

The Impact of Green Credit Policy on Enterprise Innovation Performance

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Abstract: In 1992, the United Nations held the Rio Earth Summit introduced the concept of sustainable development. Linking environmental protection with economic growth, which catalyzed the development of green finance. With growing environmental problems, many countries, including China, have implemented policies to promote financial support for sustainable development. Since 2012, China has prioritized ecological civilization and green development, encouraging both polluting and green enterprises. Green credit policy, which support environmental protection investments, have a significant impact on enterprise innovation. This paper explores the impact of green credit policies on the innovation performance, using data from the CSMAR and CNRDS databases. The study shows that green credit policies significantly improves innovation in both restricted and non-restricted enterprises, with those facing restrictions exhibiting better innovation quality. This study highlights that China's green credit policy not only promotes environmental investment but also facilitates economic restructuring and industrial transformation. Additionally, this paper uses a more novel index, "R&D expense profit margin," to assess enterprise innovation performance and guide the effective use of green credit policies.

Keywords: Green credit policy, Enterprise Innovation Performance, Innovation quality, Green finance

1. Introduction

As environmental problems become increasingly severe, the government is placing heightened emphasis on environmental protection and sustainable development. In line with this, the China Banking and Insurance Regulatory Commission (CBRC) has promoted the development of green credit within financial institutions, with the goal of fostering harmonious economic and environmental progress. This policy not only strengthens environmental risk management but also improves the social responsibility and brand image of banks, optimizes industrial structures, and improves the operational efficiency of financial institutions. Since its implementation, the green credit policy has led to significant progress, contributing to the growth of China's green credit market, which is now the most systematically developed segment within the green financial system. For enterprises, green credit provides low-cost financing and encourages environmental responsibility, while also fostering industrial upgrading and boosting innovation abilities. Previous studies on the impact of green credit policies on enterprise innovation often rely on patent applications as the solar indicator, which fails to fully reveal the quality and economic benefits of innovation. Therefore, this paper proposes using the index "R&D expense profit margin" as a more comprehensive measure of

innovation performance. This index not only reflects the innovation ability of enterprises but also effectively evaluates whether these innovations generate actual economic value. Through a parallel trend test, this paper analyzes how green credit policies impact the innovation performance of green credit restricted enterprises and non-restricted enterprises. Data from CSMAR and CNRDS databases provide empirical support for this study. The results aim to offer practical insights into how enterprises can better make use of green credit policies to enhance innovation and evaluate their development effectively. The structure of this paper is as follows: a literature review, method section, data analysis, and conclusions with policy recommendation.

2. Literature Review

2.1. Green Credit Policy

The green credit policy is designed to foster the growth of the green economy by encouraging advancements in environmental protection, energy conservation, clean energy, and related sectors. Its core goal is to facilitate the economic transition towards greener practices by relaxing financing conditions for businesses and projects that contribute positively to the environment, while simultaneously imposing strict limitations on financial support for polluting enterprises and projects [1]. Specifically, the measures adopted by the green credit policy include: establishing strict environmental access threshold, sharing environmental protection information, supporting enterprises with rectification plans to obtain credit, promoting the innovation of green financial products, and strengthening risk prevention and control [2]. Existing research shows that green credit policies can not only promote the innovation of environmental protection technologies through direct financial support, but also force polluting enterprises to carry out industrial transformation by raising their financing costs. Zhang and Lu believe that bank credit limits the capital source of enterprises by increasing the loan interest rates specifically for companies in polluting industries. This, in turn, influence both the R&D input and innovation output of these enterprises, ultimately affecting their overall innovation performance [3]. This view provides a theoretical basis for how green credit policies affect enterprise innovation through financial means. However, there is still a lack of in-depth discussion about the specific mechanisms of policy effects, especially differences among different types of firms.

2.2. Enterprise Innovation Performance

The measurement of enterprise innovation performance is the key to study enterprise innovation behavior, but the existing evaluation index has some limitations. Li and Liu pointed out that the number of patents of an enterprise can reflect its technological innovation ability to a certain extent. The greater the total number of patents, the stronger the technological innovation ability of the enterprise. The R & D expense profit margin index is different from other general enterprise performance evaluation system indicators, and is an important indicator for building enterprise innovation performance evaluation system [4]. However, some scholars have questioned the number of patents as an indicator of innovation performance. Chen argue that patent data is a poor indicator of innovation output. The increase in the number of patents does not necessarily mean the success of technological innovation, and many patents do not lead to actual commercial applications or economic benefits of the invention [5]. Therefore, using only the number of patents as a measure of innovation performance may ignore the quality of innovation and its actual value.

