

Research on the Impact of Anhui Province's Green Credit Policy on Green Innovation of Heavy Polluting Enterprises

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Abstract: In 2012, the country issued the "Green Credit Guidelines" in order to restrict the loan scale of high polluting and high emission enterprises through financial means, and force enterprises to carry out environmental governance and achieve environmental protection. On the basis of theoretical analysis of the impact mechanism of green credit policies on corporate innovation, this article constructs a double difference model using data from manufacturing listed companies in the Shanghai and Shenzhen A-shares from 2007 to 2018, and conducts a series of robustness tests and heterogeneity analysis to examine the causal relationship between the two. On this basis, taking Anhui SIERTE Fertilizer Industry Co., Ltd. as a case study, further reveals the internal mechanism between the two.

Keywords: Green credit; Enterprise innovation; Rent seeking behavior; Anhui SIERTE Fertilizer Industry Co., Ltd.

1. Introduction

The report of the 20th National Congress of the Communist Party of China proposed the goal of comprehensively building a socialist modernized strong country, and the coordinated development of ecological protection and economic growth is an important path to achieve this goal. Green innovation in enterprises is an important driving force for the coordinated development of the environment and economy, and for achieving high-quality economic development. Green financial tools assist enterprises in green innovation, and green credit, as an important green financial tool, is the source of inspiration for enterprise green innovation and an important support for achieving green economic development. Green credit, as a key measure to guide the green allocation of credit resources, plays an important role in promoting green and low-carbon economic development and assisting enterprises in green innovation.

The existing research on green credit policies mainly focuses on the macroeconomic level, elaborating on the role of policies in economic development and their mechanism paths. At the micro level, it mainly reports on the impact on bank performance, and a few studies that focus on the enterprise level also explore the impact on corporate financial performance or credit allocation. In fact, exploring the relationship between green credit policies and corporate innovation has strong theoretical significance: firstly, it helps to further consider the conditions for the establishment of the Porter hypothesis from the perspective of financial means; Secondly, it can make up for the shortcomings of current micro level research on green credit policies; Once again, we can start with the productive decision-making of enterprises and deepen the economic evaluation of green credit policies. At the same time, it also has practical significance: firstly, it can provide theoretical support for designing refined green credit policies that promote the coordinated development of enterprise innovation and ecological environment, assist in

the healthy development of green credit, and play the role that policies should have; Secondly, it is conducive to enhancing the innovation willingness of enterprises, and exerting the positive role of innovation in their sustainable operation and winning market competition; Finally, provide a solid scientific basis for China to more effectively achieve "Beautiful China".

2. Literature Review

2.1. Research on the Implementation Effect of Green Credit Policy

Most research on green credit policies focuses on their implementation effects, which can be roughly divided into two levels: micro and macro. At the micro level, Liu Yiwen et al. (2022) found through a continuous double difference model that green credit policies significantly improve the quality of environmental information disclosure for restricted enterprises, and the promotion effect is positively regulated by the development level of regional green finance and the supervision system. Zhang Chaolin and Liu Fenggen (2023) studied the micro effects of green credit policies from the perspective of enterprise R&D investment, and found that green credit policies have a significant inhibitory effect on R&D investment in heavily polluting enterprises, and this inhibitory effect exists for a long time; However, whether in the short or long term, green credit policies have not significantly promoted R&D investment by green enterprises.

2.2. Analysis of Factors Influencing Green Innovation in Enterprises

The research on the influencing factors of green innovation in enterprises mainly includes internal and external factors. From the perspective of internal factors within enterprises, Yu Wei and Guo Xiaoyi (2023) empirically tested the relationship between managers' intrinsic shortsightedness and green innovation in A-share listed companies in China's

heavy pollution industry from 2008 to 2020. The results showed that managers' shortsightedness suppressed green innovation in enterprises. Qi Liyun et al. (2023) used panel data from 927 manufacturing listed companies in A-shares from 2016 to 2020 as a sample to explore the impact of executive team heterogeneity on corporate green innovation performance. The study showed that executive team tenure heterogeneity has a significant positive impact on green management innovation.

2.3. Research on the Relationship between Green Credit Policy and Enterprise Green Innovation

The existing research results on green credit policies and corporate green innovation can be divided into two perspectives: one perspective believes that green credit policies stimulate corporate green innovation behavior by reducing industry green agency costs and improving green investment efficiency. Another view is that green credit policies affect external financing of enterprises, thereby inhibiting their innovation output. This viewpoint is mainly influenced by the cost theory, which suggests that green credit policies restrict credit resources of heavily polluting enterprises by reducing credit scale and increasing credit costs, thereby reducing green R&D investment and inhibiting green innovation.

