promoting financial credit will eliminate the distorted incentives of rent-seeking on enterprise innovation and guide the fair distribution of financial resources, thus boosting the high-quality development of enterprises. Sheng Tianxiang and Zhang Yong (2019) [11] analyzed the relationship between financial and monetary policies, financial leverage, and medium-and long-term loans. For some enterprises with serious pollution, only relying on green technology innovation can effectively reduce the environmental risk of enterprises and reduce the cost of pollution control. Goetz (2019) and He et al. (2019) [12] confirmed that green financial loans significantly improved the green innovation research and development capabilities of enterprises based on their data from China and the United States respectively.

2.2 Impact of Term Structure of Credit on the Green Innovation Development

Relevant scholars have explored the economic effects of the credit term structure. Zhang Jie et al. (2016) [13] believed its impact on R&D innovation and long-term loans that tend to meet real estate investment has caused prominent obstacles to China's innovation activities. However, Wu Yao (2020)

[14] put forward that the long-term term structure of credit has a significant innovation and promotion effect on large state-owned enterprises, growing enterprises. First of all, from the perspective of debt maturity, long-term credit has the function of continuous credit tracking in general situations. Because of its certain advantages in acquisition speed and lower capital cost, banks can effectively reduce the agency cost of free cash flow of enterprises through differentiated loan interest rates. Secondly, the role of long-term credit with long continuity will be conducive to the irrevocable disappearance of environmental and social problems such as energy consumption, pollution, ecological protection, and climate change. Furthermore, the implementation of long-term credit policies not only improves the green total factor productivity of heavily polluting enterprises (Liu, C. J. et al., 2022) [15], but also increases the innovation output of green credit-restricted industries (Wang, X. & Wang, Y., 2021). Xie Qiaoxin and Zhang Yu (2021) [16] grouped the samples according to the different property rights, debt leverage, and regional marketization degree of enterprises. They found that long-term credit policies will have different impacts on the green innovation performance of enterprises due to the differences in these factors. Finally, in addition to more effectively guiding the flow of funds to enterprises, a longer credit period can not only promote enterprises to better realize technological innovation and achievement transformation in the innovation value chain, but also accelerate the transformation of industrial structure, then achieving the effect of energy conservation and emission reduction. Financial institutions launch medium and long-term credit products and services such as innovative project loans, which can comprehensively improve the enthusiasm of enterprises for green innovation and raise the efficiency of capital use. After comprehensive research, it is found that the government should deepen the guarantee of financial services and strengthen the coordination between financial policies and fiscal policies to better promote the green innovation capability of enterprises.

2.3 Influence of Government Departments on the Green Innovation Development

The government's scientific and technological funding support for green innovation plays a vital role in improving the green innovation of enterprises. Relevant scholars have discovered a significant interaction between environmental protection policies and they found that R&D support policies can cut the cost of emission reduction by improving green innovation. Only when the two are combined to form complementary coupling can green innovation be effectively stimulated. Sun Wei et al. using the evolutionary game model proved that strict environmental regulation and technological innovation of enterprises can be realized simultaneously, and the key factor is effective government investment. From the above analysis, we can see that under the background of stricter environmental regulation policies, government science, and technology funding plays a moderating role between environmental regulation and green innovation. Government funding for science and technology can weaken the adverse effects of environmental regulation on green innovation, and strengthening environmental regulation has a positive impact on green innovation.

Secondly, the digital economy can improve the efficiency of technology market supervision of governments at all levels. Although government departments do not directly participate in technology transactions, their market supervision functions are indispensable. The sustained and healthy development of the technology market can be promoted by maintaining the fairness and justice of the market. Meanwhile, digital technology can technically support governments in their intellectual property governance of green innovation. In terms of market supervision, the digital economy gave birth to digital government and promoted the digitalization of statistics and government decision-making. With the continuous development of digital government, the governmental supervision of the technology market has become more scientific and efficient, thus the development of green innovation has been significantly improved.

