



Research on the Relationship Between Corporate Social Responsibility, Regional Financial Risk Level and Enterprise Green Innovation

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Abstract. Taking the listed companies of SHANGHAI SHENZHEN 300 INDEX from 2010 to 2020 as samples, taking the regional financial risk level as the adjustment variable, the data are obtained through SIPO patent database, CSMAR database and China economic statistics network. The original data are analyzed by reviews 11 using the benchmark regression model, and the endogeneity is tested by the least square method in order to explore the transmission path of corporate social responsibility on corporate green innovation. The results show that the improvement of corporate social responsibility can effectively promote the development of green innovation. The lower the degree of regional financial risk, the greater the positive impact of corporate social responsibility on corporate green innovation.

Keywords: corporate social responsibility · corporate green innovation; green information disclosure · regional financial risk level

1 Introduction

At present, there are two ways of enterprise green innovation: one is to force enterprises to carry out green innovation through environmental and other regulations; the other is to actively carry out green innovation in order to obtain excess profits through market-oriented incentive mechanism [1], and the means of enterprise green innovation can be divided into green technology innovation and green product innovation [2]. Through the implementation of green innovation, it improves environmental performance and realize the unity of environmental performance and economic performance [3].

Considering the micro differences of enterprises, this paper takes corporate social responsibility as the core explanatory variable, regional financial risk level as the regulating variable, and enterprise R&D investment, enterprise scale and other variables into the control variables, in order to provide a theoretical basis for different types of enterprises in China to improve the performance of green innovation by performing social responsibility. The research conclusion can not only provide a new research perspective for the green transformation of enterprises in the new era, but also help to establish the

relationship between regional financial market and micro enterprise behavior, and provide effective solutions for enterprises to implement green innovation. It has important theoretical and practical value.

Using Hexun's corporate social responsibility scoring index from 2010 to 2020 and the data of SHANGHAI SHENZHEN 300 INDEX, this paper studies the mechanism of corporate social responsibility on micro enterprise green innovation, and the difference of the impact of corporate social responsibility on Enterprise Green Innovation under different regional financial risk levels. The structure of this paper is as follows: first, review the existing literature on corporate green innovation, corporate social responsibility and related variables, and draw the research hypothesis and research design; second, conduct benchmark regression analysis, heterogeneity test and robustness test on related variables, and finally draw the corresponding conclusions through the analysis results.

2 Literature Review

2.1 Influencing Factors of Enterprise Green Innovation

At present, the existing literature on the influencing factors of enterprise green innovation mainly analyzes from the aspects of market demand, enterprise scale, environmental regulation, policy impact and so on. Enterprise green innovation is different from general innovation. It has the characteristics of "double externality". In terms of market demand, Rennings (1998) research shows that market factors (such as consumer demand, product market competition, etc.) have a significant positive impact on enterprise green product innovation. Zhao Aiwu et al. (2018) simulated the process of consumer product selection and enterprise environmental innovation from the perspective of consumer heterogeneous demand, with heterogeneous enterprises with different innovation attitudes, innovation preferences and disposable funds, as well as heterogeneous consumers with different preferences for product price, quality and environmental attributes. Finally, it is considered that the heterogeneous preference of consumers for product attributes affects the environmental innovation performance of enterprises. In terms of enterprise scale, at present, there is no unified conclusion on the impact of enterprise scale on enterprise green innovation. Baylis, Connell et al. (1998) believes that large enterprises have more human and material resources and have more ability and opportunities to reduce the impact of corporate behavior on the environment. Chen Zewen (2019) selected 133 enterprises as samples and used multiple level regression to draw the correlation between enterprise core competitiveness and enterprise green image: on the one hand, a variety of abilities and skills formed by core competence in the implementation of comprehensive green innovation strategy match with a good environmental management system and form a unique path dependence; On the other hand, core competence forms competitive advantages that are difficult to be imitated and replaced by competitors by stimulating enterprise creativity and integrating internal and external environment, which is the source of enterprise high performance. However, some scholars hold different views. Noci and Verganti [8] believe that the organizational structure of small enterprises is relatively simple, and the way of resource utilization is different from that of traditional large enterprises. They are more flexible than large enterprises in green innovation.

