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The Effect of Green Credit on Enterprises' Green Transformation under Sustainable Development: Evidence from Green Innovation in High-Pollution Enterprises in China

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Abstract: How to help enterprises reduce pollution and transform into environmentally friendly enterprises through financial channels is an important issue that needs to be urgently addressed. This study constructs a quasi-natural experiment based on the implementation of the 2012 Green Credit Guidelines and evaluates the impact of green credit policy on green transformation in high-pollution enterprises from the aspect of green innovation. The research results found the following: (1) After the implementation of green credit policy, the quantity and quality of green innovation in high-pollution enterprises have significantly improved. (2) To avoid the inaccuracy of research conclusions caused by differences in sample characteristics, this study used the PSM-DID model to verify the promoting effect of green credit policy on the green transformation of high-pollution enterprises. (3) Furthermore, this study analyzed the impact of differences in the ownership nature of enterprises and regional financial development levels on the green transformation of high-pollution enterprises under green credit policy. The results show that green credit policy has a stronger impact on the green innovation of state-owned high-pollution enterprises and high-pollution enterprises in underdeveloped financial areas. The findings of this study provide an important reference for the reform of green finance of government departments.

Keywords: green credit policy; green innovation; pollution reduction

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1. Introduction

Since the reform and opening up, China's economy has achieved rapid development and become the world's second largest economy, which had an important impact on the development of the world economy. However, the ecological environment is increasingly damaged, the air quality and natural environment that people rely on for survival have been severely damaged, and ecological problems such as energy depletion and environmental degradation are becoming increasingly prominent. In the face of the realistic constraints of environmental protection and sustainable economic development, it has become the consensus of policy departments to promote green economic development, upgrade the industrial structure, and achieve healthy and sustainable development. The report of the 19th National Congress of the Communist Party of China proposed to build the modernization of harmonious coexistence between humans and nature. The past development experience of China has shown that relying solely on strict terminal governance cannot continuously and effectively improve environmental quality.

To achieve economic development that balances the ecological environment of "green water and green mountains", financial policies play an important role that cannot be ignored [1–3]. In order to effectively form an economic development model of green

development, low-carbon development, and sustainable development, guide enterprises to spontaneously participate in ecological environment protection, vigorously enhance green technology innovation, and promote green upgrading of heavily polluting enterprises, the China Banking Regulatory Commission issued the Green Credit Guidelines in 2012, marking the official adoption of financial means by the Chinese government to promote green economic development. The core idea is to institutionalize and bind green finance policy with enterprises' environmental performance.

The concept of green finance originated internationally, and foreign scholars were the first to propose concepts such as "sustainable finance" and "environmental finance" [4]. Salazar (1998) defines environmental finance as a financial innovation activity carried out by the financial sector to meet environmental requirements [5]. Labatt and White (2002) believe that environmental finance is a financing tool developed by financial institutions to promote environmental protection [6]. Specifically, green credit policy can constrain financial institutions to reduce their financial support for pollution projects. Normally, the implementation of green credit policies strengthens financing constraints on heavily polluting enterprises, increases their financing costs, and thus affects their economic activities. In addition, the Porter hypothesis suggests that companies facing stronger environmental regulations will enhance their innovation intensity, and environmental regulations will force heavily polluting enterprises to increase green innovation investment and promote technological innovation to reduce pollution emissions [7]. Guan et al. (2022) used a nonlinear model to examine the relationship between environmental regulation and industrial structure upgrading, and the research results showed that environmental regulation has a nonlinear forcing effect on industrial structure [8]. Song et al. (2022) studied the correlation mechanism between environmental policies and industrial structure distortion, verifying the validity of the Porter hypothesis in China [9].

The existing literature on green credit policy and the green transformation of enterprises is mainly divided into three categories. The first type of research focuses on the microeffect testing of green credit policies. The impact of green credit on microenterprises is reflected in two perspectives. The first viewpoint suggests that green credit policies have a positive impact on the environmental behavior of microenterprises. The green credit policy restricts the interest-bearing debt, long-term debt, and liquidity debt of heavily polluting enterprises by regulating their financing scale, thereby affecting their investment strategies and stimulating the improvement of environmental investment expenditures and green innovation levels [10–13]. Si and Cao (2022) used a DID model to examine the impact of green credit policies on corporate environmental and social responsibility and its internal and external mechanisms. The research results found that green credit policies significantly enhance corporate environmental responsibility [14]. The second viewpoint holds that green credit has a negative impact on the environmental behavior of microenterprises. Due to the constraints of green credit policies on the financing of heavily polluting enterprises, the financing costs of enterprises have increased, forcing their investment levels to weaken, leading to a significant decrease in profits and even withdrawal from the market [15–18]. Tian and Nie (2023) analyzed the research progress of green credit in China based on a knowledge graph and found that some scholars have verified the negative effect of green credit policies on corporate environmental responsibility [19].

The second type of research focuses on exploring the factors that affect green innovation in enterprises. This type of research mainly analyzes the internal and external factors of enterprises. Regarding internal factors, relevant studies believe that stakeholders play a decisive role in the green innovation of enterprises [20,21]. In addition, Yu et al. (2021) and Wang and Chu (2022) found that corporate culture, leadership style, and other factors are also important factors that cannot be ignored in influencing green innovation in enterprises [22,23]. For external factors, policy systems and financing constraints are important influencing factors that affect the green transformation of enterprises. Generally speaking, policies and systems such as carbon emission trading policies, environmental regulations, and environmental protection taxes play an undeniable role in influencing enterprises'

green transformation [24–27]. Wang et al. (2021) focused on exploring the policy effects of environmental protection negotiations on green innovation in enterprises using the DID model. Research shows that environmental protection interviews can drive the ecological governance pressure caused by local governments, driving enterprises' green innovation strategies and generating value creation [28]. Furthermore, the degree of financing constraints also plays an important role in the green transformation of enterprises [29–32]. Cai et al. (2020) explored the impact of credit resource availability on corporate innovation activities from the perspective of financial geography structure. The study found that the higher availability of credit resources, represented by the number of adjacent bank branches, actually suppresses corporate R&D investment [33].

The third type of research is to analyze the correlation mechanism between green credit policy and enterprise green innovation. Existing research has found that green credit policies significantly promote the innovation intensity and efficiency of heavily polluting enterprises, but the impact on the quality of green innovation is not conclusive [34]. The results of existing research can be roughly divided into two categories: one type indicates that green credit policies enhance the innovation behavior of enterprises by improving green investment efficiency [35–40]. Wang et al. (2022) took Green Credit Guidelines in China as a quasi-natural experiment to examine their effect on the quality of green innovation in heavily polluting enterprises. The research results indicate that green credit standards significantly improve the quality of green innovation for enterprises [41]. Another type of result indicates that green credit policy affects the financing costs of enterprises, thereby inhibiting their innovative output. This type of research is influenced by cost theory, with an a priori belief that green credit policy will strictly limit the credit supply of high-pollution enterprises, leading to a decrease in green R&D investment and ultimately a decrease in green innovation for enterprises [42]. For example, Chen et al. (2021) incorporated green finance policies and green transformation into the asset pricing model and analyzed the mechanism of green finance policies in enterprise green transformation. Research has found that green finance policies have a certain restrictive effect on corporate financing, which in a short period of time has a negative impact on the green transformation of enterprises [43].