3. Theoretical Mechanism Analysis and Research Hypotheses

In fact, under the financing constraints of green credit policies, enterprises can alleviate financing difficulties through innovative and productive activities to achieve sustainable development, while also maintaining daily operations through rent-seeking and other means. However, under the current political system in our country, the problem of paper-based environmental regulations is still very obvious. Enterprises often take strategic actions to obtain a large amount of public resources controlled by the government through non productive activities such as rent-seeking. Therefore, when faced with financing constraints, enterprises usually do not passively accept them, but instead take measures outside of the informal system to alleviate the pressure brought about by environmental regulations, and credit can significantly reduce the innovation motivation of enterprises. Due to the fact that the cost of rent-seeking for enterprises is not very high, while innovation is the opposite, it leads to a greater net profit for enterprises engaged in non productive activities. In order to pursue maximum benefits, after the implementation of green credit policies, enterprises will make choices on the basis of balancing costs and benefits. When the net benefits obtained through rent-seeking are higher than those obtained through innovation, the rational decision of enterprises is often rent-seeking rather than innovation. It can be seen that in the current situation where paper-based environmental control is very obvious in China, the Porter hypothesis may not be able to hold true. There is literature confirming that the current implementation of green credit policies is not effective, and banks have not played a role in financial regulation.

Based on the above analysis, this article proposes a comprehensive research hypothesis:

H₀: When other conditions remain unchanged, green credit policies will have a negative impact on the innovation of

heavily polluting enterprises in Anhui Province.

4. Research Design

4.1. Quantitative research design

4.1.1. Model settings

Although the Green Credit Guidelines are uniformly implemented at the national level, differential credit is implemented for heavily polluting enterprises and non heavily polluting enterprises, which limits the loan scale of highly polluting enterprises and increases loan interest rates, guiding more credit funds to flow into green production enterprises. Based on this, referring to the research method of Lu Jingetal. (2021), the traditional double difference model is extended by using "heavily polluting enterprises" as the treatment group and "non heavily polluting enterprises" as the reference group. The causal impact of changes in corporate credit scale after policy implementation on corporate innovation ability is evaluated through the dual differences between heavily polluting enterprises and non heavily polluting enterprises, as well as before and after policy implementation, effectively overcoming the endogeneity problems that may exist in the model. The model is constructed as follows:

$$\ln APL_{it} = \beta_0 + \beta_1 treat_i \times post_t + \sum_{i=1}^j \omega_i Control_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

In model (1), lnAPL represents the innovation capability of enterprise i in year t, measured by the patent applications of the enterprise over the years. Treat is an individual dummy variable, assigned a value of 1 if the enterprise belongs to a heavily polluting enterprise, otherwise 0; Post is a time dummy variable. If the sample time is after 2012, it is assigned a value of 1, otherwise it is 0; Control is a control variable.

4.1.2. Data sources

Considering that manufacturing enterprises are more sensitive to the impact of credit allocation in order to carry out production, and most of them are polluting enterprises with severe pollution, this article selects the manufacturing industry as the research sample. Meanwhile, due to the promulgation of the new Enterprise Accounting Standards in 2007, this article takes 2007 as the starting year for the sample. On this basis, manufacturing companies listed on the Shanghai and Shenzhen A-shares from 2007 to 2018 were selected as the initial sample, excluding ST and * ST enterprises and samples with missing data. Finally, 10998 observations were obtained. The data mainly comes from the Guotai An database.

4.1.3. Variable selection and description

Enterprise innovation is the dependent variable in this article, measured by invention patents (lnAPL). Enterprise innovation can be divided into breakthrough innovation and incremental innovation. Breakthrough innovation refers to breaking through existing technological bottlenecks, manufacturing new products, and achieving a high level of innovation; Progressive innovation, on the other hand, is only a modification of the original foundation, with a relatively low level of innovation. This article draws on Henderson's (1990) measurement method and uses invention patents to represent a company's innovation level, which better reflects the company's substantive innovation capability.

