Does Heterogeneous CSR Affect Corporate Performance?

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Abstract: The market rivalry and China's ongoing economic expansion are both contributing to a gradual rise in shareholder influence over businesses. Fulfilling corporate social responsibility (CSR) is becoming more and more important to improve corporate performance, gain long-term competitive advantage and achieve sustainable development. Based on panel data of 514 listed Chinese A-share companies from 2015-2019, this study applies a two-way fixed effect model to examine the effect of CSR on corporate performance from stakeholders' perspectives. And it also examines the mediating effect played by green technological innovation and the moderating effect of two basic corporate competitive strategies on the role of CSR in corporate performance. The study's findings indicate that: (1) the fulfillment of CSR has a significant positive impact on corporate performance. (2) Green technology innovation plays a part in mediating the process of fulfilling CSR in promoting corporate performance. Internal CSR fulfillment enhances corporate performance by boosting investment in green technology innovation, but external CSR fulfillment enhances corporate performance by decreasing investment in green technology innovation. (3) The positive effect of CSR on corporate performance is weakened by an increase in the level of low-cost strategies, while the positive relationship between CSR and corporate performance is strengthened by an increase in the level of differentiation strategies.

1 Introduction

Presently, with the economic globalization and increasing social and environmental problems, CSR has the ability to increase economic, environmental and social value and thus enhance corporate performance, so its importance to the enterprise is increasingly prominent. In this context, if enterprises want to pursue their own interests to achieve corporate performance growth, they need to assume CSR. In addition, corporate stakeholders are increasingly concerned about social and environmental issues. Depending on the type of stakeholder and the content of the responsibility, CSR can be subdivided into two categories: internal and external CSR. The proper implementation of internal and external CSR makes it easier for companies to access key resources and external investment, thereby contributing to the growth of corporate performance. For example, Zhongshan Vatti Gas Appliances Co., Ltd. actively fulfills its internal CSR. The company adheres to the "people-oriented" employment concept and sets up a safety production committee to coordinate all related matters in labor production. In the end, they have taken a multi-faceted approach to increase employee motivation and satisfaction, driving the company's growth. P&G has been actively fulfilling its external CSR. They began implementing the Hope Engineering Social Welfare Project in 1989. Up to now, P&G has donated 200 P&G Hope Primary Schools, benefiting more than 350,000 rural children. P&G's mature school construction concept and the system have also attracted the participation of many companies from different fields. This broadens the stage for P&G's business cooperation and promotes the long-term development of P&G. However, enterprises are "interest-driven" socio-economic organizations, and CSR benefits have a long period and great uncertainty. Therefore, it is urgent to explore whether fulfilling corporate social responsibility can promote corporate performance.

Eco-environmental conservation has emerged as one of the critical aspects of economic development that cannot be overlooked given the modern economy's rapid development. In addition, the frequent occurrence of environmental and other problems has made consumers gradually inclined to choose green products. In this case, green development is no longer the choice of enterprises, but the way to go. Krabbe [1] (1992) et al. point out that without green technology innovation, there will be no sustainable development in the real sense, which shows that innovation in green technology has become the inevitable choice for sustainable green business development. For example, in response to the proliferation of water hyacinths, Xiamen Green Wave Bio-technology Co., Ltd. has achieved a virtuous circular economic chain through green technology innovation and enabled the company to achieve good environmental and economic benefits. However, because of the high risk, high cost and time-consuming characteristics of green innovation, enterprises usually need to bear high financial pressure. Investigating whether green technology innovation can support the expansion of corporate financial performance while maintaining environmental advantages is thus very crucial.

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The visual return from CSR investment is an important motivation for enterprises to actively fulfill their CSR, but the trade-off between cost and actual value return often makes enterprises reluctant or afraid to undertake CSR. Therefore, the question of whether the relationship between CSR and corporate performance is affected by other factors also needs to be studied. In addition, Studies have shown that the impact of CSR is often constrained by the ability of enterprises to allocate resources and assets. The cost structure and performance of businesses vary depending on the strategic direction, and competitive strategy is a crucial tool for businesses to maximize the allocation of their current resources. The link between CSR and corporate performance under various competitive strategies must thus be made clear.

This study aims to investigate the link between corporate internal and external CSR and corporate performance via empirical research in order to address the aforementioned issues. Additionally, this paper intends to introduce green technology innovation as an intermediary variable and corporate competition strategy as a moderator variable to explore their role in the impact of CSR on corporate performance. This paper's primary contributions are: first, this paper builds a theoretical analysis framework based on existing research and uses micro-enterprise information as data samples to quantitatively examine the relationship between CSR, green technology innovation, and corporate performance. This may aid businesses in developing a sound understanding of social responsibility, motivate them to actively participate in green technology innovation activities, and encourage them to avoid and manage environmental pollution as well as enhance the quality and safety of their products. Secondly, this paper explores the mechanism of CSR on corporate performance under different competitive strategy perspectives, which expands the existing research perspectives. This can also provide a more practical basis for enterprises to formulate strategies and plan for development.

The rest of the essay is organized as follows: Section 2 reviews the previous related literature, and the research hypotheses for this work are presented in Section 3. Section 4 introduces the research variables and models of this paper. Section 5 analyzes the empirical results. Section 6 presents the conclusion.

2 Literature review

Through combing the existing literature, this paper finds that the existing studies mainly focus on the relationship between CSR and corporate performance, the relationship between CSR or corporate performance and green technology innovation, and the role of corporate competitive strategy on CSR and corporate performance. Details are as follows.

2.1 Studies of CSR and corporate performance

In the study of the relationship between CSR and corporate performance, most domestic and foreign scholars tend to believe that the fulfillment of CSR will generate corresponding value appreciation and promote the growth of corporate performance. Oyewumi [2] et al. (2018) found that the disclosure of CSR was conducive to further increase in corporate performance. Based on these conclusions, they put forward the view that fulfilling CSR can achieve both financial and non-financial benefits. Perreualt [3] et al. (2022) argued that CSR was an obligation that companies commit to other stakeholders and that having social responsibility can have more positive effects on the development of the company and thus improve its performance. Cheny [4] (2014) had demonstrated that CSR improved corporate performance by reducing corporate agency costs. Zhou [5] et al. (2020) concluded that the fulfillment of CSR was positively correlated with corporate performance. Ju [6] et al. (2005) pointed out that from the perspective of consumers, companies strengthened their corporate reputation by taking CSR, which influenced consumer satisfaction and ultimately consumer loyalty, leading to greater support for the company. In addition, according to Jamali and Karam's [7] (2018) study of the CSR literature from 1990 to 2015, 51% of the studies were organizational-level-focused, 13% were institutional-level-focused, 9% were individual-level-focused, and 27% incorporated two or more levels of analysis. There is a paucity of literature that examines CSR with a stakeholder focus. Therefore, this paper will approach CSR from the perspective of stakeholder theory, dividing CSR into internal and external CSR according to market and non-market stakeholders, to explore its impact on corporate performance.