Throughout the above analysis, the commonly used econometric model is the DID model. As is well known, social experiments are different from natural experiments in that they do not have repeatability. In other words, when a policy is implemented, the possible consequences of not implementing it cannot be accurately measured. Therefore, to distinguish the effects of a policy before and after its implementation, a more common approach is to use the DID model for econometric testing. In addition, a more important difference between this article and existing research is that, based on the benchmark DID model estimation, this article also uses the PSM-DID model to conduct an econometric analysis on whether green credit policies contribute to corporate green transformation. The purpose is to obtain more robust empirical results and provide solid data support for government departments.

There is little literature on the impact of green credit policy on the green transformation of high-pollution enterprises. The existing literature has focused on examining the impact of green credit on the investment and financing, capital structure, and pollution reduction of heavily polluting enterprises, neglecting the mechanism of the impact of green credit policy on the green innovation of heavily polluting enterprises, making it impossible to comprehensively analyze the effectiveness of green credit policy on the quality of green innovation. Compared to the existing literature, the marginal contribution of this article may be reflected in two aspects: firstly, from a research perspective, the existing literature has focused on the pollution reduction effect of green credit, ignoring the deep impact on the green transformation of high-pollution enterprises, which may weaken the policy effectiveness of green credit. Secondly, in terms of heterogeneity research, this article focuses on the heterogeneity effects of different enterprise attributes and financial development levels, providing more comprehensive empirical evidence for the improvement and design of green credit policy.

The research significance of this paper is mainly reflected in two aspects: theoretical significance and practical significance. In terms of theoretical significance, this article fully studies the heterogeneity of China's green credit policies. The research results show that green credit policies have a stronger impact on the green innovation of state-owned heavily polluting enterprises and heavily polluting enterprises in underdeveloped areas of financial development. This is not only reflected in the quality of green innovation but also in the quantity of green innovation. This research result provides quantitative evidence for a deeper understanding of whether there is heterogeneity in green credit. For practical significance, the research conclusions of this article verify the heterogeneity of green credit policies, providing a reference basis for policy departments to develop reasonable and efficient financial tools. In other words, policy departments can provide more comprehensive green financial tools for state-owned heavily polluting enterprises and heavily polluting enterprises in underdeveloped areas, which has a positive impact on achieving the development goals of environmental protection and green transformation of enterprises.

2. Theoretical Analysis

2.1. Green Credit Policy and Enterprise Green Innovation

The green credit policy is essentially a type of environmental regulatory policy, but unlike market-oriented regulatory policies and administrative order regulatory policies, the green credit policy plays a role in environmental governance through credit supply channels. Specifically, the green credit policy guides the allocation of funds to increase clean investment and reduce polluting investment, thereby achieving the goals of clean production and green development in the industry [44]. For high-polluting enterprises, green credit policies, as an environmental regulatory constraint, can internalize the negative externalities generated by enterprise pollution emissions. This is because high-polluting enterprises find it difficult to obtain bank loan support before reaching emission reduction targets. At the same time, negative news about environmental pollution in enterprises can affect investor expectations and increase financing costs for enterprises. Due to the close relationship between environmental costs and financing costs, enterprises need to pay special attention to environmental factors when making production decisions.

In order to achieve the goal of green development, enterprises strengthen pollution control in production processes, update supporting equipment, and promote clean technology research and development. But in the context of external funding constraints, will green credit policies promote or suppress the technology research and development behavior of highly polluting enterprises?

According to neoclassical economics, environmental regulations will increase private costs for enterprises, which is not conducive to improving market competitiveness. That is to say, environmental regulations encourage polluting enterprises to reduce their production scale and invest more funds in pollution control, resulting in a crowding-out effect on their research and development activities, thereby reducing their competitiveness [45,46]. Therefore, environmental regulations will inhibit corporate innovation activities and be detrimental to the technological progress of enterprises [47]. The green credit policy has made it more difficult for polluting enterprises to obtain credit financing, resulting in a decrease in available credit financing and a reduction in funds available for innovation and research and development [48]. Moreover, the green credit policy has enhanced the attention of enterprises to the environmental and social impacts of their business behavior. Enterprises prefer to invest a large amount of funds in pollution control, further occupying investment in technology research and development. Therefore, the green credit policy exhibits a "crowding out effect" on the technology research and development investment of high-polluting enterprises.

The Porter hypothesis differs from neoclassical economics in that although environmental regulation increases corporate costs in the short term, companies with a long-term development perspective will increase innovation investment and enhance production

capacity, thereby offsetting the additional costs caused by environmental regulation [49]. Jiang (2015) found that companies subject to higher environmental regulations have a stronger willingness to invest in technology research and development [50]. For highly polluting enterprises, green credit policies urge enterprises to allocate limited funds efficiently to projects to improve environmental quality, adjust production levels, and reduce excess capacity. Although investing in pollution control and emission reduction projects is not conducive to the expansion of enterprise production capacity, this adverse impact will gradually decrease. As the intensification of production processes gradually increases, the relevant technologies of enterprises become increasingly developed and mature, achieving the minimum capital investment and environmental costs to achieve the highest returns, and the production efficiency of enterprises improves, offsetting the negative impact of green credit policies and exhibiting a certain "innovation compensation effect" [51]. When enterprises achieve certain results in early investment, the energy-saving and emission reduction effects gradually become apparent, the financing constraints of enterprises slow down, the probability of obtaining credit supply increases, and the funds available for innovation investment by enterprises also further increase. In addition, the better disclosure of environmental information by enterprises has increased investor confidence, overall enhancing the market value and competitive advantage of enterprises. Therefore, when facing stricter green credit policies, heavily polluting enterprises have the motivation to improve their green innovation efficiency and strengthen their green innovation capabilities, thereby meeting the financing requirements of green credit. Based on the above analysis, this article proposes the following assumption:

Hypothesis 1 (H1). *The "Porter effect" of green credit policies is significantly greater than the "crowding out effect", significantly enhancing the green innovation capabilities of heavily polluting enterprises.*

2.2. Heterogeneity Factors and Green Credit and Enterprise Innovation Relationship

Given the different nature of ownership in enterprises, the marginal financing costs they can bear will also vary. Therefore, enterprises need to balance the issue of changes in financing costs during the business process. Usually, state-owned enterprises enjoy government guarantees and undertake more national-policy-oriented tasks, thereby obtaining financing convenience. In contrast, non-state-owned enterprises often face credit discrimination, resulting in significantly lower amounts of credit funds obtained through financial institutions compared to state-owned enterprises.