Table 1. Definition of main variables and descriptive statistics of samples

Category	Variable	Reference group	Mean value	Processing Group	Mean value	T-test
Independent variable	Number of invention patents applied for(lnAPL)	7821	1.281	3177	1.025	0.256***
Enterprise level control variables	Asset liability ratio(Lev)	7821	0.429	3177	0.405	0.024***
	Sales growth rate(Growth)	7821	0.200	3177	0.170	0.030***
	Equity concentration(Top1)	7821	0.107	3177	0.109	-0.002
	Board size(Cop)	7821	14.00	3177	14.23	-0.237***
	Potential external financing needs of enterprises(Enal)	7821	0.192	3177	0.268	-0.076
Provincial level control variables	Per capita GDP of each province(lnGDP)	7821	10.91	3177	11.03	-0.121***
	The proportion of the secondary industry to GDP(Secd)	7821	45.51	3177	43.84	1.667***
Industry level control variables	Industry concentration level(HHI)	7821	21.30	3177	21.70	-0.339***

4.2. Qualitative research design

4.2.1. Case selection criteria

This article follows the principle of typicality in case selection. It is believed that compared to other enterprises, studying the impact of green credit policies on the innovation of heavily polluting enterprises is more typical. Therefore, this article selects Anhui SIERTE Fertilizer Industry Co., Ltd. (hereinafter referred to as "SIERTE") as the case. The chemical industry to which Si'er Te belongs is a heavily polluting industry as stipulated in the Environmental Protection Administration of China's document [2003] No. 101. In 2017, the environmental protection department of the People's Government of Ningguo City defined Si'er Te as a key polluting enterprise in accordance with the "Measures for Environmental Information Disclosure of Enterprises and Institutions". The main pollutants are sulfur dioxide and wastewater discharged directly from chimneys, with a total of 6 discharge outlets and a total discharge of over 150 tons.

Firstly, as a typical manufacturing enterprise, Silt has a high demand for funds and is closely related to bank credit during its development process. Due to the company's predecessor being the Ningguo Agricultural Materials Institute, which received high attention from the local government, the credit financing activities based on innovation willingness were carried out relatively smoothly in the early stage. In 1997, with the support of rural credit cooperatives in Ningguo City, Silt solved the problem of high start-up costs at the beginning of construction. In order to pursue personal development, we aim to imitate and innovate with advanced enterprises in the same industry, and hire overseas technical personnel for operational guidance. However, long-term imitation and reliance on other people's technology put Silt in a passive position. Therefore, in 2007, it began to cooperate with several famous universities in industry, academia, and research to accumulate strength for achieving its own independent innovation. Subsequently, the achievements quickly emerged and fully blossomed in technology, management, and product innovation. In 2010, it became an innovative advanced enterprise in Anhui Province.

Secondly, after the implementation of the policy, due to the considerable economic benefits in the early stage, Deslute blindly expanded its production capacity, resulting in a decrease in environmental benefits. Local banks raised the environmental access threshold to restrict loans to Deslute in response to the policy. In order to alleviate financing constraints, Silt utilized the deep political background of its

executives to establish political and banking connections for a series of informal institutional financing, such as bribing multiple officials such as the local deputy mayor (case number: 2017 Wan 1825 Xing Chu 24). The investigation of these cases provides excellent materials for further revealing the concealment of rent-seeking behavior in this article. Rent seeking has triggered a series of excessive investment behaviors, which have squeezed out innovation investment from enterprises. Compared to before the policy implementation, the amount of R&D investment by enterprises has decreased by more than ten million yuan, and the quantity and quality of innovation have significantly decreased.

Finally, in order to have a more intuitive understanding of the comparative differences in the impact of green credit policies on corporate innovation before and after implementation, enterprises with relatively small differences in the number of years before and after the policy were selected as cases. It has been nearly a decade since the implementation of the green credit policy in 2012, and prior to this, Silt has also been developing for ten years. Therefore, it is possible to accurately explore the impact of green credit policies on corporate innovation.

Based on the above analysis, this article believes that selecting Silt as a case study can accurately explore the impact of green credit policies on corporate innovation, providing reference for the improvement of green credit policies and the innovative development of enterprises.

4.2.2. Case data source

This study mainly integrates first-hand and second-hand data to gain a deeper understanding of the specific situation of Silt's green credit policy and corporate innovation. The first-hand information mainly includes informal interviews with sales personnel at fertilizer stations, retired and working relatives of the author of this article, and credit bank staff; Second hand materials mainly include compilation materials, publicity materials and materials obtained from other public information retrieval using a variety of Internet tools. The data collected in this article and the information obtained from informal interviews will form evidence to ensure the authenticity and accuracy of the information.

4.2.3. Data processing instructions

The mutual verification between primary and secondary data can provide a more comprehensive and authentic interpretation for this study. The data studied in this article is explained as follows:

Firstly, analyze the changes in credit allocation and innovation performance of the case enterprise before and after the implementation of green credit policies, and draw preliminary conclusions. Subsequently, the process of enterprise innovation and the sources and allocation of credit in each process were divided into stages, and the innovative behavior and effects reflected in the process were explained and an evidence table was formed, attempting to uncover the mechanism by which green credit policies affect enterprise innovation, and to summarize and explore the impact path. Finally, the informal interview results and Internet materials are sorted out to improve the theoretical explanation. Through repeated comparisons between information, data, and events, this article finds that due to the influence of green credit policies, the process of enterprise innovation change is very clear, which can be summarized as the implementation of green credit, changes in credit fund allocation, and continuous development of innovation vitality gradually decreasing.