2.2 Studies of CSR and green technology innovation

As environmental pollution becomes increasingly serious, scholars at home and abroad have begun to explore the relationship between CSR and green technology innovation using empirical studies and case studies, and have reached different conclusions. Clarkson [8] et al. (2007) argued that fulfilling CSR helped to maintain relationships with stakeholders. This allowed companies to attract more investment and had the financial strength to undertake green technology innovation. Cox & Wicks [9] (2011) found that companies with higher charitable giving also invested more in environmental protection. Mao and Wang [10] (2014) studied ROBAM from the perspective of stakeholder theory. They found that expanding a company's focus from stakeholder to non-stakeholder triggered continuous green technology innovation. While Zhang et al. [11] (2016) argued that fulfilling CSR would take up corporate resources, making companies focus on using CSR to gain goodwill and compete for markets, thus neglecting product quality improvement using innovation. By summarizing the literature, this article finds that the roughness and unclear breakdown of CSR variable measures are the main reasons for the divergent conclusions. In addition, more scholars currently focus on the impact of CSR on firms' general technological innovation activities [12] (Zhang,2022). For example, Lettl [13] (2007) pointed out that companies

gained the trust of consumers by providing them with quality products and after-sales service, and developed new products based on consumer feedback, thus increasing the success of technological innovation. LaBahn [14] et al. (2000) believed that by actively fulfilling CSR to suppliers and establishing good relationships with suppliers, companies could take advantage of their advanced technological know-how to develop new and better products. Therefore, this study splits CSR into internal and external views to examine their effects on the development of green technologies and to fill up any research gaps.

2.3 Studies of green technology innovation and corporate performance

Although the literature has pointed out that green technology innovation is a major means of improving the environmental performance of companies [15] (Su et al, 2020), most companies are still reluctant to initiate green technology innovation activities. The reason for this is that green technology innovation has disadvantages such as long investment horizons and unknown direct economic benefits [16] (Li et al,2022). As a result, scholars have come to realize that to stimulate companies to actively engage in green innovation activities, it is important to explore not only the impact of green technology innovation on environmental performance but also the impact of corporate green technology innovation on financial performance. Ilker [17] (2012) concluded that green product innovation had a considerable beneficial influence on the financial performance of the business after using structural equation modeling to evaluate data from 140 manufacturers in Turkey. Ye and Wang [18] (2017) concluded that green innovation positively contributed to both the long-term and short-term financial performance of firms. Green innovation practices, according to King & Lenox [19] (2001), might lower the marginal cost of environmental management and enhance company environmental performance. Li [20] et al. (2020) established a green innovation model and comprehensively analyzed the direct and indirect effects of green innovation. They confirmed that green innovation could significantly improve environmental quality. It can be seen that the literature has confirmed the positive impact of green technology innovation on corporate performance. However, after extensive reading of the literature, it is discovered that there is still a dearth of research analyzing the micro-level effects of green technology innovation on financial and environmental performance. Therefore, this paper will examine the relationship between the two from a micro perspective, trying to supplement the existing literature.

2.4 Studies of the moderating effect of corporate competitive strategy on CSR and corporate performance

In terms of research on the impact of corporate competitive strategy on CSR and corporate performance, both quantitative and qualitative methods have been used by scholars in their studies. Wang [21] et al (2021) concluded that the implementation of both low-cost and differentiation strategies by firms could significantly improve corporate performance. Xiao [22] et al (2020) argued that the close coupling of responsibility and performance at the strategic level was an important way for companies to achieve their development goals. Caroline [23] (2018) pointed out that by investing in CSR, companies could differentiate themselves from their competitors in several ways, and could then charge a premium for their products and services and improve their performance. It is worth noting that some studies have pointed out that socially responsible behavior has different competitive advantages and ultimately presents different performance outcomes under different strategic frameworks [24] (Chen et al,2018). Zhang [25] et al. (2021) argued that the additional cost of fulfilling CSR ran counter to the cost control objectives of the low-cost strategy, so low-cost strategies will weaken the positive relationship between CSR and corporate performance. And Sen [26] et al. (2006) pointed out that fulfilling CSR enabled companies to build good relationships with their stakeholders, whose contributions and resources in turn could facilitate the implementation of low-cost strategies and thus improve corporate performance. Yuen [27] et al. (2017) believed that there was a strong internal fit between CSR and differentiation strategy, which enabled the two to achieve synergy in value chain activities and produce synergies that were greater than a single factor. Additionally, after reading a large amount of literature, this paper finds that there is less literature that places corporate competitive strategy as a moderating variable to study how it affects the relationship between CSR and corporate performance. Therefore, this paper includes different corporate competitive strategies as moderating variables when exploring the mechanism of CSR's effect on corporate performance.

In conclusion, although most scholars believe that fulfilling CSR promotes corporate performance, some scholars still reach different conclusions. This demonstrates that the simple direct effect does not adequately account for the link between CSR and corporate performance, and the intermediary effect and the moderation effect need to be included in the study. Moreover, it is true that CSR has an impact on green technology innovation, and the relationship between competitive strategies regulating CSR and corporate performance has been studied by scholars. However, few works of literature examine the logical connections and causal mechanisms between CSR, green technology innovation, business performance, and competitive strategy in the same study framework. Therefore, this paper explores the relationship between CSR and corporate performance based on stakeholder theory, and analyses the mediating effect of green technology innovation and the moderating role of corporate competitive strategy.