Darnall et al. [9] research shows that small enterprises have more significant resource constraints and stronger innovation vitality, and the whole decision-making process is simpler than that of traditional large companies. They are more likely to actively carry out green innovation in response to the pressure of stakeholders.

In terms of environmental regulation, based on the panel data of 30 provinces in China in recent 10 years, Liu Mingguang (2021) took green process innovation as an intermediary variable to explore the transmission path of environmental regulation on green innovation, and then investigated the synergistic effect of the parallel policy of the combination of command-based and market-based environmental regulation on green innovation. The results show that green process innovation has a positive conduction effect between environmental regulation and green product innovation; The synergy effect of green innovation of the combination of two environmental regulation policies is mainly determined by market-oriented environmental regulation. Only when the intensity of market-oriented environmental regulation exceeds a specific threshold, the combination of two environmental regulations can lead to the maximum effect of green innovation. Based on the panel data of various industries in China's manufacturing industry, Zhu Dongdan and others (2021) believe that environmental regulation and industrial agglomeration can promote the efficiency of green innovation. Porter and VanderLinde (2010) believe that environmental regulation can force enterprises to green innovation. By innovating environmental protection and green products and markets, enterprises can expand new markets and seek new profit sources, so as to reduce or compensate the investment cost of environmental innovation. In terms of policy impact, based on the quantitative study of 1533 environmental regulation and technological innovation policies issued by the central government and various ministries and commissions (excluding local regulations issued by provinces and cities) from 1994 to 2017, Dang Guoying and others (2021) found that although there are some differences in the specific incentive effects of the characteristics of green innovation policies, they show a significant incentive effect on green technological innovation as a whole. As the only way of enterprise reform under sustainable development, enterprise green innovation has also become the focus of academic attention. Many scholars actively explore the path choice of green innovation. In addition to the above factors, many scholars also explore the influencing factors of enterprise green innovation from the frontier fields of finance such as digital finance. Among them, Zhai Huayun and Liu Yisi (2021) used the stepwise regression method to test the impact of digital Finance on Enterprise Green Innovation Based on the sample data of Shanghai and Shenzhen A-share listed companies from 2011 to 2019. The results show that the development of digital finance can effectively promote the quantity and quality of enterprise green innovation, and the development of digital finance can stimulate the improvement of enterprise green innovation level by alleviating financing constraints. Yu Desheng and Yang Lihua (2021) selected the micro level data and inter provincial panel data of polluting industries in the A-share market from 2011 to 2018, and found that there is a significant and stable positive relationship between digital finance and enterprise green innovation. Digital finance mainly promotes the green innovation ability of enterprises by reducing the financing difficulty of enterprises.

2.2 Definition, Influence Mechanism and Path of Corporate Social Responsibility

Corporate social responsibility (CSR), as the action of enterprises to coordinate themselves with market, government, environment and other stakeholders, there is little literature on its impact on green innovation. According to the research on relevant fields in the existing literature, the conclusion of the impact mechanism of corporate social responsibility on corporate green innovation can be divided into two aspects. On the one hand, Rao Shuling and Chen Ying (2019) believe that the implementation of investment ideas and ideas related to corporate social responsibility is conducive to guiding financial institutions to invest funds in corresponding green industries, improving the green investment ability of financial institutions, cultivating the self-growth and sustainable development ability of green finance, and improving the climate and environmental risk management level of financial institutions, so as to better promote green innovation of enterprises. At the same time, based on the theory of information symmetry, for enterprises suffering from capital shortage and financing difficulties, it undertakes social responsibility, improves the defect of non-transparency of public information, reduces the level of information asymmetry between investors and enterprises, and strives for market support for enterprises, which is conducive to enterprises to obtain relevant green innovation subsidies and financial support. Based on the resource-based theory, Hart (1995) believes that the performance of corporate social responsibility can bring an intangible resource to the enterprise itself, and the enterprise can use this intangible resource for enterprise green innovation. From the perspective of Organizational Resilience, based on the panel data of 467 Chinese manufacturing listed companies from 2016 to 2020, Liu Bin and Tan Shuqi (2022) found through empirical analysis that corporate social responsibility from the three dimensions of shareholders, employees and society has a significant positive impact on the sustainable growth of corporate performance.