Thirdly, the government policies on environmental protection regulate the development of green innovation. With the introduction of relevant government policies, R&D subsidies are increasing, and cost-based environmental regulation may reduce the effect of green innovation. With the rising subsidies, enterprises are more inclined to pay fines instead of developing green innovative

technologies, which has a smaller positive impact on cost-based environmental regulation. However, with the intensifying R&D subsidy, the green innovation technology regulated by market incentives will increase. The investment decision-making of enterprises featuring market incentives will be influenced by market means. Enterprises will choose economical and highly effective production methods to carry out self-innovation, which has obvious advantages in pollution reduction and technological innovation. With the augmenting government funding, enterprises characterized by market incentives will strengthen their awareness of environmental protection, and the green innovation effect will consistently develop.

Therefore, this paper puts forward the following hypotheses.

H1: Competition among provinces for scientific and technological innovation has a significant role in promoting green innovation.

H2: Competition among provinces for economic development has a significant role in promoting green innovation.

H3: Competition among provinces for environmental protection can significantly promote green innovation.

3. Research Design

3.1 Model Setting

According to the above theoretical assumptions, this paper sets a fixed model to test how the term structure of credit impacts green innovation.

$$lnGreenpatent = \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (1)$$

Where $lnGreenpatent$ indicates the number of green patents; $lncreditstructure$ indicates the term structure of credit; X_{ijt} is the control variable. The subscript i represents the province, j is the serial number of the control variable, and t represents the year; u_i and γ_t represent provinces and time effects respectively; ε_{it} are random disturbance terms.

Based on the formula (1), this paper constructs a dynamic panel model with mediating effects to test how the term structure of credit impacts energy conservation and emission reduction through green innovation.

$$lnenergy = lnGreenpatent + \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (2)$$

$$lnenvironment = lnGreenpatent + \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (3)$$

Where $lnGreenpatent$ represents mediating variables; energy consumption sulfur dioxide emissions are used as the measurement indicators of energy conservation and emission reduction.

Based on the formula (1), this paper constructs a moderating effect model to test how the term structure of credit impacts green innovation.

$$lnGreenpatent = technology + \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (4)$$

$$lnGreenpatent = protection + \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (5)$$

$$lnGreenpatent = fdi + \alpha lncreditstructure + \sum_j \beta_j X_{ijt} + u_i + \gamma_t + \varepsilon_{it} \quad (6)$$

Where $technology, protection,$ and fdi represent the moderator variables.

3.2 Variable Design

(1) Core explanatory variable: term structure of credit ($lncreditstructure$). Referring to the relevant literature, the term structure of credit in this paper is the ratio of short-term loans to long-term loans, which represents the length of banks' credit structure. The smaller the ratio, the greater the proportion of long-term loans and the smaller that of short-term loans. If the ratio is larger, there is a smaller proportion of long-term loans and a larger that of short-term loans.

(2) Explained variable: green innovation ($lnGreenpatent$). The efficiency of green innovation can be measured from input and output. Combined with previous research methods, this paper decides to measure the innovation input by the number of scientific research and R&D investments and

express the innovation output by the number of applications and publicity of green environmental protection patents. To ensure the robustness of the follow-up empirical main regression, this paper chooses the number of applications per capita of green environmental protection patents as the proxy variable in the robustness test.

(3) Control variables: this paper sets the following control variables to reduce the variable omission in the model estimation. 1) Human capital ($lngraduate$): the number of college students in each province. 2) Trade openness ($lntrade$): the proportion of import and export trade in GDP in each province. 3) Infrastructure ($lnarea$): the proportion of road area per capita in each province. 4) Government intervention ($lnfinance$): the ratio of fiscal expenditure amount to GDP of each province. 5) Environmental regulation ($lnpollution$): the investment amount of industrial pollution control in each province. 6) Industrial structure ($lnstructure$): the ratio of the output value of the tertiary industry to the output value of the secondary industry.

(4) Moderator variables: 1) Competition for growth expressed by per capita utilization of foreign direct investment (FDI). 2) Competition for innovation represented the proportion of fiscal expenditure on science and technology (TEC). 3) Competition for environmental protection expressed by fiscal environmental protection expenditure as specific indicators (PRO).

(5) Other variables: external energy intensity and green innovation are further used as intermediary variables to test whether the term structure of credit affects energy conservation and emission reduction through green innovation. External energy intensity is expressed by sulfur dioxide emission (environment) and energy consumption (energy) of provinces respectively.