As analyzed above, state-owned enterprises have a significant advantage over non-state-owned enterprises in credit allocation [52]. After the implementation of green credit policies, private heavily polluting enterprises with high financing costs are unable to maintain high sensitivity to green credit policies, resulting in a lack of innovation motivation. However, before the implementation of the green credit policy, the debt financing share of state-owned heavily polluting enterprises was relatively large, resulting in a significant impact of the green credit policy on them [53]. Therefore, state-owned heavy-polluting enterprises have stronger innovation motivation to enhance their green innovation capabilities and respond to the dividends of green finance policies [54].

In other words, according to the nature of property rights, enterprises can be divided into state-owned enterprises and non-state-owned enterprises. Based on this, the heterogeneous impact of green credit policy on the green innovation of enterprises with different ownership can be examined. Based on the above analysis, this article proposes the following assumption:

Hypothesis 2 (H2). *After the implementation of the green credit policy, the green innovation ability of state-owned high-polluting enterprises has been significantly improved.*

China has a vast territory, and there are significant differences in natural and social conditions among different regions. The level of financial development will affect the effectiveness of regional green credit policies [55]. The level of financial development will affect the effectiveness of green credit policy. Generally speaking, the implementation of green credit policy will increase financing standards, leading to increased financing constraints for high-polluting enterprises [56]. When the level of financial development in a region is relatively developed, it means that the financing channels for enterprises will become more diverse. After the implementation of green credit policy, in areas with relatively developed financial development levels, high-polluting enterprises have multiple sources of funding, such as equity financing and bond financing, in addition to credit financing, which weakens the financing constraints imposed by green credit policy [57,58].

Therefore, in areas with relatively developed financial development levels, the promoting effect of green credit policy on the green innovation of enterprises will decrease or even be not significant [35]. On the contrary, in areas with underdeveloped financial development levels, enterprises face fewer financing channels and relatively limited financing options. As the main source of financing, enterprises obtain funds through bank loans and form a high dependence on this channel. Therefore, for areas with underdeveloped financial development levels, green credit policy has a stronger incentive for the green innovation of high-polluting enterprises, thus having a strong promoting effect on their green innovation [59]. Based on the above analysis, this article proposes the following assumption:

Hypothesis 3 (H3). *After the implementation of green credit policy, the improvement effect of green innovation on high-polluting enterprises in underdeveloped areas is more significant.*

Based on the above analysis, three research hypotheses are proposed in this article. Among them, the logic proposed by Hypothesis 1 is that green credit policies, as a special environmental regulatory tool, should also have the characteristics contained in environmental regulatory policies. Therefore, green credit policies may not only hinder corporate green innovation by crowding out technological innovation investment (crowding out effect) but also enhance corporate innovation capabilities by stimulating the "Porter effect". Assumptions 2 and 3 are designed and summarized based on the observations of existing facts. Specifically, different property rights of enterprises and varying levels of financial development in their respective regions may affect the effectiveness of green credit policies. Therefore, Hypotheses 2 and 3 consider the impact of heterogeneous factors on the relationship between green credit policies and corporate innovation. Next, we will test the above hypotheses through empirical analysis.

3. Empirical Design

3.1. Model Settings

3.1.1. Benchmark Model

Green credit policy is an exogenous event for enterprises. In addition, financial institutions should distinguish whether enterprises meet environmental protection regulations when issuing loans. When enterprises do not have environmental violations, they are given priority to obtain bank loans, while polluting enterprises are subject to strict credit restrictions, indicating that the implementation of green credit policies has a "punishment effect" on heavy-polluting enterprises. Therefore, this paper takes high-polluting enterprises and non-high-polluting enterprises as the experimental group and control group, respectively, and examines the impact of green credit policy on the green transformation of high-polluting enterprises by constructing a DID model. Referring to the research of Chen et al. (2021) [40], the following benchmark model is set:

$$Ginnov_{it} = \alpha_0 + \alpha_1 treat_i + \alpha_2 policy_t + \alpha_3 treat_i \times policy_t + \lambda control_{it} + \varphi_i + \delta_t + \varepsilon_{it} \quad (1)$$

The dependent variable $Ginnov_{it}$ represents the green transformation of enterprises, including two aspects: the quantity and quality of green innovation. $treat_i$ is a processing group dummy variable, with high-polluting enterprises taking 1 and non-high-polluting enterprises taking 0; $policy_t$ is a dummy variable for the implementation of green credit policy, and the value for 2012 and later is 1. Before 2012, the value is 0. $Control_{it}$ are a series of control variables at the enterprise level. φ_i is the industry fixed effect, δ_t is the year fixed effect, and ε_{it} is the disturbance term. The test results of model (1) should focus on coefficient α_3, which reflects the changes in the quantity and quality of the green innovation of high-polluting enterprises compared to other enterprises. A positive coefficient indicates that green credit policy has a positive impact on the green innovation of high-polluting enterprises, while a negative coefficient indicates that green credit policy has no positive impact on green innovation.

3.1.2. Parallel Trend Testing and Policy Dynamic Effect Testing

Meeting the parallel trend hypothesis is an important prerequisite for constructing a DID model, which means that the green innovation differences between high-polluting enterprises and other enterprises should not show significant changes over time before the implementation of green credit policy. This study constructs an event study method for parallel trend testing and examines the dynamic effects of policy. The model is as follows:

$$Ginnov_{it} = \sum_{k=-2}^{2} \beta_k[(t = k) \times treat_i] + \lambda control_{it} + \varphi_i + \delta_t + \varepsilon_{it} \quad (2)$$

where t = 0 represents the time point of policy implementation (the official implementation year of the Green Credit Guidelines, 2012), t = −2 and t = −1 represent the two years before policy implementation and the first year, respectively, and t = 1 and t = 2 represent the one year and two years after policy implementation. The meanings of other variables are the same as in model (1) and will not be repeated. The core variable of concern in model (2) is $(t = k) \times treat$, and the change in coefficient β_k of $(t = k) \times treat$ variable reflects the dynamic changes in the impact of green credit policies on the green innovation of highly polluting enterprises.

3.2. Data Description

3.2.1. Sample Selection

This study uses A-share listed companies in China from 2007 to 2020 as raw data, and categorizes 16 types of high-polluting industries, including thermal power, steel, cement, and electrolytic aluminum, as mentioned in the "Environmental Information Disclosure Guidelines for Listed Companies" issued by the Ministry of Environmental Protection in 2010. According to the classification criteria of the "Industry Classification Indicators for Listed Companies" issued by the China Securities Regulatory Commission in 2001, listed companies are classified into secondary industries and are classified into high-pollution and non-high-pollution industries. In addition, we exclude ST and PT samples, samples severely missing financial data, and financial industry samples. After the above processing, the final sample includes 932 listed companies, including 495 in the high-pollution group and 437 in the non-high-pollution group, with a total observation value of 13,048. The patent data of listed companies come from the China Research Data Service Platform (CNRDS), which matches and screens the patent classification number information of various patents with the "International Patent Classification Green List" published by the World Intellectual Property Organization (WIPO) in 2010 to obtain data on the various green patents (green invention patents and green utility model patents) of listed companies. The company's financial data come from Wind and CSMAR databases.