On the other hand, corporate social responsibility may also interfere with corporate green innovation. According to the self-interest of management, Meng Qingbin and Hou Chanran (2020) found that taking social responsibility cannot deliver effective information to investors, and the profit seeking behavior of management distorts social responsibility into a tool for information masking. In addition, the research of Tian Lihui and Wang Kedi (2017) shows that the research of management self-interest shows that the implementation of social responsibility will also bring other negative effects, improve the trend of enterprise financialization, aggravate the risk of stock price collapse, and bring resistance to the long-term development of enterprises.

2.3 Definition, Influence Mechanism and Path of Regional Financial Risk Level

Different scholars have different research emphases on the level of regional financial risk, and the corresponding conclusions are also different. Based on the local financial risk pressure index, Shen Li et al. (2019) found that the spatial correlation network of local financial risks in China is a typical “scale-free network”, the number of correlation relationships in each province is unevenly distributed, and there is also a “small world phenomenon”, and there are obvious spatial correlation and contagion effects of local financial risks. Wang Ying and Cao Tingqiu (2017) based on the network analysis method, the results show that the regional financial risks among provinces in China

are highly correlated and highly infectious. At present, with regard to the overall situation of regional financial risks among provinces in China, Xie Kun (2019) and others have established a provincial financial risk measurement index system based on various factors affecting regional financial risks. On this basis, empirical analysis is carried out. The results show that China's regional financial risks rise successively from the western region to the central region and then to the eastern region. At present, there is little literature on the impact of regional financial risk level on enterprise green innovation. According to the research on relevant fields in the existing literature, the regional financial risk level mainly affects the enterprise financing level through the medium of commercial banks, so as to affect the enterprise green innovation activities. At present, there is no clear conclusion on the impact of regional financial risk level on enterprise green innovation. On the one hand, regional financial risk level may have an impact on the degree of regional financial agglomeration, thus affecting enterprise green innovation. Zhang Dong and Wang Haojie (2021) used a two-stage network SBM model to measure the efficiency of China's regional industrial green innovation from 2008 to 2017 based on provincial level data. The results show that there is a strong spatial positive correlation between financial agglomeration and the efficiency of two-stage industrial green innovation; Financial agglomeration promotes the improvement of R&D efficiency. On the other hand, the level of regional financial risk may negatively affect the enterprise financing environment through the reflection of credit risk, and negatively affect the enterprise green innovation.

The innovation of this paper is mainly reflected in the following aspects. First, from the perspective of corporate social responsibility, it analyzes how sustainable development affects corporate green innovation, and explores how corporate social responsibility affects corporate green innovation under the background of financial risk level in different regions. Second, under different conditions of green information disclosure, it researches whether there are differences in the impact of corporate social responsibility on corporate green innovation. This study helps to clarify the mechanism and path of corporate social responsibility on corporate green innovation, and reveals the role and importance of corporate social responsibility for corporate sustainable green development.

3 Research Hypothesis

3.1 Corporate Social Responsibility and Corporate Green Innovation

Green innovation is an innovative activity that enterprises use innovative technologies and means to achieve the dual objectives of economic performance and environmental performance for the purpose of improving resource utilization and reducing energy consumption. Enterprises can achieve energy conservation and emission reduction through green process innovation, and can also obtain market share through green product innovation. At the same time, as a green strategy, corporate social responsibility plays an important role in balancing the environment, society and economy. The incorporation of corporate social responsibility into long-term development strategies can guide the development and implementation of corporate social strategies (2019). Therefore, the

positive impact of corporate social responsibility on green innovation is mainly reflected in the following two aspects.

Corporate social responsibility can better bear the pressure exerted by external stakeholders. The number, expectation and stakeholders of any strategy increase greatly. On the whole, it can be divided into two subjects: the government and consumers to exert pressure on enterprises. On the one hand, the pressure exerted by the government on enterprises can be divided into support type, mandatory type and incentive type (2017), and the means of pressure can be divided into laws and regulations, environmental protection supervision punishment and policy guidance. On the other hand, consumers exert pressure on enterprises. Under this pressure, enterprises will actively optimize production links, reduce resource waste and reduce pollution in order to maintain a green and healthy image and obtain first mover advantages, and meet consumers' preferences for sustainable development, environment-friendly and cost-effective.