3.3 Data Samples

Table 1 gives descriptive statistics of the main variables. It can be seen from the table that the average number of green patent applications and the patent applications per capita are 6.442 and -1.788 respectively, and the standard deviations are 1.684 and 1.715 respectively. In the sample data, the average term structure of credit is 0.512, which shows that the average ratio of short-term loans to long-term loans in the bank credit system is 51.2% with little difference between them. The minimum of per capita green patent data is -6.367, the maximum is 2.204, and the standard deviation of per capita green patent is 1.715, which shows that the data fluctuates greatly with relatively poor stability. According to the current sample data, although the term structure of credit has been prolonged in recent years, short-term loans still account for a high proportion of the total loan amount.

Table 1. Descriptive Statistics of Variables

	Number of Samples	Mean Value	Standard Deviation	Minimum	Maximum
$lnGreenpatent$	450	6.442	1.684	1.792	10.382
$lnpercapitagreenpatent$	450	-1.788	1.715	-6.367	2.204
$lncreditstructure$	450	0.512	0.496	-0.572	1.806
$lngraduate$	450	-4.146	0.316	-5.195	-3.549
$lntrade$	450	0.184	5.370	-3.611	18.361
$lnarea$	450	2.643	0.295	1.677	3.266
$lnfinance$	450	-1.575	0.425	-2.528	-0.465
$lnpollution$	450	11.878	1.026	8.178	14.164
$lnstructure$	450	-0.109	0..304	-0.694	1.046

4. Analysis of Empirical Results

4.1 Regression Results of Basic Model

Table 2 indicates the regression results of the changing term structure of credit on the green innovation in each province. The results show that if no control variables are added, every unit of the

term structure of credit will inhibit green innovation by 0.884 units, and the effect is significant at the level of 1%. It is also shown that the green innovation in each province will decline with the extending term structure of credit. After adding all the control variables in the last column, we find that the term structure of credit promotes green innovation, with 0.126 and 0.260 as regression coefficients respectively. Its marginal significance is that after adding different control variables, the development of green innovation will increase by 0.126 and 0.260 for every 1 percentage increase in the proportion of long-term loans. Therefore, the extending term structure of credit can effectively boost green innovation in each province.

Table 2. Baseline Regression Results

Explained Variable	$lnGreenpatent$	$lnGreenpatent$	$lnGreenpatent$	$lnGreenpatent$
$lncreditstructure$	-0.884*** (-6.16)	-0.629*** (-5.28)	0.126 (1.27)	0.260*** (2.69)
$lngraduate$		1.602*** (9.36)	0.661*** (5.07)	0.618*** (5.01)
$lntrade$		-0.075*** (-7.18)	0.001 (0.16)	0.005 (0.65)
$lnarea$			-1.175*** (-10.08)	-0.905*** (-7.70)
$lnfinance$			-2.767*** (-19.82)	-2.307*** (-16.62)
$lnpollution$				0.391*** (1.84)
$lnstructure$				0.822*** (6.87)
Constant Term	7.093*** (71.57)	13.501*** (19.43)	7.880*** (11.76)	3.072*** (3.89)
Time Virtual Variable	Control	Control	Control	Control
Regional Virtual Variable	Control	Control	Control	Control
R^2	0.080	0.381	0.686	0.7415
Obs	450	450	450	450

4.2 Heterogeneity Effect Test

Table 3. Heterogeneity Analysis

	Innovative Provinces	Non-innovative Provinces
$lngraduate$	0.577*** (4.22)	0.059 0.58)
$lngraduate$	0.123 (0.58)	1.054*** (7.79)
$lntrade$	0.583*** (9.59)	0.001 (0.24)
$lnarea$	1.590*** (6.77)	-1.478*** (-13.03)
$lnfinance$	0.910** (3.47)	-1.505*** (-8.53)
$lnpollution$	0.341*** (4.66)	0.287*** (6.52)
$lnstructure$	1.531*** (5.84)	-0.583** (9.29)
Constant Term	1.954 (1.33)	8.614*** (-2.53)
Time Virtual Variable	Control	Control
Regional Virtual Variable	Control	Control
R^2	0.719	0.809
Obs	150	300

In this paper, the whole sample is divided into innovative and non-innovative provinces, with the estimation results of the fixed effect model shown in Table 3. According to the results of the regional test, the correlation coefficient of the credit structure coefficient in column (1) is 0.577, which is significantly positive at the level of 1%. To a certain extent, the positive effects brought by the development of credit structures are released in innovative provinces and regions in China.