3.2.2. Variable Definition

In the past few decades, with the growth of population and the acceleration of urbanization, the quality of the ecological environment has been continuously declining, leading to a series of environmental problems. With the development of the "green wave", people's demand for green consumption is also constantly increasing, followed by the emergence of a green product system for enterprises. With greenness becoming an inevitable trend in social development, enterprises have begun to pursue the development goals of low energy consumption, low pollution, safety, and environmental protection and have subsequently developed the concepts of "green knowledge" and "green innovation". However, due to the difficulty in quantifying the green knowledge of enterprises, previous research has often focused on their green innovation capabilities.

This article follows this approach and measures the green transformation of enterprises from two dimensions: the quantity and quality of innovation. The number of innovations is measured by four indicators: green patent application volume (*papent1*), green patent authorization volume (*papent2*), green utility model patent application volume (*papent3*), and green utility model patent authorization volume (*papent4*). The quality of innovation is measured by two indicators: the number of cited green patent applications (*quality1*) and the number of cited green patent authorizations (*quality2*). In terms of controlling variables, we select return on equity (*roa*), asset–liability ratio (*lev*), current ratio (*liu*), asset size (*size*), enterprise age (*age*), market-to-book ratio (*MB*), and equity concentration (*lar*). The specific definitions of the above variables are shown in Table 1.

Table 1. Variable definition.

Variable Symbol	Variable	Variable Definition
papent1	green patent application volume	ln (green patent application volume + 1)
papent2	green patent authorization volume	ln (green patent authorization volume + 1)
papent3	green utility model patent application volume	ln (green utility model patent application volume + 1)
papent4	green utility model patent authorization volume	ln (green utility model patent authorization volume + 1)
quality1	the number of cited green patent applications	ln (the number of cited green patent authorizations + 1)
quality2	the number of cited green patent authorizations	ln (the number of cited green patent authorizations + 1)
treat	high-pollution enterprises	virtual variable of high-pollution enterprise, value 1
policy	policy year	virtual variable of policy implementation year, value 1 in 2012 and later
roa	return on equity	net profit/average net assets
lev	asset–liability ratio	total liabilities/total assets
liu	current ratio	current assets/current liabilities
size	asset size	ln (assets)
age	enterprise age	years of establishment of the company
MB	market-to-book ratio	current market value/book value
lar	equity concentration	shareholding ratio of the largest shareholder

The purpose of selecting the above control variables is of general significance. In general, it is not only green credit policy that plays a unique role in influencing a company's green innovation, but other factors also have an undeniable impact on the company's green innovation. Therefore, this article selects many of the above control variables. It is worth noting that in the real economic environment, there are various influencing factors that can affect green innovation in enterprises, but there are relatively few control variables that can be measured using specific sample data. This article selects relatively mature and measurable variables as the model control variables based on the existing research.

4. Result Analysis

4.1. The Impact of Green Credit on the Green Transformation of High-Pollution Enterprises

Table 2 reports the benchmark test results of green credit policy on the green transformation of high-polluting enterprises in China. The dependent variables in columns 1–4 are the quantity of green innovation, and the dependent variables in columns 5–6 are the

quality of green innovation. All regression equations control for industry and annual fixed effects. According to the results in Table 2, the interchange term estimated coefficients of *treat* × *policy* are all positive at the significance level of 1%, which means that after the implementation of green credit policies, the quantity and quality of green innovation of high-polluting enterprises have significantly improved compared to non-high-polluting enterprises. The green credit policy has formed an effective reverse effect on the green innovation of high-pollution enterprises, with both the quantity and quality of green innovation showing an upward trend after the implementation of the green credit policy.

Table 2. Impact of green credit policy on green innovation of high-pollution enterprises.

Variable	Quantity of Green Innovation				Quality of Green Innovation	
	papent1	***papent2***	***papent3***	***papent4***	***quality1***	***quality2***
policy	0.541 *** (3.21)	0.627 *** (2.95)	0.403 *** (3.16)	0.685 *** (4.42)	0.453 *** (3.87)	0.366 *** (4.75)
treat × *policy*	0.213 *** (4.31)	0.255 *** (5.06)	0.198 *** (4.53)	0.236 *** (3.89)	0.187 *** (4.42)	0.176 *** (5.01)
roa	0.223 (1.03)	0.193 (1.34)	0.174 (0.98)	0.201 (1.23)	0.322 (1.50)	0.295 (1.47)
lev	0.104 *** (2.78)	0.133 *** (2.84)	0.127 *** (3.02)	0.108 *** (3.21)	0.125 *** (2.92)	0.119 (3.66)
liu	−0.203 * (−1.78)	−0.188 * (−1.91)	−0.075 (−1.52)	−0.104 (−1.43)	−0.122 * (−1.85)	−0.212 ** (−2.03)
size	0.004 * (1.71)	0.003 * (1.80)	0.005 ** (2.04)	0.004 * (1.77)	0.005 * (1.86)	0.003 * (1.92)
age	−0.003 * (−1.80)	−0.002 * (−1.73)	−0.001 ** (−2.11)	−0.002 * (1.92)	−0.002 ** (−2.32)	−0.001 * (1.88)
MB	0.013 *** (3.03)	0.019 *** (3.75)	0022 *** (2.89)	0.025 *** (2.77)	0.032 *** (3.01)	0.036 *** (3.15)
lar	−0.231 *** (−4.32)	−0.324 *** (−5.32)	−0.372 *** (−3.84)	−0.401 *** (−4.63)	−0.389 *** (−4.59)	−0.355 *** (−5.03)
intercept	0.641 *** (5.12)	0.753 *** (6.83)	0.712 *** (4.35)	0.474 *** (5.13)	0.783 *** (5.38)	0.722 *** (5.81)
year *industry* R^2	YES YES 0.165	YES YES 0.148	YES YES 0.144	YES YES 0.157	YES YES 0.151	YES YES 0.138

Note: t-statistic provided in parentheses; ***, **, and * indicate that regression coefficient is significant at the 1%, 5%, and 10% levels, respectively.

In fact, green credit policy imposes environmental considerations on the financing market. Faced with numerous corporate financing needs, the government has issued administrative directives to the banking system, incorporating the environmental performance of enterprises into the standards of credit granting, which will stimulate the motivation for green innovation of enterprises and ultimately achieve the policy objectives of environmental protection. Therefore, the above results confirm that the implementation of green credit policy significantly promotes the progress of green innovation in high-polluting enterprises, supporting Hypothesis H1 of this study.