3 Theoretical analysis and research mechanisms

3.1 CSR and corporate performance

The implementation of CSR has evolved into an investment in intangible assets that cannot be disregarded due to the social economy's quick expansion, the market's escalating competitiveness, and the expanding concern for CSR behavior among people from all walks of life. On the one hand, by actively fulfilling internal CSR, companies can stabilize and attract high-quality human resources and shape good employee relationships. These can help enterprises effectively improve production efficiency and achieve improved business performance. On the other hand, the implementation of external CSR by companies can send positive signals to stakeholders about the long-term sustainability of the company. This not only resolves the information asymmetry issue but also boosts stakeholders' confidence in the company's growth and readiness to offer the assistance the company needs to succeed. Enterprises can rely on these advantages to create a favorable competitive environment and improve enterprise performance. The following assumption is put forth in this study based on the analysis shown above:

H1: Fulfilling CSR has a significant positive effect on corporate performance.

3.2 Heterogeneous CSR and Green Technology Innovation

By fulfilling CSR, companies can gain the trust of their stakeholders and obtain resources and support from all stakeholders to promote green technology innovation. At the level of internal CSR, the active implementation of internal CSR can effectively increase employee satisfaction, improve the working environment of employees and establish a fair remuneration system, which can improve the enthusiasm of employees and enhance their affirmation and cooperation with the enterprise. Relying on the above advantages, enterprises can better cultivate employees' environmental awareness and innovation ability, help enterprises form a sense of green innovation, and thus promote the development of green technology innovation. In addition, as living standards improve, consumers gradually begin to pursue green products. Thus, companies will invest more in green technology innovation to achieve their internal CSR of providing quality products and services to society. About external CSR, a company's performance in terms of external CSR is an important indicator for investors to assess when making investment decisions, so companies with a high degree of external CSR are more likely to attract quality investors and thus get more funding for activities related to green technology research. In addition, the active fulfillment of external CSR by enterprises can usually be positively evaluated by the general public, which can help enterprises build a good external reputation, obtain more help and resources from outside, and then help enterprises to carry out green technology innovation. The following assumptions are put forth in this study based on the analysis shown above:

H2a: Fulfilling internal CSR is positively associated with green technology innovation.

H2b: Fulfilling external CSR is positively associated with green technology innovation.

3.3 Green Technology Innovation and corporate performance

According to the cost-benefit theory, green technology innovation by enterprises can increase enterprise revenue and reduce enterprise costs, which plays an important role in improving the economic and environmental performance of enterprises. (1) Green technology innovation can help companies build their green image and help them to better meet the diverse needs of their customers, thereby enhancing their brand value and reputation, increasing their market share, and generating higher economic returns. In addition, companies that develop green technology innovations to address environmental challenges can achieve better financial performance by reducing costs, improving productivity, and increasing profits. (2) Green technology innovation by enterprises can, on the one hand, reduce the use of raw materials and energy consumption by improving productivity and the efficiency of production systems, thus improving the environmental performance of enterprises; on the other hand, reduce pollutant emissions and reduce the use of resources or energy by recycling materials and alternative resources and raw material inputs, thus improving the environmental performance of enterprises. The following assumptions are put forth in this study based on the analysis shown above:

H3: Green technology innovation plays a partial mediating effect in CSR and corporate performance.

H3a: Corporate green technology innovation is positively related to corporate financial performance.

H3b: Corporate green technology innovation is positively related to corporate environmental performance.

3.4 The moderating role of corporate competitive strategy

Low-cost strategy and differentiation strategy are the two most dominant forms of competitive strategy, and under these two strategic orientations, companies present different cost structures and performance [27] (Yuen et al,2017). (1) Price-sensitive customers are the target customers of companies that implement low-cost competitive strategies. For such customers, whether a company fulfills its social responsibility is not the most important measure when evaluating and selecting a company's products or services. This means that the economic value and other added effects of CSR with a high level of low-cost strategy are small. Besides, price-sensitive customers are prone to churn [28] (Liao,2020). This kind of freedom and instability distracts the long-term insurance effect of CSR, affects the stability of stakeholders such as investors and suppliers in assessing the value of enterprises, and becomes a distraction factor

for the mechanism for CSR to play an active role. (2) According to the signal transmission theory, companies with a high level of differentiation and active CSR can convey good signals of the company's strategy and image to stakeholders. This signal can reduce the marginal cost of the company's operation. And the higher the level of differentiation, the stronger the company's ability to accurately grasp market dynamics, obtain information on stakeholders' needs, and improve market information asymmetry problems. These capabilities can further enhance the novelty and added value of corporate brands, and generate more image and brand premiums. The following assumptions are put forth in this study based on the analysis shown above:

H4a: Low-cost strategy moderate the impact of CSR on corporate performance. With the improvement of the level of low-cost strategy, the positive relationship between CSR and corporate performance will be weakened.

H4b: Differentiation strategy moderates the impact of CSR on corporate performance. With the improvement of the level of differentiation strategy, the positive relationship between CSR and corporate performance will be strengthened.

In summary, the research mechanism of this paper is shown in Figure 1.

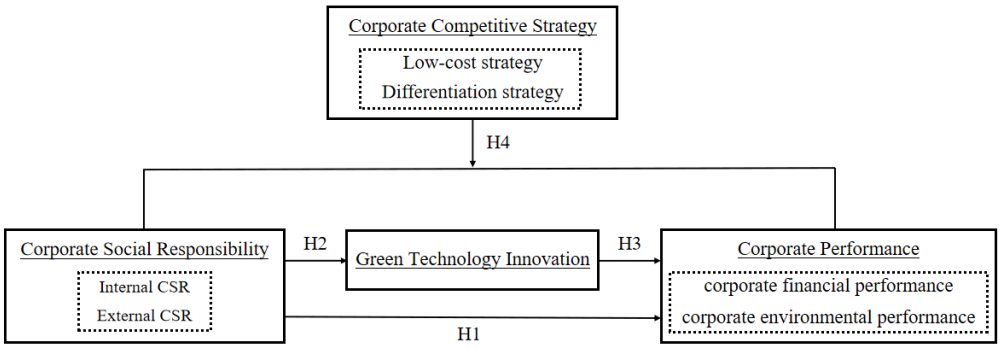

Fig. 1. Research mechanism diagram

4 Research design

4.1 Data sources and sample selection

The data for this paper are mainly obtained from Hexun.com, CNRD, financial statements of listed companies, Wind database, and CSMAR. In order to guarantee the availability and accuracy of the data, this paper chooses a total of 514 non-financial listed companies from 2015 to 2019 as the initial research sample, taking into account factors like the lack of standardized CSR data in Hexun before 2013 and the low number of green innovation patents in the early years of Chinese listed companies. Besides, this article excludes samples with missing values, extreme data as well as ST and ST*.