Comparing the grouping regression coefficient, the term structure of credit has a limited positive impact on non-innovative provinces, which may be due to the enterprises with higher financing constraints in non-innovative provinces. Such enterprises are not easy to obtain more funds at one time, so they are likely to face a large funding gap and the long-term loans may be more used for general production and operation rather than green innovation research and development, thus inhibiting the green innovation activities of enterprises.

Thanks to the comprehensive effects of two aspects, the term structure of credit has a significant positive impact on innovative provinces. On the one hand, the green innovation in provinces featuring innovative development is higher, and their regional economies of scale are more significant. On the other hand, their technology market is relatively developed, leaving a positive linkage effect with green innovation and development.

4.3 Analysis of Moderating Effect

Table 4. Moderating Effects

	GI(1)	GI (2)	GI (3)
$lncreditstructure$	-1.731*** (-7.70)	-0.071 (-0.34)	-0.173 (-0.64)
$lncreditstructure$*TEC	0.522*** (9.93)		
$lncreditstructure$*FDI		-0.095** (-2.01)	
$lncreditstructure$*PRO			0.107** (1.89)
$lngraduate$	0.065 (0.43)	0.325** (1.88)	0.304** (1.77)
$lntrade$	-0.008 (-1.08)	-0.007 (-0.87)	-0.004 (-0.45)
$lnarea$	-0.265 (-1.59)	-0.771*** (-4.33)	-0.730*** (-4.06)
$lnfinance$	-1.860*** (-13.30)	-2.434*** (-15.55)	-2.310*** (-15.61)
$lnpollution$	0.236*** (4.90)	0.370*** (7.10)	0.372*** (7.15)
$lnstructure$	0.646*** (4.14)	0.345** (2.01)	0.366** (2.11)
Constant Term	1.663* (1.89)	1.453 (1.46)	1.454 (1.46)
Time Virtual variable	Control	Control	Control
Regional Virtual variable	Control	Control	Control
R^2	0.794	0.742	0.742
Obs	450	450	450

Table 4 shows the data and results of the moderating effect, where the independent and moderator variables are multiplied by each other to empirically analyze the moderating effect. Based on the baseline regression, this empirical study adds the cross-multiplication term of three moderator variables to test their interference with the main regression. It can be seen from Table 4 that the moderator variables competing for innovation have the strongest influence on the promotion of green innovation, with a coefficient of 0.522, which is significant at the level of 1%, followed by the moderator variables competing for environmental protection. The moderator variable for growth and

competition restrains green innovation, with a coefficient of 0.095, which is significant at the level of 5%. Therefore, hypotheses H1 and H3 hold true.

The proportion of scientific and technological innovation expenditure is directly related to green innovation. Without scientific and technological funds, it is impossible to promote green innovation. The green innovation is to protect the environment, so the increasing environmental protection expenditure will financially support green innovation and force relevant organizations to improve their green innovation. As for the per capita utilization of foreign direct investment, capital is profit-seeking in the short term and foreign capital will favor related projects with short return periods and large operating profits to pursue immediate benefits, thus ignoring the promotion of organizational green innovation, which is not conducive to long-term development.

4.4 Mediating Effect Analysis

To test how the term structure of credit impacts energy saving and emission reduction, this paper applys uses the mediating effect model. The explanatory variables in columns (1) and (3) of Table 5 will be replaced by energy consumption and sulfur dioxide emissions of each province, and the variables of green innovation will be added to columns (4) and (6) based on columns (1) and (3).

The results in column (1) show that the credit term structure coefficient is significantly negative at the level of 1%, which indicates that the extension of credit term structure significantly reduces energy consumption; The results in column (2) show that the development level of green innovation as an intermediary variable is significantly positive at the level of 1%, which indicates that the change of credit term structure can effectively reduce energy consumption through the development of green innovation level.

The results in column (3) illustrate that the credit structure coefficient is significantly negative at the level of 1%, indicating that the extending term structure of credit greatly reduces the emission of sulfur dioxide in the air. According to the results, the development of green innovation as an intermediary variable is significantly positive at the 1% level, which proves that the improvement of green innovation can significantly undercut sulfur dioxide emissions and improve air quality.