Corporate social responsibility can better improve the environmental protection orientation of internal stakeholders. The concept of corporate social responsibility will imperceptibly affect corporate shareholders and managers. In resource-based enterprises, when shareholders with forward-looking and environmental protection tendency exert environmental protection pressure on managers, in order to meet the wishes of shareholders, managers will give priority to their environmental protection tendency and established assessment indicators in decision-making and formulate green innovation policies. Only by promoting the practice of green innovation can we obtain shareholder recognition and incentive compensation, retain existing positions or get promotion.

To sum up, hypothesis H1A is proposed.

H1A: corporate social responsibility can promote the improvement of corporate green innovation level.

However, according to the existing literature research, corporate social responsibility does not necessarily have a positive impact on corporate green innovation. Based on the self-interest of management, it believes that the performance of corporate social responsibility will distort information resources, hinder the profit seeking behavior of enterprises, and have an adverse impact on the long-term development of enterprises. Chen Guan (2017) and others studied the impact of social responsibility performance of GEM listed enterprises on innovation performance by taking GEM listed enterprises as samples. Finally, they found that although the social responsibility performance of GEM listed enterprises to creditors is positive, the impact on innovation technology performance is not significant, however, the implementation of social responsibility to customers and suppliers by enterprises listed on GEM has a negative impact on the performance of innovative technology.

The impact of corporate social responsibility on corporate green innovation may play a "strategic innovation tool" in terms of positive impact, but it may also play a "cover up tool" in reverse (2022). Because enterprises may actively disclose information, so as to create the appearance of actively performing their own social responsibility. Its real purpose is to hide major problems and risks within the enterprise. Based on the perspective of enterprise life cycle, enterprises with high enthusiasm to fulfill social responsibility are mostly enterprises with stable development and mature stage. At this

time, such enterprises are limited by the market and themselves, and the vitality of enterprise green innovation is not strong.

To sum up, hypothesis H1B is proposed.

H1B: corporate social responsibility hinders the improvement of corporate green innovation level.

3.2 Regulation of Regional Financial Risk Level

Regional financial risk is the financial risk faced by the financial industry within a regional economy. As far as China is concerned, due to the different economic and social development in different regions and the great differences in relevant aspects, there may also be regional differences in regional financial risks. Generally speaking, the economic and social development of the eastern region is relatively full, the financial market is dynamic and the financial system has strong pressure resistance. However, from the perspective of local debt, the volume of government debt is large and the growth rate is fast; The economy of the western region is fragile and the financial market still needs to be developed. From the perspective of local debt, it is found that the scale of government debt is small and the debt risk is relatively low (2021).

The overall spatial pattern of China's green innovation is relatively stable, but there are significant differences in the space of green innovation among provinces. The green innovation among provinces shows significant positive spatial autocorrelation (2016). To some extent, the level of regional financial risk can reflect the economic development of regional enterprises and the activity of regional finance, so as to reflect and support enterprises to fulfill their social responsibilities. Preventing credit risk is an inherent requirement of the development of the financial industry, an effective way to improve the quality of financial services, and an important basis for relevant enterprises to fulfill their social responsibilities (2009).

To sum up, hypothesis H2 is proposed.

H2: the level of regional financial risk reversely regulates the impact of corporate social responsibility on corporate green innovation, that is, the lower the degree of regional financial risk, the greater the positive impact of corporate social responsibility on corporate green innovation.

4 Research Design

4.1 Sample Selection and Source

This paper takes the listed companies of SHANGHAI SHENZHEN 300 INDEX from 2010 to 2020 as the research sample, and processes the data as follows: ① eliminate the listed and delisted companies during the sample period; ② Eliminate enterprises with missing financial data; ③ Eliminate samples with data less than 5 consecutive years; ④ Remove the companies with missing data related to the main research variables; ⑤ The variables were Winsorized with less than 1% and more than 99%, and 666 "enterprise

year” observation samples were finally obtained. In the sample, the green innovation data comes from SIPO patent database of the State Intellectual Property Office, and other relevant data come from CSMAR database and China economic statistics network. The original data are preprocessed by reviews 11, and then analyzed.