5. Quantitative Result Analysis

On the basis of reporting the regression results, this section conducts parallel trend testing and dynamic effect analysis, and conducts a series of robustness tests.

5.1. Benchmark regression results

The regression results of the impact of green credit policy

Table 2. The Benchmark Regression of Green Credit's Impact on Enterprise Innovation

	(1)	(2)	(3)	(4)
<i>GCP</i>	-0.2260*** (0.0618)	-0.1671** (0.0650)	-0.1727*** (0.0559)	-0.1378** (0.0659)
<i>Cons</i>	0.7006*** (0.0455)	-3.9164 (2.6948)	-4.5395 (3.0588)	0.1115 (0.1102)
<i>Firm Control</i>	NO	YES	NO	YES
<i>Province Control</i>	NO	YES	NO	YES
<i>Industry Control</i>	NO	YES	NO	YES
<i>Year Fixed Effects</i>	YES	YES	YES	YES
<i>Firm Fixed Effects</i>	YES	YES	NO	NO
<i>Province Fixed Effects</i>	NO	NO	YES	YES
<i>Industry Fixed Effects</i>	NO	NO	YES	YES
<i>N</i>	10998	10998	10998	10998
<i>Adj-R²</i>	0.7035	0.7053	0.6916	0.7119
<i>F</i>	20.5882	10.1571	41.7447	9.1829

5.2. Parallel trend test

The use of the double difference method needs to satisfy the parallel trend assumption, that is, before the implementation of green credit policies, the innovation trends of heavily polluting enterprises and non heavily polluting enterprises have consistency. This article draws inspiration from Jacobson et al. (1993) and Lietal The research framework of (2016) adopts the Event Study method to test the parallel trends before the impact of green credit. The final estimated results of the parallel trend test are shown in Figure 4. Observing Figure 4, it can be observed that before the implementation of green credit (L0), interaction term $treat_i \times post_t$ had no statistically significant impact on the innovation level of lnAPL in enterprises. It can be seen that before the implementation of green credit, there was no significant difference in the innovation level between heavily polluting enterprises and non heavily polluting enterprises, and the parallel trend hypothesis was verified. With the continuous implementation of policies, the impact of green

on corporate innovation are shown in columns 1-4 of Table 3. The first column represents the control for firm and inter fixed effects, and the results show that green credit policy has a negative impact on corporate innovation at the 1% level. The second column added control variables on top of the first column, and the result still holds. The third column controls for the fixed effects of provincial industries and time, and the results are still significantly negative at the 1% level. The fourth column adds control variables on the basis of the third column, and the results show a negative and significant impact coefficient of -0.1378 at the 5% level. Specifically, the implementation of green credit policies will reduce the innovation level of enterprises by 13.78%. This means that the implementation of green credit policies will indeed reduce the innovation investment of enterprises, and the inhibitory effect is very significant, which verifies the hypothesis. This result is contrary to the research conclusion of Liu Qiang (2020), who believes that the green credit policy confirms the Porter hypothesis. However, the current paper-based environmental regulations in our country are quite serious. When facing environmental regulations, enterprises will seek help from the government and banks to obtain resources, leading to rent-seeking behavior and causing the failure of the Porter hypothesis. The above viewpoint will be validated in parallel trend testing and dynamic effect analysis.

credit policies has remained at a negative level, indicating that the policies have not yet achieved the expected results.

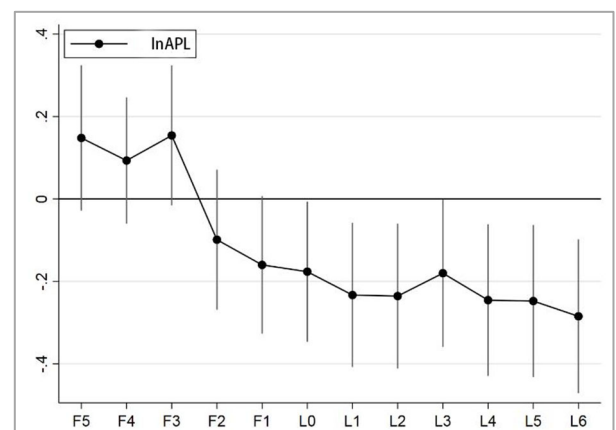


Figure 1. Parallel trend test

5.3. Placebo test

It is worth considering whether the impact of green credit policies on corporate innovation is disrupted by other unobservable factors? In this regard, this article constructs a series of counterfactual frameworks to perform placebo tests on the benchmark regression results. If the inhibition of corporate innovation capability is also observed under the hypothetical policy treatment, it indicates that the inhibitory effect of corporate innovation capability may originate from other unobservable systemic factors, rather than the influence of green credit policies.