4.2 Variable design and indicator measurement

4.2.1 Explained variable

This paper divides corporate performance into financial performance and environmental performance based on the research hypothesis. Corporate financial performance is characterized by return on net assets (*Roe*), drawing on Han and Wen [29] (2019). Corporate environmental performance is measured by corporate environmental investment (*Eicr*), drawing on Shen [30] et al. (2018) and Hu [31] (2019).

$$Roe = \frac{P}{E} \quad (1)$$

$$Eicr = Ln(GIA + 1) \quad (2)$$

Where *Roe*, *P*, *E*, *Eicr,* and *GIA* denote financial performance, net profit, net assets, environmental performance, and environmental investment amount respectively.

4.2.2 Explanatory variable

CSR is the explanatory variable. According to Gallo's [32] (2008) article, internal CSR refers to providing satisfactory products or services to society, promoting the overall development of employees, etc. External CSR refers to the efforts made by enterprises to rectify the damage of economic activities to society. Since the social responsibility evaluation indicators of Hexun.com are reliable and used by many scholars, this paper also uses them. This paper combines the definitions of shareholder responsibility (*shareholder*,), employee responsibility (*staff*), supplier, customer and consumer rights responsibility (*consumer*) as internal social responsibility (*Incsr*), and sums the above three indicators to obtain the internal CSR score. Environmental responsibility (*environment*) and social responsibility (*society*) are defined as external social responsibility (*Excsr*), and sums the above two indicators to obtain the external CSR score. In addition, the different order of magnitude and scale of evaluation indicators may lead to large errors in the research results, so the indicators in this paper are standardized using the maximum difference dormalization method.

$$Incsr = shareholders + staff + consumer \quad (3)$$

$$Excsr = environment + society \quad (4)$$

4.2.3 Mediating variable

Green technology innovation is the mediating variable. This research uses the quantity of green patent applications to describe the green innovation of businesses in accordance with Zheng's [33] (2016) method. Specifically, the entire amount of green technology innovation is broken down into the number of green invention patent applications (*GIP*) and the number of green utility model patent applications (*GRP*). Moreover, to eliminate the problem of right-skewed distribution of green patent application data, this paper takes the natural logarithm of the number of green patent applications after adding one to measure the green technological innovation of enterprises, which is denoted by *Gi*.

$$Gi = ln(GIP + GRP + 1) \quad (5)$$

4.2.4 Moderating variable

In this article, low-cost strategy and differentiation strategy are chosen as the moderating variables. Combined with the approach of Wei [34] et al (2021), this paper uses the logarithm of the mean of total asset turnover (*TAT*) and cost efficiency (*CE*) as a measure of low-cost strategy, denoted by *LS*; and the logarithm of the mean of selling expense ratio (*SR*), administrative expense ratio (*AR*) and financial expense ratio (*FR*) is chosen as a measure of differentiation strategy, denoted by *DS*.

$$LS = ln\left(\frac{TAT+CE}{2}\right) \quad (6)$$

$$DS = ln\left(\frac{SR+AR+FR}{2}\right) \quad (7)$$

4.2.5 Control variable

In order to minimize the bias of missing variables, this paper adds the control variables shown in Table 1 according to the existing research results [36-37] (Qin,2018; Yin,2014) and the actual development status of enterprises.

Table 1. Description of control variables

Variable type	Variable name	English coed	Measurement methods
Control variable	total net asset margin	*Roa*	Net Profit / Total Assets
	equity ratio	*Equity*	Total liabilities/total owners' equity
	shareholders' balance	*Sw*	ln (shareholders' balance)
	total directors' remuneration	*Dcl*	ln ((Total remuneration of directors)
	equity concentration	*Gp*	the first big proportion of shareholding
	financial leverage	*Flev*	Asset-liability ratio

4.3 Descriptive statistics

Table 2 shows the results of the descriptive statistics of each variable. The mean value of the return on net assets of the sample enterprises is 0.058 and the median value is 0.061, the mean value is slightly smaller than the median value, which shows that the profitability of the sample enterprises over the five years period is not very high. The mean value of corporate environmental investment is 16.472, the median is 16.732, and the standard deviation is 3.197. The large difference between the indicators of maximum and minimum values indicates that the polarization of the sample companies' investment in environmental protection is obvious and varies widely. The mean value of the internal CSR score is 16.89, the median is 16.020, the standard deviation is 9.557, the minimum value is -8.79 and the maximum value is 57.32, suggesting that there is a significant difference in the fulfillment of internal CSR between enterprises, and the fulfillment of internal CSR needs to be improved. The mean value of the external CSR score is 5.641, the median value is 4.505, the standard deviation is 6.032, the minimum value is -15 and the maximum value is 37. This illustrates that the difference and dispersion degree of external CSR is lower than that of internal CSR.

Table 2. Descriptive statistical analysis

Variable	N	Mean	p50	SD	Min	Max
Roe	2570	0.058	0.061	0.112	-0.563	0.330
Eicr	2570	16.472	16.732	3.197	0.000	21.924
Inscr	2570	16.890	16.020	9.557	-8.790	57.320
Excsr	2570	5.641	4.505	6.032	-15.000	37.000
Gi	2570	10.331	2.000	33.223	0.000	649.000
LS	2570	1.046	0.950	0.519	0.441	9.576
DS	2570	0.054	0.044	0.049	-0.004	0.786

4.4 Model design

4.4.1 Main effect test

To verify the relationship between CSR and corporate performance, regression models (8) and (9) are set up in this paper.

$$Y_{it} = a_0 + a_1 Incsr_{it} + a_2 Controls_{it} + \varepsilon_{it} \quad (8)$$

where $Y_{it}=\{Roe,Eicr\}^T$ denotes the corporate performance index of firm *i* in year *t*, $Incsr_{it}$ denotes the internal social responsibility index of firm i in year t, the control variables are $Controls_{it}=\{Roa,Equity,Sw,Dcl,Gp,Flev\}^T$, and ε represents the random error term of the model.

$$Y_{it} = \alpha_0 + \alpha_1 Excsr_{it} + \alpha_2 Controls_{it} + \varepsilon_{it} \quad (9)$$

where $Excsr_{it}$ denotes the external social responsibility index of firm i in year t. The remaining indicators have the same meaning as equations (8).