2.3. Influence of Green Credit Policy on Enterprise Innovation Performance

The existing literature on the impact of green credit policies on enterprise innovation performance mainly discusses from two aspects: one is to promote environmental transformation by directly stimulating green technological innovation in enterprises; and second, influencing corporate financing decisions through adjustments in environmental costs, which indirectly promote innovation activities.

To elaborate, green credit policies directly encourage companies to engage in green innovation and environmental transformation by integrating environmental performance into creditworthiness evaluations. Wu and Yin pointed out that different from previous credit policies, green credit policies take indicators such as pollution control and ecological protection of enterprises as critical criteria for assessing credit qualification. Therefore, firms with superior environmental performance have a higher likelihood of securing loans. This incentivizes industries characterized by "high pollution, high energy consumption, and excess capacity" (i.e., "two high and one high") to pursue green innovation and transformation more vigorously [6]. This policy mechanism not only enhances resource allocation efficiency but also contributes to the structural optimization of traditional industries to a certain extent.

Secondly, green credit policies indirectly affect the innovation behavior of companies by regulating financing costs. The active disclosure of corporate environmental information is considered to be an important means to reduce financing costs. Wu pointed out that the initiative of enterprises to disclose their own environmental information can reduce their financing costs, which provides more financial support for technological innovation of enterprises [7]. On the contrary, Su and Lian found that for high-polluting enterprises with poor environmental performance, green credit policies increase the difficulty of obtaining funds by raising the financing threshold and cost, thus forcing these enterprises to seek green innovation paths to alleviate financing constraints [8].

In addition, in the face of high environmental costs, green credit policies also encourage enterprises to achieve transformation and upgrading through green technology innovation. Xie and Zhang believe that enterprises must reduce environmental costs by means of green technology innovation under the promotion of policies, so as to improve their innovation performance [9]. Shu et al. further pointed out that the implementation of green credit policies can promote the performance of enterprises in green innovation, especially in terms of industry transformation and green technology upgrading [10].

Finally, in the specific implementation process of credit policy, different types of industries face different constraints and policy effects. For example, Wang pointed out through their research on the industries of listed companies that enterprises with environmental and social risks rated as Class A are the main targets of green credit policy restrictions. Specifically, Category A enterprises span across 9 sectors, such as nuclear power generation, hydropower generation, water conservancy, and inland port engineering, coal mining and processing, oil and natural gas extraction, iron ore mining, non-ferrous metal ore extraction, non-metallic mineral mining, and other related mining industries [11]. This classification not only provides a basis for the precise implementation of green credit, but also reflects the differentiated impact of the policy on the industry dimension.

In addition, some empirical studies have further verified the positive influence of green credit policies on enterprise innovation performance. For instance, Zhang and Lu employed a PSM-DID model to measure enterprise innovation performance through annual patent applications. Their findings indicated that the enforcement of green credit policies substantially enhances the innovation performance of state-owned and large-scale green credit restricted enterprises [3]. This shows that green credit policies not only serves as an incentive for environmentally friendly enterprises but also significantly affect the transformation of large-scale, traditional industries. Similarly, Liu and Hu

used the DID approach to examine the impact of green credit policies on the innovation performance of environmental protection enterprises, further validating that such policies contribute to improving the innovation performance of these enterprises. These enterprises can rely on green credit to accelerate innovation and transformation, and have achieved significant development results with policy support [12].

3. Methods

3.1. Sample Selection and Data Source

This paper selects all A-share listed companies in China from 2008 to 2016 as the initial sample. In order to improve the accuracy of the results, the following data screening procedures are applied: first, eliminate listed enterprises related to the financial and insurance industries; second, eliminate Special Treatment (ST) enterprises; third, exclude enterprises missing important financial data.

The research and development expenditure data is sourced from the CNRDS database, while net profit data is obtained from the CSMAR database. Using the parallel trend test, the sample is divided into two groups: the experimental group (green credit restricted enterprises) and the control group (green credit unrestricted enterprises).

3.2. Variable Definition

The independent variable is year. This variable is used to observe the changes in time dimension before and after the implementation of green credit policy. The dependent variable is the margin on R&D expenses. This variable measures the R&D efficiency of the firms (Inn). The formula for calculating this index is as follows: $Inn = R\&D \text{ expenditure} / \text{net profit}$. Control variable: The green credit policy issued in 2012 is used to classify enterprises into two types: those with restricted green credit and enterprises without restricted green credit. This classification helps distinguish the experimental group from the control group and serves as a basis for comparative analysis.

3.3. Experimental Process

This paper employs the parallel trend test method to examine whether the profit margin on R&D expenses of restricted enterprises (treatment group) and unrestricted enterprises (control group) follows the same trend before the implementation of green credit policy. This step is crucial to ensure that the two groups are comparable and supports the robustness of the results.