Table 5. Mediating Effects

	$lnenergy$	$lnenergy$	$lnenvironment$	$lnenvironment$
$lncreditstructure$	-0.219*** (-4.35)	-0.272*** (-5.74)	-0.295*** (-3.90)	-0.329*** (-4.36)
$lnGreenpatent$		0.177*** (7.59)		0.115*** (3.10)
$lngraduate$	-0.343*** (-4.19)	-0.389*** (-5.09)	-0.320*** (-2.61)	-0.350*** (-2.88)
$lntrade$	-0.002 (-0.43)	-0.001 (-0.20)	-0.022*** (-3.53)	-0.021*** (-3.46)
$lnarea$	-0.421*** (-4.92)	-0.282*** (-3.45)	-0.387*** (-3.01)	-0.297** (-2.28)
$lnfinance$	-0.682*** (-9.58)	-0.269*** (-3.15)	0.359*** (3.37)	0.627*** (4.60)
$lnpollution$	0.406*** (16.41)	0.337*** (13.62)	0.596*** (16.07)	0.551*** (13.99)
$lnstructure$	-0.252*** (-3.06)	-0.305*** (-3.97)	-0.804*** (-6.52)	-0.839*** (-6.85)
Time Virtual Variable	Control	Control	Control	Control
Regional Virtual Variable	Control	Control	Control	Control
Constant Term	3.213*** (6.77)	3.003*** (6.79)	6.283*** (8.83)	6.146*** (8.72)
R^2	0.804	0.831	0.675	0.683
Obs	450	450	450	450

4.5 Robustness Checks

To test the robustness of the subsequent regression results, this paper tests from two aspects, that is, changing variables and methods. Firstly, the number of green patent applications per capita is used as an alternative indicator of the number of green patent applications. According to the results in column (1) of Table 6, the estimated coefficient of credit structure is 0.892, which is significant at the level of 1%, using the number of green patent applications per capita in each province as the indicator. It can be seen that the positive impact of the extending term structure of credit on the green innovation of each province is not affected by the loan structure indicators.

Secondly, the instrumental variable method is used to regress the samples. To eliminate the bad influence of the fixed effect model on the estimation results, premised on not changing the sample data, the tool variable method was replaced for regression analysis. The regression coefficient of credit structure is 1.342, which is significantly positive at the level of 1%. Representing that the term structure of credit can promote green innovation and the research conclusion has strong robustness.

Table 6. Robustness Test

	Changed Variable	Instrumental Variable Method
$lncreditstructure$	0.892*** (6.38)	1.342*** (2.95)
$lngraduate$	1.369*** (7.66)	0.661*** (3.70)
$lntrade$	0.027** (2.45)	0.025 (0.36)
$lnarea$	-1.576*** (-9.26)	-0.121 (-1.04)
$lnfinance$	-1.937*** (-9.65)	0.131 (0.69)
$lnpollution$	0.322*** (4.75)	0.039 (1.33)
$lnstructure$	0.032 (0.19)	-0.306* (-1.91)
Time Virtual Variable	Control	Control
Regional Virtual Variable	Control	Control
Constant Term	0.712 (0.62)	8.143*** (6.48)
Constant Term		8.506
R^2	0.532	0.972
Obs	450	420

5. Conclusion and Recommendations

The term structure of credit is key to promoting green innovation and supporting the green economy in various provinces. Based on the above theoretical analysis, this paper selects the panel information of 30 provinces in mainland China from 2005 to 2019 and uses the fixed effect model for empirical tests. The results are as follows. 1) As for robustness tests with changing methods and variables, the regression coefficient of the term structure of credit to the green innovation is significantly positive, indicating that the extending term structure of credit can significantly promote green innovation. 2) The promotion of changing credit term structure to green innovation is quite different among various innovative provinces. Specifically, the extending term structure of credit has a stronger promoting effect on the market development of innovative provinces than that of non-innovative provinces, because both the green economy and technology market of innovative provinces have developed better. 3) Term structure of credit has a significant positive impact on energy saving and emission reduction through green innovation, and the mediating effect increases

from the term structure of credit, green innovation, to energy conservation and emission reduction in turn.

Thus, according to the relevant research in this paper, the following suggestions are given.