4.4.2 Mediating effect test

In this paper, regression models (10), (11) and (12) are set up to test the mediating effect of green technology innovation in CSR and corporate performance.

$$Gi_{it} = b_0 + b_1 Incsr_{it} + b_2 Excsr_{it} + b_3 Controls_{it} + \varepsilon_{it} \quad (10)$$

$$Y_{it} = c_0 + c_1 Incsr_{it} + c_2 Gi_{it} + c_3 Controls_{it} + \varepsilon_{it} \quad (11)$$

$$Y_{it} = \mu_0 + \mu_1 Excsr_{it} + \mu_2 Gi_{it} + \mu_3 Controls_{it} + \varepsilon_{it} \quad (12)$$

In equation (10), Gi_{it} represents the green technology innovation index of firm i in year t. The rest of the indicators have the same meaning as equations (8) and (9).

4.4.3 Moderating effect test

In this paper, regression models (13), (14), and (15) are set up to test the moderating effect of a company's competitive strategy on the main effect.

$$Y_{it} = \varphi_0 + \varphi_1 Incsr_{it} + \varphi_2 LS_{it} + \varphi_3 L_{it} + \varphi_4 Controls_{it} + \varepsilon_{it} \quad (13)$$

$$Y_{it} = \varphi_5 + \varphi_6 Excsr_{it} + \varphi_7 LS_{it} + \varphi_8 L1_{it} + \varphi_9 Controls_{it} + \varepsilon_{it} \quad (14)$$

$$Y_{it} = \gamma_0 + \gamma_1 Incsr_{it} + \gamma_2 Excsr_{it} + \gamma_3 DS_{it} + \gamma_4 D_{it} + \gamma_5 Controls_{it} + \varepsilon_{it} \quad (15)$$

In equations (13) and (14), *L* and *L1* are the cross-product terms of *Incsr* and *LS*, *Excsr* and *LS* respectively, the moderating variable *D* in equation (15) is the cross-product term of *Incsr*, *Excsr* and *DS*. The meaning of the remaining indicators is the same as equations (8) and (9).

5 Empirical tests and results analysis

5.1 Correlation Analysis and VIF test

Before the empirical analysis, the reference model is multicollinearity diagnosis by using the variance expansion factor (VIF) method, as shown in Table 3, the VIFs of the variables are all less than 5, demonstrating that there is no significant multicollinearity issue. In addition, this paper conducts a Hausman test on the benchmark model of CSR affecting corporate performance. The final estimate is significant at the 10% level, indicating that the fixed-effect model is applicable to the study.

Table 3 displays the findings of the correlation analysis of the key variables. The results show that the correlations between corporate performance and CSR, green technology innovation and other variable are all significant without considering other factors, which initially proves the rationality of the model. Further analysis of internal CSR and external CSR reveals that both are significantly positive at the 1% level with financial performance and environmental performance. This suggests that a higher level of CSR will be followed by an increase in corporate performance. Hypothesis H1 is preliminarily verified. In addition, the relationship between green technology innovation and corporate financial and environmental performance is also significantly positive at the 1% level, which means that as green technology innovation investment increases, the corporate performance also increases. This also tentatively proves hypotheses H3a and H3b

Table 3. Correlation Analysis and VIF test

Variables	(Eicr)	(Incsr)	(Excsr)	(Gi)	(LS)	(DS)	(Roa)	(Gp)	(Equity)	(Sw)	(Dcl)	(Flev)	VIF
Eicr	1.000												
Incsr	0.162***	1.000											3.16
Excsr	0.137***	0.672***	1.000										2.19
Gi	0.267***	0.091***	-0.006	1.000									1.31
LS	-0.051**	0.249***	0.087***	-0.137***	1.000								1.34
DS	-0.127***	-0.122***	-0.048**	-0.179***	-0.031	1.000							1.16
Roa	0.083***	0.465***	0.138***	0.026	0.331***	-0.169***	1.000						2.22
Gp	0.131***	0.103***	0.078***	0.044**	0.109***	-0.128***	0.106***	1.000					1.17
Equity	0.063***	-0.137***	-0.017	0.061***	-0.099***	0.009	-0.237***	-0.011	1.000				1.42
Sw	0.377***	0.303***	0.225***	0.408***	0.038*	-0.289***	0.183***	0.228***	-0.049**	1.000			1.55
Dcl	0.125***	0.205***	0.053***	0.148***	0.166***	-0.019	0.167***	-0.204***	-0.046**	0.247***	1.000		1.25
Flev	0.066***	-0.080***	0.041**	0.024	-0.114***	0.007	-0.011	0.010	0.113***	0.072***	-0.058***	1.000	1.16
Variables	(Eicr)	(Incsr)	(Excsr)	(Gi)	(LS)	(DS)	(Roa)	(Gp)	(Equity)	(Sw)	(Dcl)	(Flev)	
Eicr	1.000												
Incsr	0.162***	1.000											
Excsr	0.137***	0.672***	1.000										
Gi	0.267***	0.091***	-0.006	1.000									
LS	-0.051**	0.249***	0.087***	-0.137***	1.000								
DS	-0.127***	-0.122***	-0.048**	-0.179***	-0.031	1.000							
Roa	0.083***	0.465***	0.138***	0.026	0.331***	-0.169***	1.000						
Gp	0.131***	0.103***	0.078***	0.044**	0.109***	-0.128***	0.106***	1.000					
Equity	0.063***	-0.137***	-0.017	0.061***	-0.099***	0.009	-0.237***	-0.011	1.000				
Sw	0.377***	0.303***	0.225***	0.408***	0.038*	-0.289***	0.183***	0.228***	-0.049**	1.000			

Dcl	0.125***	0.205***	0.053** *	0.148***	0.166***	-0.019	0.167***	- 0.204***	-0.046**	0.247***	1.000
Flev	0.066***	- 0.080***	0.041**	0.024	- 0.114***	0.007	-0.011	0.010	0.113***	0.072***	- 0.058***	1.000