4.2 Variable Measurement

4.2.1 Explained Variable: Enterprise Green Innovation

At present, there is no unified standard for the measurement of enterprise green innovation at home and abroad. At present, according to the existing literature research, relevant scholars mainly take the number of enterprise green patents as the index of green innovation. Enterprise green patents can be divided into invention patents and utility model patents. Therefore, based on the method of Yu Desheng and others(2021), this paper sums up the number of green invention patents and utility model patents obtained by the enterprise in that year, and then takes the logarithm to measure the green innovation ability of the enterprise. The reason for choosing green patent authorization quantity rather than application quantity is that although patent authorization lags behind, there are certain differences between enterprise green patent application quantity and authorization quantity, and the authorization quantity can better reflect the level and quality of enterprise green innovation.

4.2.2 Core Explanatory Variable: Corporate Social Responsibility (CSR)

Hexun’s CSR evaluation system has evaluated the social responsibility performance of all A-share listed companies in Shanghai and Shenzhen since 2010, including 5 first-class indicators, 13 s-class indicators and 37 third-class indicators. It can evaluate the performance of corporate social responsibility more comprehensively and objectively. It has a certain authority and has been recognized and used by many domestic scholars. Therefore, this paper chooses this index to measure the variable of corporate social responsibility (CSR). Because this paper selects 300 listed companies in Shanghai and Shenzhen from 2010 to 2020 as the research object, compared with the CSR index of Hexun, the time span of runling corporate social responsibility index is larger, which is more in line with this study.

4.2.3 Adjusting Variable: Regional Financial Risk Level

At present, the academic circles have not reached a unified method for measuring the level of regional financial risk. Referring to the research of Shen Li et al. (2019), the indicators of the financial sector reflect the risk accumulation caused by financial institutions and market operation, and the ratio of the number of loans of financial institutions in each province to the GDP of each province is selected to reflect the difference of financial risk level among provinces.

4.2.4 Control Variable

In order to avoid the errors caused by missing variables, this paper selects several variables with high correlation with green innovation at the enterprise level as the control variables, involving enterprise characteristics and corporate governance. Among them, enterprise characteristic variables include: (1) enterprise R&D investment intensity (R&D), using the current internal R&D investment expenditure of the enterprise as the proxy variable; (2) The age of the enterprise, taking the time of the establishment of the enterprise as the proxy variable; (3) Asset liability ratio (DAR); (4) Return on assets (ROA) takes the ratio of net profit to average total assets as the proxy variable. Corporate governance variables include: (1) the first shareholder; (2) Enterprise scale (CS) takes the logarithm of the total assets of the enterprise at the end of the period as the proxy variable.

4.3 Model Setting

This paper examines the impact of corporate social responsibility on corporate green innovation by constructing a benchmark regression model. The model is constructed as follows:

$$innov_{i,t} = \beta_0 + \beta_1 csr_{i,t} + \beta_2 control_{i,t} + \varepsilon_{i,t}$$

$csi_{i,t}$ is the explanatory variable, which indicates the degree of social responsibility fulfillment of enterprise i in year t , $innov_{i,t}$ is the explained variable, which indicates the green innovation level of enterprise i in year t . $controls_{i,t}$ includes all the control variables mentioned above by enterprise i in year t , $\varepsilon_{i,t}$ is the random disturbance term.

5 Analysis of Empirical Results

5.1 Descriptive Statistics

Table 1 shows the descriptive statistical results of variables. The results show that the average value of enterprise green innovation after taking logarithm is 1.8576, indicating that the level of enterprise green innovation is low. From the maximum and minimum values, there are great differences in the level of green innovation among enterprises. After the standardization of corporate social responsibility, the maximum value is 0.902 and the minimum value is -0.0522 , indicating that there are great differences in the level of corporate social responsibility. At the same time, it also shows that there is still a large growth space for enterprises to undertake social responsibility.

5.2 Benchmark Regression Analysis

The effect of corporate social responsibility on corporate green innovation is shown in Table 2. According to the probability p value corresponding to F statistics, the model has strong explanatory power. According to the series of Table 2, the estimated coefficient of corporate social responsibility (CSR) is 0.4255, and the p value is less than 0.1, which

Table 1. Descriptive statistical results of variables

Var	Mean	Max	Min	S.D.	N
Ininnov	1.8576	6.8987	0.0000	1.5942	666
csr	0.3722	0.9024	-0.0522	0.2077	666
cs	24.5651	29.4131	20.3776	1.5185	666
dar	0.5021	0.9339	0.0435	0.1683	666
roa	0.0748	0.3986	-0.1356	0.0648	666
rd	3.9532	41.33	0.0000	4.2339	666
fin	0.5541	1.0000	0.0000	0.4974	666
age	22.4009	37.0000	8.0000	4.4879	666
fsholder	0.0164	0.1637	0.0007	0.0185	666