Firstly, based on the increasing R&D and innovation of green products in various provinces, the banks' extending term structure of credit will significantly promote green innovation. Therefore, all provinces can improve the scientific and technological support for green innovation and boost the incentive for extending the banks' term structure of credit. Besides, they should guide the capital financing to accurately invest long-term credit funds in related enterprises with strong technological innovation power, broad development prospects, and rising industries, so as to eliminate the financial burden of enterprises in all provinces in green technology innovation activities and lay a solid foundation for economic transformation and development.

Secondly, the over-investment of enterprises should be restrained to obtain short-term benefits and play a full and active role on the extending term structure of credit in improving green innovation. It is necessary to use market-oriented legal means to follow and strengthen the supervision of the illegal inflow of bank credit funds into industries with high carbon emissions and environmental damage, such as real estate and heavy industry. In addition, we should raise the funds' access requirements in related industries and increase the financing costs of related enterprises. At the same time, China's major banks should be discerning and well prepare for entering related emerging green industries in advance. They can also rely on policy support and government-related subsidies to guide corresponding debt financing projects such as loan funds to flow into low-carbon enterprises, thus innovating the growth of the banking business and enhancing the sustainable development of China's macro economy.

Thirdly, China should speed up improving the incentive system of green credit structure in the top policy design. The People's Bank of China will give priority to price tools such as interest rate regulation to maximize the policy effect. Meanwhile, to support the strategy of energy conservation and emission reduction, the central bank should use relevant supportive policies of carbon emission reduction and green special loan policies to accurately aid areas in climate change, environmental protection, energy conservation, and emission reduction, thus encouraging major financial capitals to provide continuous financing support for enterprises or projects with high scientific and technological innovation and remarkable benefits of environmental protection, so as to promote the green transformation and development of the macro economy. Finally, the high-level governments represented by the central bank should not only further strengthen the research on the tracking development of domestic and international green credit structure, but also constantly explore the optimization of innovating and expanding the green credit structures. Moreover, they need to deepen the reform of China's financial system and promote the sustainable development of strategies such as innovation-driven development, energy conservation, and emission reduction.

References

[1] Zhang, L. L., Xiao, L. M. & Gao, J. F. (2018). Measurement and comparison of green financial development level and efficiency in China: Based on data of 1040 public companies. Forum of Science and Technology in China, (9), 100-112+120.

[2] Cui, X. M., Wang, J. Y. & Xu, G. Y. (2021). Environment uncertainty, executive tenure and enterprise green innovation. Scientific Decision Making, (10), 20-39.

[3] Wang, X. & Wang, Y. (2021). Research on the green innovation promoted by green credit policies. Journal of Management World, 37(6), 173-188+11.

[4] Ma, J., Zhu, B. & He, X. (2020). How can family business become more active promoters of green innovation? From the perspective of socioemental wealth and institutional legitimacy. Journal of Management Sciences in China, (09), 31-60.

[5] He, Y., Yu, W. L., Dai, Y. C. et al. (2019). Career experience of managers and enterprises' innovation. Journal of Management World, 35(11), 174-192.

[6] Zhang, J. F., Li, H. Y. & He, H. (2017). IPO and firm innovation: An empirical study based on Chinese patent data. Journal of Financial Research, (05), 160-175.

[7] Wang, X. & Chu, X. (2019). External financing and enterprises' green technology innovation: A study based on the threshold model of firm size. Systems Engineering-Theory & Practice, 39(08), 2027-2037.

[8] Porter, M. (1991). American's green strategy. Scientific American, 264(4), 168-264.

[9] Liu, J. K. & Xiao, Y. Y. (2022). China's environmental protection tax and green innovation: Incentive effect or crowding-out effect? Economic Research Journal, 57(1), 72-88.

[10] Sheng, T. X. & Zhang, Y. (2019). Monetary policy, financial leverage, and long-term credit resources--Based on the perspective of Chinese commercial banks. Studies of International Finance, (5), 55-64.

[11] Goetz, M. (2019). Financing conditions and toxic emissions. SAFE Working Paper.

[12] Zhang, J. & Ju, Y. W. (2017). Loan term structure and China's economic growth. World Economic Papers, (5), 1-22.

[13] Liu, C. J., Chang, S. H. & Li, X. (2022). Has green credit policy boosted green total factor productivity in China's heavily polluting industries? Studies of International Finance, (4), 3-11.

[14] Xie, Q. X. & Zhang, Y. (2021). Green credit policy, supporting hand, and innovation transformation of enterprises. Science Research Management, 41(1), 125-134.