In terms of control variables, return on equity (*roa*) has a positive impact on the green innovation of high-pollution enterprises, but the impact coefficient is not significant. The impact of the asset–liability ratio (*lev*) on the green innovation of high-pollution enterprises is significantly positive, which means that when the pollution enterprises with a high debt ratio face strict financing conditions, in order to obtain credit advantages, they will vigorously increase the green innovation of enterprises. The results have important implications

for policy departments. The asset–liability ratio will significantly affect the green innovation of enterprises. This factor can also be taken into account when formulating environmental protection policies to enrich the policy toolbox. In addition, variables such as the current ratio (*liu*), asset size (*size*), enterprise age (*age*), and market–book ratio (*MB*) have a significant negative impact on the green innovation of high-pollution enterprises. Among them, the key concern is the enterprise age variable, which has a significant inhibitory effect on the green innovation of heavy pollution enterprises. Generally, high-pollution enterprises tend to develop conservatively over time, continue to adhere to the past development strategy, and lack the internal power of innovation in green innovation, which shows that the more serious the pollution of enterprises, the weaker the green innovation.

In addition, the variable of ownership concentration (*lar*) also has a significant inhibitory effect on the green innovation of heavily polluting enterprises. Generally speaking, the higher equity concentration means a higher shareholding ratio of the largest shareholder in the enterprise, which will lead to the conservative development strategy of the enterprise, resulting in the lack of green innovation ability of heavily polluting enterprises. The influence of this variable is similar to the enterprise age variable, which will promote the development of heavily polluting enterprises to take a steady style, thus weakening the enterprise's green innovation motivation.

4.2. Robustness Analysis

4.2.1. Parallel Trend Test

The above results show that the green credit policy effectively promotes the green transformation of high-pollution enterprises. But only when the treatment group and the control group meet the parallel false timing, the above results can accurately reflect the treatment effect. Therefore, according to model (2), this study conducts a parallel trend test on the green innovation indicators of six types of enterprises.

Figure 1 shows the size and significance of the coefficients when six categories of indicators are used as explained variables. It can be seen from the observation that before 2012, the coefficient of the cross-multiplication term β_k was not significantly different from 0, indicating that before the implementation of the policy, the quantity and quality of green innovation between high-pollution enterprises and non-high-pollution enterprises did not change with time, so the parallel trend hypothesis was verified. At the same time, the estimated values of the multiplicative coefficient after 2012 are significantly different from 0, which indicates that after the implementation of the green credit policy, the green transformation willingness and behavior of high-pollution enterprises are stronger.

4.2.2. PSM-DID Inspection

In fact, there may be differences in basic characteristics between high-pollution enterprises and non-high-pollution enterprises before the implementation of the green credit policy, resulting in an obvious gap in the green innovation ability of the two types of enterprises, which further reduces the accuracy of DID estimation. Therefore, we use the combination of the propensity matching score and double difference method to re-regress the model. According to the return on equity (*roa*), asset–liability ratio (*lev*), enterprise age (*age*), market–book ratio (*MB*), ownership concentration (*lar*), and annual and industry dummy variables as covariates, nearest-neighbor matching was performed. Table 3 shows the impact of green credit policy after propensity matching on the green innovation of high-pollution enterprises. In order to save space, Table 3 only reports the estimated coefficients of $treat \times policy$. According to the estimated results, the implementation of green credit policy can significantly promote the green innovation of high-pollution enterprises, which is essentially consistent with the above research results and further supports the basic conclusion of this paper.

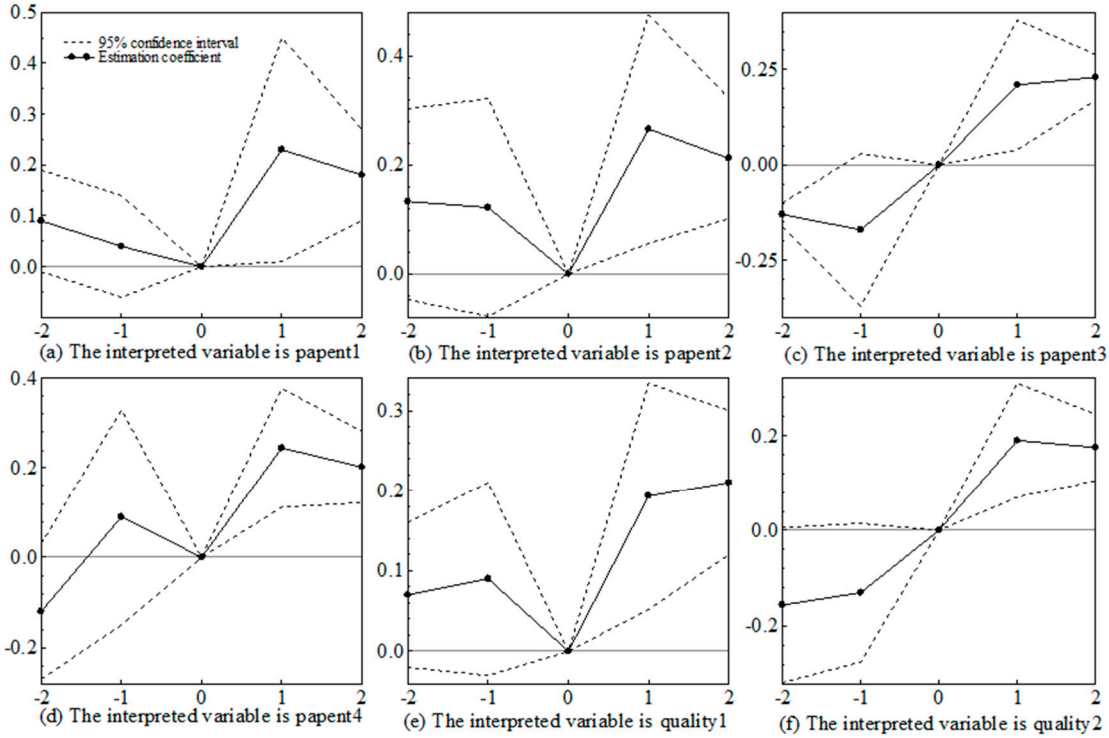

Figure 1. Parallel trend test.

Table 3. PSM-DID estimation results.

Variable	Quantity of Green Innovation				Quality of Green Innovation	
	papent1	***papent2***	***papent3***	***papent4***	***quality1***	***quality2***
treat × *policy*	0.327 ***	0.331 ***	0.205 ***	0.287 ***	0.212 ***	0.194 ***
	(3.86)	(4.55)	(5.11)	(4.29)	(4.22)	(4.84)
year	YES	YES	YES	YES	YES	YES
industry	YES	YES	YES	YES	YES	YES
R^2	0.164	0.152	0.149	0.161	0.155	0.142

Note: t-statistic provided in parentheses; *** indicates that regression coefficient is significant at 1%.

In fact, the above estimation results based on the PSM-DID model further support the research conclusion that the implementation of green credit policy will significantly improve the green innovation of heavily polluting enterprises. Compared with the DID model, the PSM-DID model fully eliminates the impact of individual differences between the experimental group and the control group on the effect of policy implementation, so as to ensure that the assessment results of environmental protection of green credit policy are more accurate. The above research is not only the robustness test of the basic research conclusion of this paper but also provides solid data support for the evaluation of the effect of green credit policy.

4.3. Further Analysis

According to the above regression results, compared with non-high-polluting enterprises, the implementation of green credit policy has a significant role in promoting green innovation for high-polluting enterprises. In order to further test the logic of the impact of the implementation of green credit policy on enterprises' green innovation, the next part focuses on the impact of green credit policy on enterprises with different ownership characteristics and regional financial development characteristics.