Firstly, randomly assign a processing group and a reference group. This article uses Bootstrap technology to randomly process groups and reference groups for each enterprise, and repeat regression 500 times according to model (1). According to the statistical analysis of the regression results (Figure 7), it was found that the t-value of the impact coefficient of green credit policy on enterprise innovation lnAPL follows an approximate normal distribution, mostly concentrated around 0, and rarely distributed around ± 3 and ± 4 . This indicates that in the random 500 experiments, the proportion of the regression coefficient of the constructed false green credit policy on enterprise innovation lnAPL is significantly positive and significantly negative is small, which is a small probability event. The false processing effect of green credit policy implementation does not exist.

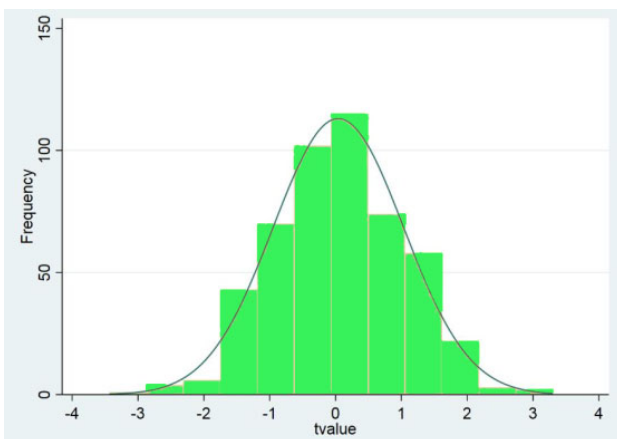


Figure 2. Placebo test results

Secondly, this article constructs a false implementation time for green credit policies, advancing the implementation time by 1-2 years. A false time dummy variable PRE-1-2 is constructed, and regression estimation is performed based on the benchmark model (1). The estimation results are shown in columns 1-2 of Table 4, and the impact of PRE-1-2 on corporate innovation is not statistically significant. This indicates that except for the actual year of implementation of green credit policies, advancing the implementation time by 1-2 years will not have a significant negative impact on corporate innovation.

Based on the above results, it can be confirmed that the negative and significant impact of green credit policies on corporate innovation is not due to other unobservable factors. The benchmark regression results have strong robustness, and the research hypothesis H_0 is further validated.

6. Case Result Analysis

6.1. Case Description: Dynamic Analysis of Enterprise Innovation Behavior from the Perspective of Credit Allocation

Considering that there are differences in the decision-making willingness of companies at different resource levels, this article distinguishes the impact process of green credit policies on Syt's innovation ability as follows: before and after policy implementation. The main manifestations of each stage are as follows:

(1) Before the implementation of the policy, the case enterprises had a good momentum of technological innovation due to their high willingness to innovate, sufficient credit funds, and free allocation. Firstly, imitate the innovation of advanced enterprises in the same industry, and then engage in industry university research cooperation to accumulate innovation capital, in order to achieve independent innovation.

(2) The case enterprise has already experienced a decline in environmental benefits after development. After the implementation of policies, financing is constrained, and production capacity must be reduced according to national regulations. Therefore, environmental uncertainty and resource constraints are also affected. In order to alleviate financing constraints, frequent rent-seeking behaviors such as bribery have emerged, resulting in rent-seeking costs, excessive investment problems, crowding out research and development investment, and inhibiting corporate innovation.

Phase 1: Before Policy Implementation (1997-2011)

The innovation process in this stage is closely related to the support of local banking and other financial institutions. The experience of Silt in this stage is distilled into the following key events (A1-A3): A1: Imitation stage. At the beginning of construction in 1997, combined with the background of agricultural modernization and the experience of domestic and foreign advanced fertilizer enterprises, technical leaders from Sinochem Fertilizer and Norwegian Hydro Co., Ltd. were hired to provide technical guidance to the company, and technical loans were provided by the local rural credit cooperative society; A2: Accumulated their own innovation capabilities, signed a "Research Cooperation Agreement" with China Agricultural University in 2005 to strengthen industry university research cooperation and exchange. In the same year, the Anhui Branch of the Agricultural Development Bank of China announced credit support to SIERT; A3: Innovative achievements have emerged, with significant improvements in both quantity and quality, and a comprehensive flowering in technology, management, and products. After the cooperation with Agricultural University of China and the accumulation of corresponding innovation, the innovation ability of enterprises has been substantially improved after 2008, and these achievements have received corresponding financing support. In terms of technology, during the construction of the Xuancheng City project in 2008, we independently designed and installed waste heat power generation equipment, and China Construction Bank Xuancheng Branch provided a loan of 18 million yuan. In terms of management, in 2010, various independently developed agricultural assistance information systems were launched to provide scientific agricultural technology services to farmers nationwide, and were granted credit by the Agricultural Bank of China. In terms of total product

