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Does green finance promote the social responsibility fulfilment of highly polluting enterprises? – empirical evidence from China

Xiuling Li^{a,b} , Zhitao Wang^a , Yue Yu^a and Yijie Chen^c

^aSchool of Accounting, Zhongnan University of Economics and Law, Wuhan, China; ^bDepartment of Economics and Management, Yuncheng University, Yuncheng, Shanxi, China; ^cPublic Affairs Department, Wallaby Medical Holding, Inc, Shanghai, China

ABSTRACT

This study explores whether and how the development of green finance can facilitate the social responsibility of highly polluting enterprises. We conducted a quasi-natural experiment in 2017 in five Chinese provinces (districts), based on the establishment of green finance reform and innovation pilot zones. The research samples were China's A-share heavy pollution-industry-listed companies from 2013 to 2020, and the difference in differences model was used to examine the relationship between green finance and social responsibility fulfilment of highly polluting firms. The mediating and moderating effects of financial constraints and media monitoring were also discussed. The findings indicate that the advancement of green finance significantly improves the level of social responsibility fulfilment of highly polluting firms, particularly in the area of environmental responsibility. Furthermore, strengthened financing constraints partially mediate the aforementioned relationship, and media monitoring positively moderates the facilitation effect of green finance development on highly polluting firms' social responsibility fulfilment. Our study demonstrates that a higher degree of financing constraints is an important channel for establishing a green finance reform and innovation pilot zone to force enterprises to fulfilment their social responsibility, and provides theoretical support for governments and enterprises to better understand the policy effects.

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1. Introduction

In parallel to increase economic development, the problem of global environmental pollution and climate change has been increased (Elahi et al., 2022; Ehsan et al., 2021). Since the reform and opening-up of China, the country's economy has grown rapidly; however, this growth has been primarily impelled by crude capital investment, causing serious environmental problems. Moreover, Chinese companies have

CONTACT Zhitao Wang  zuel_wangzhitao@163.com

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developed a habit of externalising environmental costs and disregarding social responsibility. In recent years, as the problem of environmental pollution has become increasingly serious, the Chinese have become vocal about sustainable development and the fulfilment of corporate social responsibility (CSR). Additionally, China has pledged to achieve green development goals in relation to carbon peaking by 2030 and carbon neutrality by 2060. Therefore, the ways in which sustainable development can be achieved have become the focus of the Chinese government, and consequently, a series of policies and regulations have been introduced. For example, China's efforts to develop green finance, which is highly aligned with the concept of sustainable development, have profoundly changed the financial environment of companies, especially that of heavy polluters.

Green finance refers to the financial sector's incorporation of environmental governance and conservation factors into investment decisions, which could increase the financing of clean projects and reduce the supply of funds for polluting projects, thereby achieving a green allocation of funds (Liu et al., 2021; Mamun et al., 2022). Since the 18th National Congress, the Chinese government has actively constructed a green financial standard system. In September 2015, the Political Bureau of the Central Committee of the Communist Party of China (CPC) adopted the General Programme for the Reform of the Ecological Civilization System wherein the strategy of establishing a green financial system was first proposed, emphasising the acceleration of developing green funds and green bond markets to support the financing of green projects. In June 2017, the Chinese State Council decided to select Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang as the first five provinces (regions) to build pilot zones for green financial reform and innovation by utilising their resources, marking the establishment and implementation of green finance. This move aimed to improve the green sustainability of financial institutions and guide the allocation of financial resources to green environmental projects. Additionally, it reduces the supply of funds to highly polluting enterprises, forcing them to participate in green projects and fulfil their social responsibility.

The existing literature has explored the economic consequences of green finance primarily from the financing and investment perspective. For example, regarding financing, Liu et al. (2017) found that green finance policies have a significant financing penalty effect on high energy consumption and highly polluting enterprises. Su and Lian (2018) comprehensively examined the impact of green finance on the investment and financing behaviour of heavy polluters and found that it significantly reduced the interest-bearing debt financing and long-term liabilities of heavy polluters, with the largest reduction observed in large state-owned enterprises in high-emission areas. Moreover, new investments of state-owned and heavy polluters reduced significantly, and the cost of debt of heavy polluters increased considerably along with a substantial decline in business performance. Regarding investment, green finance can effectively promote eco-friendly investments (Lee & Lee, 2022; Thompson & Cowton, 2004) and green transformation investments (Chen et al., 2019; Liu et al., 2019). In other words, green finance policies have introduced strong financing constraints to highly polluting enterprises; however, they can induce them to improve their investment efficiency and change their development philosophy, thus ultimately promoting green and low-carbon

economic development. However, the existing literature has not focused on the impact of green finance on the fulfilment of the social responsibility of highly polluting enterprises. This study fills the aforementioned research gap in the literature.