4.3.1. Nature of Ownership

The whole sample is divided into state-owned enterprises and private enterprises according to the nature of enterprises and is re-estimated. The regression results are shown in Table 4. According to the estimation results in Table 4, the implementation of the green credit policy has a significant positive impact on the green innovation of state-owned heavy-polluting enterprises, while it has no significant effect on the green innovation of non-state-owned heavy-polluting enterprises. In general, state-owned enterprises enjoy government guarantees and undertake more national-policy-oriented tasks, so as to obtain financing facilities. In contrast, non-state-owned enterprises often face credit discrimination, so the marginal financing costs they can bear will be different due to the different nature of enterprise ownership.

Table 4. State-owned enterprises vs. private enterprises.

Variable	State-Owned Enterprise			Non-State-Owned Enterprises		
	papent2	***papent4***	***quality2***	***papent2***	***papent4***	***quality2***
treat × *policy*	0.022 **	0.027 ***	0.031 ***	0.017	0.019	0.02
	(2.43)	(2.76)	(3.01)	(1.42)	(1.38)	(0.99)
year	YES	YES	YES	YES	YES	YES
industry	YES	YES	YES	YES	YES	YES
R^2	0.241	0.302	0.328	0.286	0.277	0.335

Note: t-statistic provided in parentheses; *** and ** indicate that regression coefficient is significant at the 1% and 5% levels, respectively.

The advantages of state-owned enterprises in credit distribution are obviously greater than those of non-state-owned enterprises. When the green credit policy is implemented, private heavy-polluting enterprises with high financing costs cannot maintain high sensitivity to the green credit policy, which leads to a lack of innovation motivation. However, before the implementation of the green credit policy, the station financing share of the state-owned heavy-polluting enterprises was relatively large, leading to a greater impact of the green credit policy. Therefore, the state-owned heavy-polluting enterprises have stronger innovation motivation to improve their green innovation ability to obtain the comparative advantage of credit allocation.

In addition, given that state-owned enterprises undertake more national development strategic tasks, state-owned enterprises need to cooperate with this series of policies after the implementation of the policies. The 19th CPC National Congress clearly pointed out that the modernization we are building is the modernization of harmonious coexistence between man and nature, and it is essential to adhere to the basic national policy of saving resources and protecting the environment, accelerate the transformation of the mode of economic development, identify and take the green development path of an efficient, clean, safe, harmonious, and low-carbon cycle, and promote the construction of a beautiful China.

In view of this, after the implementation of the green credit policy, the state-owned heavy-polluting enterprises will vigorously improve their green innovation ability to support the policy, so the empirical results show that the implementation of the green credit policy has a positive impact on the green innovation of state-owned heavy-polluting enterprises but has no effective positive impact on the green innovation of non-state-owned heavy-polluting enterprises.

4.3.2. Regional Financial Development Degree

Regional financial development will affect the choice of financing channels of enterprises and then have a greater impact on the green transformation of enterprises. Compared with developed areas, enterprises in less developed areas will be subject to more stringent financing constraints, so the impact of green credit policy is more prominent. Therefore, we divide the whole sample into financial developed regions and less developed regions

according to the development degree of the factor market, and the grouping regression results are shown in Table 5. According to the results, the implementation of green credit policy in financial underdeveloped areas has a stronger role in promoting the number and quality of green innovation of high-polluting enterprises.

Table 5. Developed finance vs. underdeveloped finance.

Variable	Financial Developed Areas			Financial Underdeveloped Areas		
	papent2	***papent4***	***quality2***	***papent2***	***papent4***	***quality2***
treat × *policy*	0.011 ***	0.013 ***	0.018 ***	0.032 ***	0.028 ***	0.021 ***
	(3.74)	(3.03)	(4.55)	(3.85)	(3.10)	(2.98)
year	YES	YES	YES	YES	YES	YES
industry	YES	YES	YES	YES	YES	YES
R^2	0.424	0.384	0.411	0.395	0.416	0.453

Note: t-statistic provided in parentheses; *** indicates that regression coefficient is significant at 1%.

The difference in the level of financial market development is a characteristic fact that cannot be ignored in China's financial development. The difference in the level of financial market development means that the financing market environment faced by enterprises in different regions is also different, so the level of financial development is bound to affect the policy effect of green credit. Generally, the implementation of the green credit policy will improve the financing standards, resulting in an increase in the financing constraints of heavily polluting enterprises. When the regional financial development level is more developed, the financing channels of enterprises will be more diverse. Therefore, after the implementation of the green credit policy, the capital sources of heavily polluting enterprises are not only credit financing but also equity financing, bond financing, and other channels, which weakens the financing constraints imposed by the green credit policy. On the contrary, in areas with less developed financial development, enterprises face fewer financing channels. As the main source of financing, enterprises obtain funds through bank loans and form a high degree of dependence on this channel. Therefore, for areas with less developed financial development, the green credit policy should provide stronger incentives for the green innovation of heavily polluting enterprises.

Based on the estimation results in Table 5, it can also be found that the implementation of the green credit policy also has a significant impact on the green innovation of enterprises in the financial developed regions, but the impact effect is weaker than that in the less developed regions. As pointed out in the previous theoretical analysis, enterprises in developed financial regions face relatively abundant financing channels, which leads to the weakening of the constraint effect of environmental regulation imposed by the green credit policy. The results of this study provide positive enlightenment for the government departments to formulate green financial policies at this stage: in the developed financial regions, in order to make the green financial policies more effective in encouraging heavily polluting enterprises to improve their green innovation ability, the government should bring a variety of financing channels into the scope of policy supervision, so as to strengthen the positive role of green financial policies in the objectives of pollution reduction and green development.

5. Conclusions and Enlightenment

The relationship between humans and nature is the most fundamental relationship in human society. To implement the concept of green development that green waters and green mountains are golden mountains and silver mountains, we should aim for sustainable development, safety, harmony, and low-carbon circulation and build a new pattern of green development and good ecological economic development. Transforming the mode of economic development and promoting the green transformation of high-polluting enterprises is the top priority of the "dual carbon" work. Against the backdrop of the current

strong promotion of green finance policies, this article focuses on examining the impact of green credit policies on the green transformation of high-polluting enterprises, providing theoretical support for green finance to assist low-carbon economic and social development, and also providing empirical references for optimizing the design of green finance policies. This paper constructs a quasi-natural experiment based on the policy of "Green Credit Guidelines" implemented in China in 2012, constructs a double difference model, measures the green transformation of enterprises from two dimensions—the quantity and quality of green innovation—and further explores whether green credit policies will promote the green transformation of high-pollution enterprises.