5.2 Multiple regression analysis

5.2.1 Main effect regression analysis

This paper uses a two-way fixed effect model to investigate the influence of fulfilling CSR on corporate performance, and the results are shown in Table 4. The coefficients of internal and external CSR in columns (1) and (2) are 0.167 and 0.061 respectively, and are significant at the 1% level. The coefficients of internal and external CSR in columns (3) and (4) are 1.997 and 1.758 respectively, which are also significant at the 1% level. This indicates that after controlling for other influencing factors, the fulfillment of internal and external CSR has a significant impact on enterprise performance. Hypothesis H1 is tested. As mentioned earlier, with the development of society and changes in the environment, the fulfillment of internal and external CSR has become more and more effective in improving the satisfaction and loyalty of employees and consumers, enhancing the trust of shareholders and suppliers and shaping a good corporate image, so companies are often willing to invest heavily in social responsibility activities to improve their corporate performance. Further analysis of the coefficients shows that an increase of 1 standard unit of internal CSR has a greater positive effect on corporate performance than an increase of 1 standard unit of external CSR. This paper hypothesizes that the reason for this is that companies fulfill their internal CSR with little interference from external factors, and that most stakeholders are individuals. Therefore, the fulfillment of internal CSR can be quickly perceived by stakeholders, and effectively feedback on the improvement of corporate performance by providing individual or collective value. In summary, the regression results are consistent with previous studies by many scholars [5,6,37] (Zhou,2020; Ju,2005; Li,2016)

Table 4. Main effect regression result

	(1)	(2)	(3)	(4)
	Model (8) Roe	Model (9) Roe	Model (8) Eicr	Model (9) Eicr
Incsr	0.167***		1.997***	
	(0.013)		(0.645)	
Excsr		0.061***		1.758***
		(0.011)		(0.543)
Roa	1.127***	1.217***	-1.850*	-0.938
	(0.019)	(0.018)	(0.959)	(0.881)
Equity	-0.003***	-0.003***	0.076***	0.074***
	(0.000)	(0.000)	(0.021)	(0.021)
Sw	0.004***	0.006***	1.027***	1.033***
	(0.001)	(0.001)	(0.063)	(0.062)
Dcl	0.005***	0.007***	0.083	0.109
	(0.002)	(0.002)	(0.079)	(0.078)
Gp	0.000	0.000	0.012***	0.013***
	(0.000)	(0.000)	(0.005)	(0.005)
Flev	0.000*	0.000	0.008	0.007
	(0.000)	(0.000)	(0.011)	(0.011)
Area	YES	YES	YES	YES
_cons	-0.176***	-0.229***	-8.393***	-8.980***
	(0.030)	(0.030)	(1.527)	(1.512)
r2	0.744	0.729	0.181	0.181
r2_a	0.740	0.725	0.169	0.169

Standard errors in parentheses
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

5.2.2 Regression analysis of mediating effects

The statistical graph of the quantity of green technology innovation patents in China for the five years between 2015 and 2019 is shown in Figure 2. According to the graph, the total number of green technology innovation patents held by the businesses climbed from 3202 in 2015 to 6936 in 2019, more than doubling in just five years. This shows that businesses have gradually begun to take green technology innovation seriously and have steadily boosted their efforts in this area to speed up the green transition.

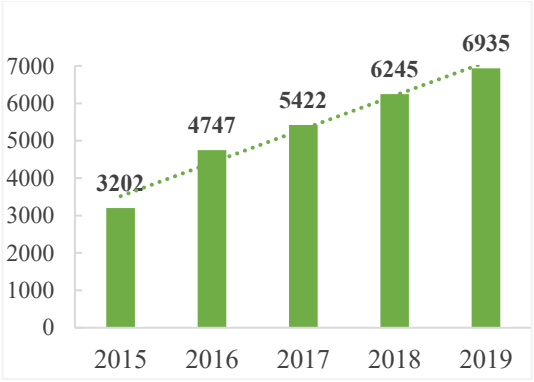

Fig. 2. Bar chart of the number of patents for green technology innovations, 2015-2019

Theoretical analysis shows that the implementation of CSR can influence corporate performance by influencing green technology innovation, so this paper constructs a fitted curve of internal and external CSR and green technology innovation to observe the correlation between the variables from the image. As can be seen from Figure 3, the slope of the fitting curve of internal CSR and green technology innovation is positive, so it can be preliminarily judged that the two have a positive correlation. The slope of the external CSR line segment is negative, and the preliminary judgment is that the two have a negative relationship.

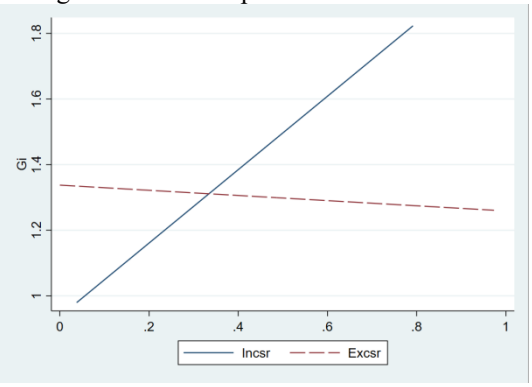

Fig. 3. Fitted curve of internal and external CSR and green technology innovation

Based on the above research, the mediation model is tested in equations (8)-(12), and the outcomes are displayed in Table 5. It can be seen from column (1) that under the condition of controlling other influencing factors, the coefficient between internal CSR and green technology innovation is significantly positive at the 1% level. This illustrates that the implementation of internal CSR can lead stakeholders to help the company form a green innovation image and provide key resources needed by the company, which in turn promotes green technology innovation. Research hypothesis H2a is supported. The coefficient between external CSR and green technology innovation is significantly negative at the 1% level, which indicates that the higher the level of external CSR, the higher the degree of constraint on green technology innovation. The research hypothesis H2b is not supported. This paper makes an educated guess as to why this would be the case: excessive focus on external CSR causes a shift in business resources toward upholding external social relationships and growing markets. Enterprises are protected by the government, the media, and the public because they have a good social image, so they can continue to survive without carrying out or reducing technological innovation. For example, due to China's unique situation, the government has relatively greater power to allocate resources. Most of the key resources required by enterprises, such as land, financial subsidies and financing channels, are in the hands of the government. Therefore, the main purpose of external CSR is not to improve corporate performance through green innovation activities, but to obtain more external support from the government to help enterprises improve their performance. The green technology innovation coefficients in columns (2), (3), (4), and (5) are 0.004, 0.004, 0.316, and 0.333 respectively, all of which are significant at the level of 1%, suggesting that green technology innovation can significantly promote the growth of corporate financial performance and environmental performance. Suppose H3a and H3b hold. In addition, the impact of green technology innovation on the environmental performance of enterprises is greater. The reason may be that green technology innovation can reduce the consumption of energy and resources from the source, thereby indirectly reducing the emission of pollutants and reducing the pressure on the environmental resources of production. These advantages are directly tied to the enterprise's environmental governance and can greatly enhance the enterprise's environmental performance. While green technology innovation helps enterprises gain competitive advantage in the market and reduce production costs, it still needs to invest a lot of research and development funds to support it. Therefore, the positive impact of green technology innovation on financial performance is relatively small.