innovation, in 2010, innovative products were launched for three consecutive years and sold well at the Anhui Agricultural Expo. Recommended by distributors, Guoyuan Securities announced a financing of 500 million yuan for its new product technology research and development.

(1) Technical imitation stage. China has always attached great importance to agricultural development and is also a major user of fertilizers. The market prospects for fertilizer products are broad. Prior to policy implementation, the case company worked hard to imitate product technology from establishment to listing, attempting to gain market share and receiving strong support from local banks and other financial institutions. Based on its own experience and feedback from distributors and farmers, SIERT continuously improves its products to meet the needs of agricultural production, and gains competitive advantages through product diversification. (A1)

(2) Expansion stage of industry, academia, and research. But imitation technology is about following rather than leading, let alone surpassing. Due to relying on the technology of others, Silt has always been in a passive situation and difficult to achieve significant development. If we want to transition from introducing and digesting technology to secondary innovation and independent innovation, and cross over to technology reserves and outputs, we must take the path of "open independent integrated innovation". However, innovation involves a wide range of fields and is difficult to achieve solely through internal resources. Therefore, Silt has started to strengthen cooperation and exchange with universities through industry, academia, and research, promoting technological innovation in enterprises. (A2)

(3) Stage of demonstrating innovative achievements. The combination of industry, academia, and research has accumulated innovative capital and conditions for SIERT. Through cooperation with universities and corresponding innovation accumulation, SIERT is actively responding to the call for energy conservation and emission reduction, striving to innovate production processes and win environmental benefits without reducing economic benefits. Director Jin sighed, "Energy conservation and emission reduction cannot rely solely on government supervision. Enterprises should be conscious and have this social responsibility to do a good job in energy conservation and emission reduction. If operating enterprises do not have this awareness, it is difficult to go far." In 2008, SIERTE invested 340 million yuan to build a national key "dual high and one excellent" 400000 ton/year sulfur-based NPK compound fertilizer project in Xuancheng City. (A3)

Seeing the achievements of technological innovation, Silt's innovation momentum is even stronger. In terms of management innovation, in 2010, we independently developed various information systems to provide scientific agricultural technology services to farmers nationwide, and were awarded as an innovative enterprise in Anhui Province. Mr. Zhang, who provides technical support services to farmers, said, "Food also needs to eat, and promoting the development of the fertilizer industry can sustain the development of agriculture, rural areas, and farmers... SIERT

has written serving farmers into its corporate culture, paying attention to the needs of farmers nationwide, and independently developed an information system to provide scientific agricultural technology services to farmers nationwide... Our special agricultural technology service personnel can check the land situation and crop growth in real time. As long as they receive feedback from farmers in the system, they can rush to the fields as quickly as possible, impart knowledge hand in hand, guide farmers to use fertilizers reasonably, and periodically send new scientific planting and fertilization knowledge to the farmland, receiving widespread praise from farmers and enterprises." (A3)

These preparations have further opened up sales channels for SIERT's fertilizer products. At the 2011 Anhui Agricultural Expo, SIERT showcased its innovative products - soil conditioners and organic fertilizers, which received widespread attention. This has been the third consecutive year that SIERT has launched new fertilizer products on the Agricultural Expo platform. Table 7 shows the new products added by SIERT from 2009 to 2011. In order to maintain a good momentum, in 2011, SIERTE sought help from the Ningguo Branch of Guoyuan Securities and successfully raised 500 million yuan for product production and technological innovation. In the same year, they successively held a "High yield and Efficient Soil Testing Formula Fertilization Technology Training Conference", established the "China Agricultural University SIERTE Soil Testing Formula Fertilization Research Base", and won the honorary title of "Best Cooperative Manufacturer of Chinese Agricultural Materials Distributors in 2011". (A3)

From the innovation situation of the case enterprise in this stage, it can be seen that the enterprise is in an upward trend, requiring a large amount of investment in research and development and construction, and a high demand for credit. However, due to the excellent business performance of the enterprise, local financial institutions have provided sufficient credit services. For example, "Si Er Te Hui is the pride of Ningguo and even Anhui, and there is no reason why rural credit cooperatives do not support agricultural development" (A1); For enterprises like Silt, conducting bank enterprise cooperation can achieve win-win results and play an indispensable role in promoting regional economic development (A2); The financial industry and local enterprises share the common goal of sustainable development, and investing in waste heat power generation equipment meets the requirements of environmentally friendly strategies (A3).