The research results found the following: (1) The implementation of green credit policies is beneficial for improving the quantity and quality of green innovation in high-polluting enterprises. This result implies that green credit policies have a positive role that cannot be ignored in promoting the green transformation of enterprises and building a new pattern of green development. (2) To avoid weakening the accuracy of research conclusions due to differences in sample characteristics, this article uses the PSM-DID model to further verify the positive impact of green credit policy implementation on the green transformation of high-polluting enterprises. (3) This article analyzes the effects of green credit policies on the green transformation of enterprises based on the nature of enterprise ownership and regional differences in financial development levels. The results show that the implementation of green credit policies has a stronger impact on the green transformation of state-owned high-polluting enterprises and high-polluting enterprises in underdeveloped financial areas.

Based on the above research conclusions, we can propose the following policy implications: (1) At present, the government vigorously advocates high-quality economic development, and the concept of green development is an important indicator for building high-quality economic development. Therefore, the government can actively play an important role in building high-quality development through green finance. Government departments and financial institutions dynamically adjust the incentive and punishment mechanisms, guide high-polluting enterprises to raise environmental awareness, increase green investment and financing, and enhance financial support for environmentally friendly enterprises. (2) Government departments should continuously improve the green financial market system, accelerate the innovation of green financial products, play the environmental protection role of green financial policies, and stimulate high-polluting enterprises to strengthen their own innovation drive and improve green production efficiency to meet the requirements of green finance. In addition, strict supervision should be carried out on the supply of credit funds for entities with high environmental and social risks and their investment and financing projects, and the reverse mechanism of green credit policies should be fully utilized. (3) High-polluting enterprises should actively adapt to the new situation of green finance regulation, actively align with the requirements of green finance policies, exert their initiative in independent innovation, strive for the dividends of green finance policies, and inject a continuous stream of new impetus into the green and high-quality development of the economy.

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References

1. Wang, X.; Wang, Y. Research on promoting green innovation through green credit policies. *J. Manag. World* **2021**, *37*, 137–188.
2. Zhou, X.; Jia, M.; Zhao, X. Evolutionary game dynamic analysis and empirical research on green finance boosting enterprise green technology innovation. *China Indust. Econ.* **2023**, *6*, 43–61.
3. Ma, T.; Han, T. Empirical research on the impact of financial development on innovative and green development: Based on the perspective of China's industrial chain. *Macroecon* **2023**, *7*, 21–34.
4. Wei, L.; Yang, Y. Research on the Evolution Logic and Environmental Effects of China's Green Finance Policy. *J. Northwest Norm. Univ. Soc. Sci. Ed.* **2020**, *57*, 101–111.
5. Salazar, J. Environmental finance: Linking two worlds. In Proceedings of the A Workshop on Financial Innovations for Biodiversity, Bratislava, Czech Republic, 1–3 May 1998; Volume 1, pp. 2–18.
6. Labatt, S.; White, R. *Environmental Finance: A Guide to Environmental Risk Assessment and Financial Products*; John Wiley & Sons: Hoboken, NJ, USA, 2002.
7. Ambec, S.; Barla, P. A theoretical foundation of the Porter hypothesis. *Econ. Lett.* **2002**, *75*, 55–360. [CrossRef]
8. Guan, S.; Liu, J.; Liu, Y.; Du, M. The nonlinear influence of environmental regulation on the transformation and upgrading of industrial structure. *Int. J. Environ. Res. Public Health* **2022**, *19*, 8378. [CrossRef] [PubMed]
9. Song, Y.; Ma, J.; Guan, S.; Liu, Y. Fiscal Decentralization, Regional Innovation and Industrial Structure Distortions in China. *Sustainability* **2022**, *15*, 710. [CrossRef]
10. Jaffe, A.; Palmer, K. Environmental regulation and innovation: A panel data study. *Rev. Econ. Stat.* **1997**, *79*, 610–619. [CrossRef]
11. Shao, S.; Hu, Z.; Cao, J. Environmental regulation and enterprise innovation: A review. *Bus. Strateg. Environ.* **2020**, *29*, 1465–1478. [CrossRef]
12. Wang, Y.; Lei, X.; Long, R. Has the green credit policy improved the investment efficiency of enterprises—From the perspective of financial resource allocation for heavily polluting enterprises. *Chin. J. Popul. Resour.* **2021**, *31*, 123–133.
13. Guo, J.; Fang, Y. Green credit, financing structure, and enterprise environmental investment. *J. World Econ.* **2022**, *45*, 57–80.
14. Si, L.; Cao, H. Can green credit policies improve corporate environmental and social responsibility: From the perspective of external constraints and internal concerns. *China Indust. Econ.* **2022**, *4*, 137–155.
15. Hu, Y.; Jiang, H.; Zhong, Z. Impact of green credit on industrial structure in China: Theoretical mechanism and empirical analysis. *Environ. Sci. Pollut. Res.* **2020**, *27*, 10506–10519. [CrossRef] [PubMed]
16. Xu, X.; Li, J. Asymmetric impacts of the policy and development of green credit on the debt financing cost and maturity of different types of enterprises in China. *J. Clean. Prod.* **2020**, *264*, 121574. [CrossRef]
17. Zhang, S.; Wu, Z.; Wang, Y. Fostering green development with green finance: An empirical study on the environmental effect of green credit policy in China. *J. Environ. Manag.* **2021**, *296*, 113159. [CrossRef] [PubMed]
18. Gu, X.; An, X.; Hou, Y. Financing constraints or transformation incentives—Research on the impact of green credit on TFP of heavy polluting enterprises in China. *Theor. Pract. Financ. Econ.* **2023**, *44*, 26–33.
19. Tian, L.; Nie, Y. A review of green credit research in China based on knowledge graph. *Sci. Res. Manag.* **2023**, *44*, 97–104.
20. Xiao, X.; Tian, Q.; Wang, Z. Can stakeholder environmental orientation promote green innovation—A moderated mediation effect model. *Sci. Res. Manag.* **2021**, *42*, 159–166.
21. Zhang, Z.; Mu, T.; Yu, X. A study on the impact of the quality of corporate social responsibility information disclosure on green innovation: Evidence from listed manufacturing companies. *J. Shandong Unvi. Financ. Econ.* **2023**, *35*, 98–107.
22. Yu, F.; Yuan, S.; Hu, Z. Research on the impact of knowledge base and knowledge distance on green innovation of enterprises. *Sci. Res. Manag.* **2021**, *42*, 100–112.
23. Wang, X.; Chu, X. A study on the same group effect of green technology innovation in manufacturing enterprises: A reference role based on multilevel context. *Nankai Bus. Rev.* **2022**, *25*, 68–81.
24. Shen, L.; Fan, R.; Wang, Y. Impacts of environmental regulation on the green transformation and upgrading of manufacturing enterprises. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7680. [CrossRef] [PubMed]
25. Zhang, B.; Yu, L.; Sun, C. How does urban environmental legislation guide the green transition of enterprises? Based on the perspective of enterprises' green total factor productivity. *Energy Econ.* **2022**, *110*, 106032. [CrossRef]
26. Lu, Y.; Gao, Y.; Zhang, Y. Can the green finance policy force the green transformation of high-polluting enterprises? A quasi-natural experiment based on "Green Credit Guidelines". *Energy Econ.* **2022**, *114*, 106265. [CrossRef]
27. Yao, X.; Chen, L.; Zhang, Y. Carbon trading mechanism and green innovation of enterprises: Based on the triple difference model. *Sci. Res. Manag.* **2022**, *43*, 43–52.