Table 2. The impact of corporate social responsibility on corporate green innovation: benchmark regression results and regulatory effects

Variable	Benchmark regression	Regulation effect
Csr	0.4255*	1.1233***
	(-1.7351)	(3.1238)
Rd	0.0445***	0.0410***
	(3.4316)	(3.1658)
Age	-0.0266**	-0.0235**
	(-2.3714)	(-2.0650)
Cs	0.8122***	0.7975***
	(17.3832)	(16.9232)
fsholder	-32.7729***	-33.6188***
	(-8.3681)	(-8.6159)
Roa	-0.1589	-0.4070
	(-0.1606)	(-0.4122)
Dar	0.548	0.6516
	(1.3067)	(1.5512)
Fin		0.6666*
		(3.2249)
fin*csr		-1.2649***
		(-2.6433)

(continued)

Table 2. (continued)

Variable	Benchmark regression	Regulation effect
C	-17.5594***	-17.6408***
	(-14.7411)	(-14.8322)
adj-R ²	0.3611	0.3712
N	666	666

is significant at the 10% significance level, indicating that the improvement of corporate social responsibility can significantly improve the level of green innovation. The possible reasons are: for the enterprise management, actively performing CSR helps to narrow the relationship between the enterprise and stakeholders, and many problems faced by the enterprise in green innovation, such as lack of capital, technology and equipment, can often be solved, thus laying a material foundation for the enterprise's green innovation; For enterprise employees, actively fulfilling corporate social responsibility can enhance employees' organizational identity(Liu Dejun et al. 2020), so as to enhance employees' enthusiasm for innovation and lay a human foundation for enterprise green innovation; For the enterprise as a whole, actively performing CSR can create a positive atmosphere within the enterprise. While pursuing financial performance, the collective or individual will also pay more attention to social performance such as environmental protection, thus laying an environmental foundation for enterprise green innovation.

In addition to the important impact of corporate social responsibility on corporate green innovation, the impact of other control variables on green innovation is also worthy of attention. The regression coefficient of enterprise R&D investment is significantly positive, which shows that enterprise R&D investment under corporate social responsibility has a significant positive impact on green process innovation, that is, the more R&D investment, the better the effect of enterprise green innovation. Possible reasons for this phenomenon: on the one hand, the continuous strengthening of consumers' green preference intensifies the domestic market competition, domestic enterprises maintain the market position, continue to innovate and increase the R&D investment in green process innovation; On the other hand, under the requirements of corporate social responsibility, the entry threshold of ordinary enterprises has been raised, making the current green technology content of the market relatively high. The original enterprises rely on their R&D investment to accelerate the effective absorption and utilization of green process innovation, which is conducive to the improvement of the level of green process innovation (Tan Deqin et al. 2008).

5.3 Regulation Effect Analysis

After introducing the regional financial risk level as the adjustment variable, the improvement of corporate social responsibility can still significantly improve the level of green innovation, which is consistent with the conclusion of benchmark regression analysis. It can be seen from the regulation effect column that the regional financial risk level coefficient is significantly positive at the level of 1%, indicating that the regional financial

risk level has a positive regulation and promotion effect on enterprise green innovation, while the interaction coefficient between the regional financial risk level and corporate social responsibility is significantly negative at the level of 1%, indicating that the lower the degree of regional financial risk, The greater the positive impact of corporate social responsibility on corporate green innovation, which confirms the previous research hypothesis H2.

6 Heterogeneity Test

According to the green information disclosure status of sample enterprises, they can be divided into disclosure and non-disclosure groups. The grouping empirical results are shown in Table 3. It can be seen that the estimated coefficient of undisclosed enterprise green information is 0.3794, which fails to pass the significance test; The estimation coefficient of enterprise green information disclosure is 0.5784, and it has passed the significance test under the confidence level of 10%.