Table 8 below summarizes the innovative behavior and credit fund allocation status of Silt before policy implementation. Overall, in this stage, the case companies experienced a transformation from imitation tracking innovation to collaborative innovation, and then to independent innovation due to sufficient credit funds. From the perspective of the relationship between green credit policies and corporate innovation, there is no financing constraint at this stage. While enterprises invest in research and development, they have the freedom to allocate credit funds and achieve significant innovation results.

Table 3. The allocation of corporate credit funds and corporate innovation before policy implementation

A1	Tracking imitation	Technical Director of Norwegian Hydro (Far East) Limited Ren Lisun came to the company for inspection.	In the early days of its establishment, it received strong support from Ningguo Rural Credit Cooperative Union (now known as Wannan Rural Commercial Bank)
A2	Industry university research cooperation	① In 2007, we collaborated with Hefei University of Technology to establish a fertilizer technology research center;	In 2007, the Anhui Branch of the Agricultural Development Bank of China announced credit support to SIERTE
		② In 2009, it was recognized as a joint demonstration enterprise of industry, academia and research in Anhui Province	
A3	Innovation in production process	In 2008, during the construction of the project, the waste heat generated by sulfuric acid was utilized for power generation, and waste heat power generation equipment was designed and installed to save energy consumption.	New loans from China Construction Bank Xuancheng Branch 828 million yuan for regional economic and technological investment, including Silt
	Management Innovation	① In 2010, it was rated as an innovative enterprise in Anhui Province	Close cooperation with Agricultural Bank of China
		② Independently developed information system	
Product Innovation	The product sold well at the Anhui Agricultural Expo and was recognized by distributors. In 2011, a new type of compound fertilizer product was launched for three consecutive years, with an increase in the number of valid patents.	Guoyuan Securities Co., Ltd. has raised a total of 500 million yuan for SIERTE	

Phase 2: Policy Implementation and Beyond (2012-2020)

In 2012, due to policy changes and development bottlenecks, enterprise innovation began to shrink and the quality of innovation declined. In this stage, the following key events (B1-B3) occurred in the case enterprise. B1: Two years before the implementation of the green credit policy from 2012 to 2013, the Environmental Supervision Detachment of Xuancheng City received reports that Si'er Te was suspected of discharging sewage into the Shuiyang River. The local banks have already welcomed the policy of increasing environmental access thresholds, and after receiving signals, they have started to restrict the use of Silt loans. The financing constraints for enterprises have become tighter, and the amount of short-term and long-term loans has decreased, leading to a decrease in research and development investment; B2: When a company engages in rent-seeking behavior, first Director Jin bribed Vice Mayor of Ningguo City, Liu Chuangxin, for a period of four years, and then established connections with local banks through political connections to obtain credit; B3: Rent seeking behavior has led to excessive investment by enterprises, and has invested in a large number of short-term projects such as sand mines, hotels, and tourist resorts, further squeezing out innovative investment from enterprises.

(1) Trapped in the quagmire of financing constraints. Due to excessive research and development of new products in the early stage, product sales have increased significantly. However, the expansion of production capacity by enterprises has neglected the maintenance of environmental benefits, which has brought many environmental problems to the production process of fertilizer products. In addition, with the introduction of the green credit policy in 2012, local banks have raised the environmental access threshold, and have received negative news signals, which have led to stricter restrictions on Silt loans. Credit allocation has become more difficult, and the amount of long-term and short-term loans for enterprises has decreased, leading to a decrease in research and development investment.(B1)

(2) Relieve financing constraints through rent-seeking.

However, as a local pillar enterprise and facing performance pressure from investors after just going public, Silt did not passively accept the current situation. Instead, it triggered a series of informal institutional financing to alleviate constraints and stimulate rent-seeking behavior, resulting in the failure of green credit policies in the case enterprise. This article learned from relevant information that before the establishment of the factory, Mr. Jin, a director of SIERT, held positions such as the Director of Personnel Department of Ningguo Port Mining Area Commercial Bureau and the Director of Ningguo Supply and Marketing Society. I and several senior executives of the company have a deep political background, and it seems not difficult to establish connections with the government.(B2)

6.2. Analysis of the Mechanism of the Impact of Silt's Green Credit Policy on Enterprise Innovation

In the first stage of policy implementation, we clearly found that enterprises need corresponding credit funds for innovation. Because these financing are based on innovation, and the credit funds obtained from innovative projects often have a supervisory role, it promotes the development of enterprise decision-making towards innovation.