28. Wang, X.; Zhang, X.; Zhu, R. The value creation effect of "environmental supervision" from the perspective of enterprise green innovation: A quasi-experimental study based on environmental interviews. *Sci. Res. Manag.* **2021**, *42*, 102–111.
29. Liu, J.; Xiao, Y.; Zhu, R. China's environmental protection tax and green innovation: Leveraging effect or crowding out effect? *Econ. Res. J.* **2022**, *57*, 72–88.
30. Tian, C.; Li, X.; Xiao, L. Exploring the impact of green credit policy on green transformation of heavy polluting industries. *J. Clean. Prod.* **2022**, *335*, 130257. [CrossRef]
31. Chen, B.; Luo, P.; Yang, J. Interaction between bank and tax, financing constraints, and investment and financing of small and micro enterprises. *Econ. Res. J.* **2021**, *56*, 77–93.
32. Wang, H.; Wang, S.; Miao, Z.; Li, X. The heterogeneous threshold effect of R&D investment on green innovation efficiency: An empirical study based on China's high-tech industry. *Sci. Res. Manag.* **2016**, *37*, 63–71.
33. Cai, Q.; Chen, Y.; Lin, K. Availability of credit resources and enterprise innovation: Incentives or restraints-micro evidence based on bank outlet data and financial geographic structure. *Econ. Res. J.* **2020**, *55*, 124–140.
34. Zhang, F.; Yu, H. Has the green credit policy driven green innovation in heavily polluting enterprises-Empirical testing based on the theory of enterprise life cycle. *Nankai Bus. Rev.* **2023**, *1*, 1–22.
35. He, L.; Liu, R.; Zhong, Z. Can green financial development promote renewable energy investment efficiency? A consideration of bank credit. *Renew. Energy.* **2019**, *143*, 974–984. [CrossRef]
36. Zhang, J.; Luo, Y.; Ding, X. Can green credit policy improve the overseas investment efficiency of enterprises in China? *J. Clean. Prod.* **2022**, *340*, 130785. [CrossRef]
37. Chen, Y.; Guan, J.; Tian, D. Research on the micro effects of green credit policies: Punishment or incentives-Retesting the porter effect of green credit policy. *J. Fianc. Dev. Res.* **2022**, *9*, 50–61.
38. Gu, H.; Zhu, H. Will fulfilling social responsibility affect commercial banks' risk-taking-Based on related party transactions, loan clustering, and green credit channels. *China Soft Sci.* **2023**, *2*, 136–145.
39. He, J.; Wei, Y. Research on the impact of green finance development on high quality economic growth. *Finac. Econ.* **2023**, *7*, 48–60.
40. Hu, G.; Wang, X.; Wang, Y. Can the green credit policy stimulate green innovation in heavily polluting enterprises? Evidence from a quasi-natural experiment in China. *Energy Econ.* **2021**, *98*, 105134. [CrossRef]
41. Wang, H.; Qi, S.; Zhou, C. Green credit policy, government behavior and green innovation quality of enterprises. *J. Clean. Prod.* **2022**, *331*, 129834. [CrossRef]
42. Li, Z.; Wang, W. Can the environmental responsibility performance of "too much speech and too little action" affect bank credit acquisition: A text analysis based on the dual dimensions of "speech" and "action. *Finac. Res.* **2021**, *12*, 116–132.
43. Chen, G.; Ding, S.; Zhao, X. China's green finance policy, financing costs, and green transformation of enterprises: From the perspective of the central bank's collateral policy. *Finac. Res.* **2021**, *12*, 75–95.
44. Li, C.; Lv, X.; Wu, G. R&D investment, financing constraints and green-tech content of Chinese exports. *Sci. Res. Manag.* **2015**, *36*, 28–35.
45. Petroni, G.; Bigliardi, B.; Galati, F. Rethinking the porter hypothesis: The underappreciated importance of value appropriation and pollution intensity. *Rev. Policy Res.* **2019**, *36*, 121–140. [CrossRef]
46. Yu, B. How green credit policies affect technological innovation in heavily polluting enterprises. *Bus. Manag. J.* **2021**, *43*, 35–51.
47. Testa, F.; Iraldo, F.; Frey, M. The effect of environmental regulation on firms' competitive performance: The case of the building & construction sector in some EU regions. *J. Environ. Manag.* **2011**, *92*, 2136–2144.
48. Lu, J.; Yan, Y.; Wang, T. Research on the micro effects of green credit policy: From the perspective of technological innovation and resource reallocation. *China Indust. Econ.* **2021**, *1*, 174–192.
49. Porter, M.; Van, L. Toward a new conception of the environment-competitiveness relationship. *J. Econ. Perspect.* **1995**, *9*, 97–118. [CrossRef]
50. Jiang, W. Does environmental regulation affect R&D innovation in Chinese manufacturing enterprises: Empirical research based on micro data. *Finan. Res.* **2015**, *41*, 76–87.
51. Yu, X.; Zhou, Y. Green credit policy and green transformation of high polluting enterprises: From the perspective of emission reduction and development. *Quant. Econ. Technol. Res.* **2023**, *40*, 179–200.
52. Su, D.; Lian, L. Does green credit affect the investment and financing behavior of heavily polluting enterprises? *Finac. Res.* **2018**, *12*, 123–137.
53. Li, D.; Gou, C.; Han, M. Research on the influence mechanism of green finance on the quality of green innovation of private enterprises: Evidence from China. *Environ. Sci. Pollut. Res.* **2023**, *30*, 30905–30918. [CrossRef] [PubMed]
54. Chai, S.; Zhang, K.; Wei, W. The impact of green credit policy on enterprises' financing behavior: Evidence from Chinese heavily-polluting listed companies. *J. Clean. Prod.* **2022**, *363*, 132458. [CrossRef]
55. Chen, Q.; Zhang, G. Research on the impact of green credit on corporate debt financing: Empirical data from heavy polluting enterprises. *Financ. Account. Comm.* **2019**, *8*, 36–40.
56. An, S.; Li, B.; Song, D. Green credit financing versus trade credit financing in a supply chain with carbon emission limits. *Eur. J. Oper. Res.* **2021**, *292*, 125–142. [CrossRef]
57. Claessens, S.; Perotti, E. Finance and inequality: Channels and evidence. *J. Comp. Econ.* **2007**, *35*, 748–773. [CrossRef]

58. O'Toole, C.; Newman, C. Investment financing and financial development: Evidence from Viet Nam. *Rev. Financ.* **2017**, *21*, 1639–1674. [CrossRef]
59. He, L.; Zhang, L.; Zhong, Z. Green credit, renewable energy investment and green economy development: Empirical analysis based on 150 listed companies of China. *J. Clean. Prod.* **2019**, *208*, 363–372. [CrossRef]