From columns (2) and (4), the coefficients of CSR and corporate performance are both positive and significant at the 1% level after the inclusion of corporate green technology innovation, indicating that the fulfillment of CSR improves corporate performance by enhancing green technology innovation. Green technology innovation plays a part in the mediating effect, which accounts for 2.98% and 8.17% of the total effect of CSR on corporate financial and environmental performance. The coefficients of external CSR and corporate performance in columns (3) and (5) are also significantly positive at the 1% level and are both larger than the coefficients of external CSR in the main effects regressions in Table 4. Combining the significantly negative results of external CSR in column (1), it can be concluded that fulfilling external CSR promotes corporate performance by reducing the investment in green technology innovation and making more use of other means such as maintaining social relationships. Green technology innovation plays a partial mediating effect, which accounts for 28.81% and 29.53% of the total effect of corporate external CSR on corporate financial and environmental performance. In summary, research hypothesis H3 holds.

Table 5. Regression results for the mediating effect of green technology innovation

	(1)	(2)	(3)	(4)	(5)
	Model (10)	Model (11)	Model (12)	Model (11)	Model (12)
	Gi	Roe	Roe	Eicr	Eicr
Incsr	1.246***	0.168***		2.096***	
	(0.359)	(0.013)		(0.640)	
Excsr	-1.911***		0.066***		2.155***
	(0.302)		(0.011)		(0.541)

Gi		0.004***	0.004***	0.316***	0.333***
		(0.001)	(0.001)	(0.049)	(0.049)
Roa	-1.081***	1.128***	1.219***	-1.705*	-0.788
	(0.400)	(0.019)	(0.018)	(0.952)	(0.873)
Equity	0.032***	-0.003***	-0.003***	0.066***	0.063***
	(0.008)	(0.000)	(0.000)	(0.020)	(0.020)
Sw	0.541***	0.002	0.004***	0.858***	0.849***
	(0.025)	(0.001)	(0.001)	(0.068)	(0.067)
Dcl	0.035	0.004***	0.006***	0.065	0.092
	(0.032)	(0.002)	(0.002)	(0.078)	(0.078)
Gp	-0.003*	0.000	0.000	0.013***	0.014***
	(0.002)	(0.000)	(0.000)	(0.004)	(0.004)
Flev	0.001	0.000*	0.000	0.008	0.007
	(0.004)	(0.000)	(0.000)	(0.011)	(0.011)
Area	YES	YES	YES	YES	Area
_cons	-10.568***	-0.137***	-0.186***	-4.918***	-5.331***
	(0.622)	(0.032)	(0.032)	(1.608)	(1.592)
r2	0.241	0.745	0.730	0.194	0.196
r2_a	0.229	0.741	0.726	0.182	0.184

Standard errors in parentheses
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

5.2.3 Regression analysis of moderating effects

Based on the premise that the main effect of Table 4 is significantly positive, the moderating effect of the competitive strategy of enterprises is tested here. In Table 6, columns (1) and (2), the impact of CSR and low-cost strategy on financial performance is significantly positive at the 1% level, and the impact of the intersection of CSR and low-cost strategy on financial performance is significantly negative at the 1% level. This shows that the adoption of low-cost competitive strategies by enterprises will negatively regulate the impact of CSR on corporate performance. The adoption of a low-cost competitive strategy by companies means that they focus more on how to reduce manufacturing costs and sales management costs than on improving corporate performance by fulfilling their CSR. To demonstrate more clearly the moderating effect of low-cost competitive strategies, this study uses a simple slope test to analyze the moderating effect of low-cost strategy on the positive impact of CSR on corporate financial performance at different levels. According to Figures 4 and 5, the slope of the curve with a lower degree of low-cost strategy is greater than the slope of the curve with a higher degree of low-cost strategy, indicating that the positive role of CSR is more significant when the degree of low-cost is low, but as the degree of low-cost strategy increases, the positive role of CSR gradually decreases. This means that there is a clear substitution between low-cost strategy and CSR in terms of financial performance. In columns (3) and (4), the effect of CSR on environmental performance is significantly positive at the 1% level, and the impact of low-cost strategy variable and the intersection of CSR and low-cost strategy on environmental performance is significantly negative at the 1% level, indicating that low-cost strategy also weakens the positive relationship between CSR and environmental performance. In summary, a low-cost strategy weakens the positive relationship between CSR and corporate performance, and hypothesis H4a holds. In columns (5) and (6), the effect of differentiation strategy on enterprise performance is significantly negative at the 1% level, while the impact of CSR variable and the intersection of CSR and differentiation strategy on corporate performance is significantly positive at the 1% level, i.e., differentiation strategy has a significant positive moderating effect. This is displayed that when companies choose differentiation as their competitive strategy, they are more inclined to differentiate their products with innovations such as developing green products. The above will help them attract consumers to their products or services by creating a differentiated competitive advantage, thereby allowing the company to gain market share and ultimately achieve growth in corporate performance. Hypothesis H4b holds.

Table 6. Regression results for the moderating effect of green technology innovation

	(1)	(2)	(3)	(4)	(5)	(6)
	Model (13)	Model (14)	Model (13)	Model (14)	Model (15)	Model (15)
	Roe	Roe	Eicr	Eicr	Roe	Eicr
Incsr	0.213***		4.577***		0.582***	5.121***
	(0.013)		(0.694)		(0.029)	(1.538)
Excsr		0.078***		3.485***	0.172***	4.412***
		(0.012)		(0.582)	(0.024)	(1.260)
LS	0.153***	0.136***	-1.800***	-1.583***		
	(0.015)	(0.020)	(0.284)	(0.283)		
L	-0.373***		-7.359***			
	(0.042)		(2.181)			
L1		-0.254***		-11.762***		
		(0.047)		(2.330)		