When the second stage of policy implementation generates financing constraints, enterprises establish informal institutional financing through political and banking connections in order to alleviate these constraints. In fact, the downfall of officials such as Liu Chuangxin in 2017 provided corresponding evidence for further research on rent-seeking behavior in enterprises. Renting itself is covert, and we have proven its authenticity through public disclosure.

Through case analysis, we have discovered the existence of rent-seeking costs. However, due to the strong hidden effects of rent-seeking, even if the case has already occurred and the responsible parties have been sentenced, it is difficult for us to reveal the true amount of rent-seeking. So from the surface, there is indeed a corresponding rent-seeking phenomenon in the case analysis. Although the total amount we can obtain is

not high, it helps this article to further analyze other cases arising from rent-seeking.

This article believes that the bank affiliation of Syt is based on political affiliation. When applying for bank loans, due to the strong political background of the senior management, they can first provide implicit government guarantees to convey a good reputation signal to the outside world. Secondly, it facilitates enterprises to directly intervene in bank credit decisions through government intervention, making it easier for enterprises to obtain long-term loans and credit. From the previous text, it can be seen that after Wang Chuanzhou was bribed, he provided a credit project investment of 1.88 million yuan to Si Erte. Due to the convenience of political connections, Si Erte can also easily obtain credit funds. Moreover, due to being one of the few listed companies in the local area, although the efficiency has declined after the policy implementation, it is still valued by the local banking industry.

From this, it can be seen that after the implementation of the green credit policy, the case enterprise established political and banking connections. From the media's disclosure of the bribery situation and confession records of the fallen officials, it can be seen that even if the rent-seeking behavior is covert, this article cannot obtain the true amount, but the rent-seeking costs caused by it are obvious.

7. Conclusions and Suggestions

7.1. Conclusions

The overcapacity brought about by China's long-term high-speed growth and the blind expansion of high energy consumption, high pollution, and high emission enterprises have caused serious environmental pollution. In the context of advocating the implementation of the innovation driven high-quality development strategy, it is worth pondering how to transform from "winning by quantity" to "high-quality" development. In 2012, the China Banking Regulatory Commission issued the Green Credit Guidelines, which serve as a financial regulatory tool to encourage sustainable development of enterprises and are profoundly influencing their green business decision-making and innovative behavior. Innovation is a powerful support for the sustainable operation of enterprises and an important guarantee for high-quality economic development.

This article uses the double difference method to construct a DID model. By comparing the innovation situation of heavily polluting enterprises and non heavily polluting enterprises under green credit policies, it is concluded that green credit policies significantly inhibit the innovation ability of enterprises. After a series of robustness tests and placebo tests, this result is still valid; The implementation of the Green Credit Guidelines has a more significant inhibitory effect on non-state-owned enterprises, small enterprises, and capital intensive enterprises.

The conclusion we found through the first stage of case study is that in order for enterprises to establish themselves in the product market, they must have sufficient innovation willingness in order to better promote their own development. It will be easier to obtain financing based on the intention of innovation itself, as banks are willing to provide corresponding financial support for enterprises with development potential.

However, due to the constraints of policies and the decline in their own environmental benefits, it is difficult for

enterprises to obtain funds in the later stage, which has led to rent-seeking among enterprises, resulting in rent-seeking costs and excessive investment caused by rent-seeking behavior, squeezing out investment in innovation.

7.2. Suggestions

For enterprises, based on their own development, they need to seek financing through innovation. Even if cash flow can be obtained through informal financing methods, losing the source of innovation can lead to chaotic fund allocation, which is not conducive to long-term development; We must firmly believe in taking the path of green development, allocate funds reasonably, and actively build a full process green industry chain from financing, production to products, from treating three wastes to purchasing and transforming environmental protection equipment and improving production processes. Put one's environmental responsibility into practice.

The government should strengthen the regulation of green credit policies and impose greater penalties accordingly; Relevant departments should establish a green information sharing platform as soon as possible, encourage the development of green enterprises such as new energy, restrict the blind expansion of heavily polluting enterprises, and provide clear directions for financial institutions to invest funds; Financial regulatory authorities should adapt to local conditions, strengthen supervision of financial institutions, introduce supporting incentive policies and measures, further play the positive role of green credit, and encourage banks to develop green finance.

Acknowledgment

This study was supported by the Anhui University of Finance and Economics College Student Research Innovation Fund Project (XSKY23090).

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