The possible explanation is: for enterprises that do not carry out green information disclosure, the external pressure is small and the demand for their own information transparency is low. At the same time, due to industry classification and other reasons, they have low correlation with green production. Therefore, they do not carry out green information disclosure and have little demand for green innovation. For enterprises that disclose green information, they are more likely to bear higher public pressure (Charles et al. 2006). Under the high attention of the public, in order to stabilize their image, respond to the close attention of multiple stakeholders and bear more social responsibility(Wang Xia et al. 2013), the level of corporate social responsibility should be higher, which significantly improves the level of green development of enterprises.

Table 3. Heterogeneity analysis results

Variable	Enterprise green information disclosure	
	Disclosure	Non-disclosure
csr	0.5784* (1.9137)	0.3794 (0.8526)
constant	-22.1765*** (-14.5858)	-7.5239*** (-3.1359)
control var	control	control
N	440	226
adj-R ²	0.4285	0.1621

7 Robustness Test

7.1 Excluding 2020 Data

This paper tests the robustness of the model by changing the measurement of core explanatory variables. In 2020, COVID-19 had a deep influence on production and life. Therefore, the data in 2020 were excluded, and the data of hexun.com CSR score and Shanghai and Shenzhen 300 share index in 2010–2019 were tested again. The results are basically the same as the benchmark regression results. The corporate social responsibility index excluding the 2020 data has a significant positive effect on enterprise green innovation at the significant level of 10%, and the results of the control variables are basically the same (Table 4).

7.2 Endogenous Test

When using benchmark regression to study the impact of corporate social responsibility on corporate green innovation, it may cause endogenous problems due to inappropriate

Table 4. Robustness test results: excluding 2020 data

Variable	Coefficient
csr	0.4243* (1.7332)
cs	0.7972*** (16.8400)
dar	0.6474 (1.5343)
roa	-0.3111 (-0.3139)
rd	0.0420*** (3.2231)
age	-0.0224* (-1.9611)
fin	0.1956* (1.8583)
fsholder	-33.2321*** (-8.4842)
c	-17.4124*** (-14.6126)
adj-R ²	0.3645
N	666

control variables, missing variables or mutual causality. In this paper, considering that corporate green innovation and corporate social responsibility may be mutual causality, the endogenous test is carried out. Specifically, on the one hand, corporate social responsibility may promote the development of corporate green innovation, on the other hand, the improvement of corporate green innovation ability may also affect the level of corporate social responsibility. Therefore, in order to make the research results more credible, it is necessary to test the endogeneity of the model. In this paper, the two-stage least square method (2SLS) is used for regression. In order to solve the endogenous problem, the CSR index of Hexun enterprises lags behind for two periods is selected as the instrumental variable. On the one hand, there is a correlation between corporate social responsibility and its lag phase II; On the other hand, because the lag variable has occurred, it is not related to the disturbance term of the current period, which meets the correlation and exogenous requirements of instrumental variables. The results show that at the significant level of 5%, corporate social responsibility has a significant role in promoting corporate green innovation, which is basically consistent with the benchmark regression results, which further shows the reliability of the research results (Table 5).

Table 5. Endogenous test results

Variable	Coefficient
csr	1.9774** (2.394503)
cs	0.9282*** (16.20583)
dar	0.2800 (0.580794)
roa	-1.1801 (-0.911558)
rd	0.0560*** (3.8381)
fin	0.1314 (1.124703)
age	-0.0148 (-1.161166)
fsholder	-36.5036*** (-8.473901)
c	-21.1162*** (-13.8562)
Adj-R ²	0.3547
N	557

8 Research Conclusion and Enlightenment

Based on the empirical analysis of the panel data of the listed companies of SHANGHAI SHENZHEN 300 INDEX from 2010 to 2020, this study discusses the internal mechanism of the impact of CSR on green innovation. According to the empirical results, this study draws the following conclusions: (1) enterprises' active performance of social responsibility can improve the level of green innovation. (2) Regional financial risk level plays a partial regulatory role in the relationship between CSR and green innovation, and reversely regulates the relationship between CSR and green innovation. (3) For enterprises with better green information disclosure, the incentive effect of fulfilling social responsibility on enterprise green innovation is more significant. Therefore, enterprises should root the concept of "adhering to sustainable development" and "green water and green mountains are golden mountains and silver mountains" in corporate culture, integrate corporate social responsibility with green innovation development strategy, and focus on short-term performance to the realization of long-term and sustainable performance.

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