Unlike developed countries, the proportion of endogenous financing for listed companies in China is low, and corporate development is predominantly financed exogenously (Mi & Li, 2002), especially debt financing. Therefore, the financial environment, which is dominated by state-owned banks, has considerable influence on the development of Chinese companies. Under the financial resource allocation policy guided by environmental protection and green development, highly polluting enterprises face severe external financing constraints. This issue begets the following question: Will highly polluting enterprises fulfil their social responsibility because of the realistic demand to alleviate financing constraints? Furthermore, as the main target of the green finance policy, highly polluting enterprises are bound to become the focus of public, media and other attention vis-à-vis the green financial reform and innovation pilot zone. Therefore, Will highly polluting firms actively fulfil their social responsibilities as a result of media monitoring? In short, whether and how green finance promotes the fulfilment of social responsibility of highly polluting enterprises is an important factor to test if developing green finance can effectively transform the development philosophy of enterprises.

This study empirically examines the impact of green finance development on the fulfilment of the social responsibility of highly polluting enterprises. As the research sample, it utilises the 2013–2020 Chinese A-share listed companies in Shanghai and Shenzhen and the five provinces (regions) – Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang – selected by the Chinese State Council in 2017 as an exogenous shock. This study employs the double difference method. Its significance is as follows. First, unlike the existing literature, which focuses on the impact of green finance on enterprises' investment and financing behaviour, this study includes green finance and the fulfilment of the social responsibility of highly polluting enterprises, which aids in further understanding the positive spillover effects of green finance policies. Second, this study goes on to discuss the influencing mechanism and moderating factors of green finance on the social responsibility fulfilment of highly polluting firms. The conclusion shows that financing constraints are an important channel for promoting highly polluting firms to fulfil social responsibilities and that media monitoring has a significant positive moderating effect. This study provides theoretical support for the government and businesses to better understand the policy effects as well as serves a reference for decision-making in the subsequent reform and pilot promotion of green finance. Finally, the empirical studies on the microeconomic effects of green finance have been predominantly based on a single green financial instrument and product, whereas the pilot green financial reform and innovation zone is a comprehensive green financial policy, involving various green financial products and services, such as green credit, bonds, funds and insurance. Assessment of the economic effects of this comprehensive green finance policy has been relatively scarce. Therefore, this study uses the green financial reform and innovation pilot zone policy as a quasi-natural experiment to explore the relationship between green finance and the fulfilment of the social responsibility of highly polluting enterprises, which can provide a reference for new research designs.

The rest of this paper is organised as follows. [Section 2](#) reviews the existing literature and formulates the hypothesis of this paper. [Section 3](#) describes the empirical methodology and materials. [Section 4](#) explains the results and discussion. Finally, the conclusions and policy implications are presented in [Section 5](#).

2. Literature review and hypothesis formulation

2.1. Factors influencing the fulfilment of CSR

CSR has been studied for more than half a century; however, the concept of CSR is not uniform. Wood (1991) argued that CSR primarily refers to companies actively engaging in socially responsible behaviour that goes beyond the economic and legal business requirements. Other scholars, such as Clarkson (1995) and Dai et al. (2021), adopted a stakeholder perspective, arguing that while companies generate profits and have economic responsibilities to shareholders, they also have social responsibilities to employees, consumers, suppliers, communities and the environment.

A review of the existing literature reveals that the fulfilment of CSR is essentially influenced by corporate governance, the external market environment and the institutional environment. First, at the corporate governance level, most studies suggest that the higher the level of corporate governance, the more positive the CSR performance (Frank et al., 2021; Jo et al., 2011; Khan et al., 2013; Walls et al., 2012). For example, Barako et al. (2006) found that foreign investor shareholding monitors management self-interest and promotes CSR. Hong et al. (2016) highlighted that shareholder-friendly companies and companies with good executive incentive systems are more focused on long-term corporate development and thus have higher levels of social responsibility fulfilment. Second, at the market environment level, Campbell (2007) argued that if the economic market conditions in which a company operates are poor or there is unreasonable competition in the industry (the existence of oligopoly or lack of market competition), it is more likely that the company will reduce product quality and safety, squeeze employees and partners and negatively assume social responsibility. As per the strategic CSR perspective, as the intensity of competition increases, firms can adopt socially responsible behaviours to differentiate themselves, such as highlighting the greenness in their products and marketing for the public good (Campbell, 2007; Zhao et al., 2022). Therefore, the higher the intensity of competition in an industry, the more likely it is that firms will engage in CSR to achieve differentiated competition. Third, institutional theory emphasises that corporate behaviour is determined by the external institutional environment (Meyer & Rowan, 1977). Gardberg and Fombrun (2006) and Campbell (2007) found that institutional environmental pressures, including social norms and expectations, are the key drivers of CSR. Jia and Liu (2014) found that public opinion pressures, such as media scrutiny, can promote CSR performance. Zhang et al. (2016) found that politically connected companies are more likely to seek rents through political connections and less actively participate in social responsibility activities.