DS					-0.037***	-0.735***
					(0.003)	(0.141)
D					0.194***	1.831**
					(0.015)	(0.787)
Roa	0.992***	1.088***	1.593	3.296***	0.878***	-0.813
	(0.019)	(0.019)	(0.995)	(0.912)	(0.020)	(1.059)
Equity	-0.003***	-0.004***	0.095***	0.086***	-0.003***	0.092***
	(0.000)	(0.000)	(0.021)	(0.021)	(0.000)	(0.021)
Gp	0.000	0.000*	0.035***	0.036***	-0.000	0.029***
	(0.000)	(0.000)	(0.004)	(0.004)	(0.000)	(0.005)
Dcl	0.003*	0.007***	0.566***	0.640***	0.002	0.519***
	(0.002)	(0.002)	(0.080)	(0.079)	(0.002)	(0.080)
Year	YES	YES	YES	YES	YES	YES
_cons	-0.093***	-0.117***	5.407***	4.442***	-0.296***	3.052**
	(0.023)	(0.024)	(1.174)	(1.179)	(0.026)	(1.390)
r2	0.713	0.682	0.085	0.088	0.727	0.079
r2_a	0.711	0.680	0.081	0.083	0.726	0.074

Standard errors in parentheses
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

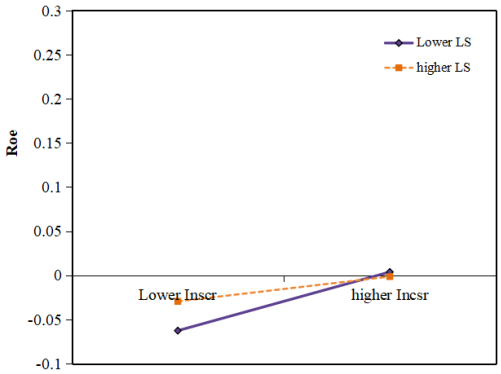

Fig. 4. The moderating effect of low-cost competitive strategies on internal CSR and financial performance

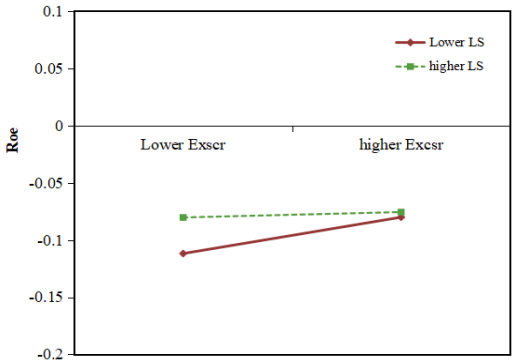

Fig. 5. The moderating effect of low-cost competitive strategies on external CSR and financial performance

5.2.4 Robustness test

To ensure the reliability of the model conclusions, this paper uses Tobin's Q value to measure financial performance for robustness test. From the regression results in the robustness test section of Table 7, it can be seen that the regression coefficients for CSR and financial performance remain significantly positive, with only the strength of significance of individual indicators changing, indicating strong robustness of the study's findings.

Moreover, considering the problem that there is a certain time lag between the research and development of green technology innovation and the granting of a patent by the enterprise as well as the possible mutual causality between green innovation and corporate performance, it is assumed that H3a and H3b may have the problem of endogeneity bias. Therefore, this paper introduces the first-order lag term of green technology innovation into equations (11) and (12) to construct a two-way fixed-effects model. The endogeneity test part of Table 7 includes the model estimation findings. It can be seen that after accounting for endogeneity, green technology innovation still has a significant positive effect on the coefficient of corporate performance, and the mediating effect of green technology innovation still exists, which is consistent with the previous mediating model and reflects the robustness of the study results.

Table 7. Robustness test and endogenous regression analysis

	Robustness test		Endogenetic test			
	(1)	(2)	(3)	(4)	(5)	(6)
	Tobin's Q	Tobin's Q	Roe	Roe	Eicr	Eicr
Incsr	0.839***		0.190***		2.162***	
	(0.194)		(0.015)		(0.800)	
Excsr		0.376**		0.067***		2.214***
		(0.163)		(0.013)		(0.674)
L.Gi			0.002*	0.002**	0.318***	0.334***
			(0.001)	(0.001)	(0.058)	(0.058)
Roa	2.465***	2.908***	1.064***	1.157***	-1.542	-0.680
	(0.288)	(0.265)	(0.020)	(0.019)	(1.049)	(0.959)
Equity	-0.015**	-0.016**	-0.002***	-0.002***	0.059***	0.056**
	(0.006)	(0.006)	(0.000)	(0.000)	(0.023)	(0.023)
Sw	-0.468***	-0.457***	0.003*	0.005***	0.894***	0.883***
	(0.019)	(0.019)	(0.001)	(0.002)	(0.079)	(0.079)
Dcl	0.005	0.015	0.004***	0.007***	0.095	0.129
	(0.024)	(0.024)	(0.002)	(0.002)	(0.092)	(0.091)
Gp	0.004***	0.005***	0.000	0.000**	0.012**	0.013**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.005)	(0.005)
Flev	-0.005	-0.005*	0.000	0.000	0.008	0.007
	(0.003)	(0.003)	(0.000)	(0.000)	(0.012)	(0.012)
Area	YES	YES	YES	YES	YES	YES
_cons	11.637***	11.374***	-0.169***	-0.225***	-6.265***	-6.761***
	(0.458)	(0.455)	(0.036)	(0.036)	(1.889)	(1.871)
r2	0.261	0.257	0.749	0.732	0.189	0.190
r2_a	0.250	0.245	0.744	0.727	0.173	0.175

6 Conclusions

Based on the viewpoint of the stakeholders, the study develops a theoretical framework of the impact of CSR on business performance and builds a two-way fixed effects model. Using panel data of Chinese A-share listed enterprises from 2015-2019, the study examines the mediating effect played by green technology innovation in the impact of CSR on corporate performance. Moreover, the mechanism of the moderating effect of corporate competitive strategy in the process of CSR affecting corporate performance is clarified, and the study's findings are summarized as follows: (1) CSR significantly enhances corporate performance, i.e., corporate fulfillment of internal and external CSR can lead to an increase in corporate financial and environmental performance and contribute to sustainable development. (2) Green technology innovation plays a part in mediating the process of fulfilling CSR for corporate performance. Among them, green technology innovation is significantly benefited by the accomplishment of internal CSR, while the fulfillment of external CSR has a significant negative impact on green technology innovation. i.e., the higher the fulfillment of external social responsibility, the more the company's resources will be dispersed, and the company's focus will shift from improving technology innovation to maintaining social relationships. (3) Different corporate competitive strategies have different mechanisms for CSR to act on corporate performance. The higher the level of a company's low-cost strategy, the smaller the positive effect of its fulfillment of CSR on corporate performance; while an increased level of differentiation strategy reinforces the positive relationship between CSR and corporate performance.

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