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( 1)  o._D_F4 = 0
( 2)  o._D_F3 = 0
( 3)  o._D_F2 = 0
( 4)  o._D_F1 = 0
      Constraint 1 dropped
      Constraint 2 dropped
      Constraint 3 dropped
      Constraint 4 dropped

      F( 0, 1236) = .
      Prob > F = .

RESULT: 'Parallel-trend' passed
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Figure 1: Result of Parallel Trend Test

After confirming the verification of parallel trends as shown in Figure 1, this paper proceeds to analyze the changes in the profit margin on R&D expenses of green credit restricted enterprises compared with non-restricted enterprises after the implementation of green credit policy in this next chapter. This will provide empirical support for the research hypothesis.

4. Results

As shown in Figure 2, prior to the implementation of the green credit policy in 2012, the innovation quality gap between the two types of enterprises was relatively small but showed fluctuations. Enterprises restricted by green credit exhibited better innovation quality compared to those without such restrictions. Green credit limits the profit margin on enterprises' research and development expenses to fluctuate between 0 and 0.5, that is, less research and development expenses can bring greater net profit, which can make enterprises better benefit. The profit margin on R&D expense of non-restricted enterprises with green credit fluctuates around 0.5~1, which is slightly inferior to the innovation quality of enterprises with green credit restriction. Even in 2008, the profit margin of R&D expense was greater than 1, and R&D expenditure was greater than net profit. In 2010, the innovation quality of both types of firms was basically equivalent.

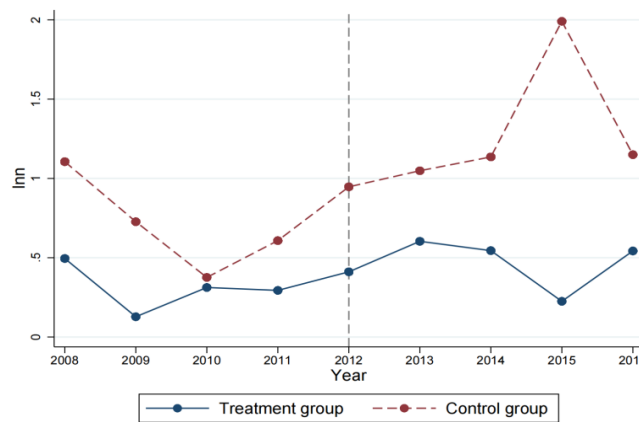


Figure 2: Trends of Innovation Quality in Two Groups Before and After the Implementation of Green Credit Policy (2012)

After the implementation of the green credit policy in 2012, the innovation quality of enterprises with green credit restriction was significantly better than that of enterprises without green credit restriction.

The profit margin on R&D expenses of green credit enterprises is greater than 1, that is, R&D expenditure is greater than net profit. It can be seen that although the non-restricted enterprises with green credit have obtained credit support, the innovation quality is not high at this time and can not bring good benefits to the enterprises. Although enterprises are restricted by credit, their overall innovation quality is only slightly lower than before the implementation of the green credit policy. It can be seen that the implementation of green credit policy still affects the innovation performance of two types of enterprises, namely innovation quality.

These findings highlight the pivotal role of green credit policies in enhancing enterprise innovation performance. For restricted enterprises, the policy effectively guided R&D investments towards higher-quality innovation, aligning with environmental and economic objectives. Non-restricted enterprises, however, need to better utilize the support provided by green credit to improve their innovation strategies and achieve sustainable development goals.

5. Conclusion

This study investigates the effects of China's 2012 green credit policies on the innovation quality of enterprises, both those subject to and exempt from green credit restrictions. The findings indicate that these policies significantly improve innovation performance, with restricted enterprises showing

notably higher innovation quality due to the policy's "forcing mechanism." The results highlight the importance of green credit in promoting sustainable development.

However, this study has limitations. The sample size is constrained by data availability, and the analysis relies on a single variable the profit margin of R&D expense to measure innovation performance. Future research should include broader metrics, such as the sources of R&D funding, and assess the role of policy-oriented investment and green credit.

To optimize green credit policies, the government should strengthen policy guidance, improve incentive mechanisms, and enhance oversight of financial institutions. The government can also strengthen the incentive mechanism, adopt fiscal subsidies, tax incentives and other means to encourage financial institutions to increase investment in green credit. Financial institutions need to upgrade their professional capacity, innovate align green credit services with real market demand., and enrich green credit products, such as green bonds, green funds, green insurance, etc., to meet the diversified green financing needs of enterprises and individuals. At the same time, financial institutions should actively explore the application of green credit in clean energy, energy conservation, emission reduction, ecological protection and other fields, promote the deep integration of green credit with the real economy, and help the green economic transformation. Additionally, fostering collaboration and information sharing among governments, banking, and enterprises will further promote green transformation and sustainable economic growth.

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