Regarding the factors influencing CSR, the existing literature provides a theoretical basis for this study. However, the focus on the impact of changes in the financial environment on CSR performance is low considering that green and sustainable development has become a worldwide consensus. No literature has yet investigated this issue.

2.2. Green finance and the fulfilment of CSR

Green finance is essentially credit rationing based on environmental constraints that directing funds to green enterprises (Hu et al., 2018; Li et al., 2022; Wang et al., 2020). From the market perspective, the development of green finance improves the sharing mechanism of environmental information to curb the occurrence of ‘greenwashing’ while also increasing the reputational risk of polluting enterprises’ investments and the institutions that provide them with financial support. This highlights the reputation advantage of green enterprises’ investments while compressing the financing space of polluting enterprises (Allet & Hudon, 2015; Lyon & Montgomery, 2013; Zhang et al., 2021). However, through the allocation mechanism of funds based on environmental information, polluters’ access to finance is reduced (Liu et al., 2017; Su & Lian, 2018), thus discouraging polluters’ investment. From the government perspective, ‘political tournament’ that targets economic development has resulted in governments ignoring the environmental impacts of projects and directed financial resources to economically efficient projects, thus excluding environmentally efficient projects that are not economical (Li & Zhou, 2005; Zhou, 2007). Green projects face more serious problems in terms of credit discrimination compared to general projects. Improving the central and local green finance policy system provides a strong impetus to the allocation of credit in accordance with the ‘environmental financing order’, thereby gradually alleviating the financing constraints of green enterprises and aggravating those of polluting enterprises.

Resource dependency theory and stakeholder theory contend that CSR is conducive for obtaining financial resources from banks, investors and other stakeholders, specifically with the purpose of alleviating the financing constraints faced by enterprises (Ghoul et al., 2017). On the one hand, CSR can make up for the shortcomings of financial reports with incomplete information, reduce the degree of information asymmetry between banks and enterprises and help enterprises in obtaining more credit funding support and longer loan terms (Goss & Roberts, 2011). On the other hand, an enterprise actively fulfilling its social responsibility indicates that it pays more attention to its long-term development, which can reduce investors’ concerns about the future of the enterprise as well as its operations, thus enhancing investors’ willingness to invest and reduce the cost of equity capital (Ghoul et al., 2011; Niu et al., 2022). Therefore, to alleviate financing constraints, companies are willing to shoulder social responsibility and send positive signals to external stakeholders. This also suggests that high financing constraints can force companies to actively engage in environmental governance and participate in green projects, thus fulfilling their social responsibility (Li et al., 2022).

2.3. Green finance, media monitoring, and CSR fulfilment

The role of media has increased with the rise of social media (Core et al., 2008; Dyck et al., 2008; Gao et al., 2021; Li et al., 2017). Stakeholders can reduce information asymmetry by interpreting media coverage of business-related information (Chen et al., 2021). In recent years, besides the prominence of environmental issues and the increasing importance that the government attaches to environmental protection, the Regulations on the Assessment Work of Party and Government Leading Cadres

promulgated by the General Office of the Central Committee of the CPC in 2019 have incorporated environmental protection performance into the index system of the performance assessment of local leading cadres. Additionally, green finance requires financial institutions to review the destination of funds and establish strict requirements for financing highly polluting enterprises. Therefore, for better political assessment and lending efficiency as well as to reduce information asymmetry, government officials and financial institutions pay attention to media reports related to highly polluting enterprises. Evidently, the increase in demand for information will lead to more media attention and coverage of highly polluting enterprises, thus putting them under greater public pressure.

In a green financial environment that promotes a green and sustainable development model, media coverage of CSR activities will strongly stimulate enterprises and have a punitive effect on enterprises that do not fulfil their social responsibility. First, negative media coverage of CSR reduces executive political resources (An et al., 2022; Dyck et al., 2008). In state-owned enterprises, executives are usually appointed administratively, and their careers are inevitably affected once the media exposes the crisis caused by the company's avoidance of social responsibility (Zheng et al., 2012). In private enterprises, although the government is not the capital provider, there is competitive advantage in the market through political rent-seeking, meaning that the government's attitude is considered important. Moreover, private companies usually seek to gain government support in terms of the business environment, industry access and tax incentives (Chen et al., 2011). Second, negative media coverage of CSR can also increase costs or reduce financial sources (Kölbel et al., 2017). In other words, negative information about enterprises can increase the probability of financial institutions not giving them loans and thus causing a reduction in the scale of external financing. Consequently, this study contends that media monitoring can positively moderate the facilitation effect of green finance on highly polluting firms' social responsibility fulfilment.

Based on the aforementioned analysis, the following hypotheses are proposed.

Hypothesis 1 (H1): Green finance development promotes the fulfilment of social responsibility of highly polluting enterprises.

Hypothesis 2 (H2): Green finance development intensifies the financing constraints of highly polluting enterprises, thus forcing them to fulfil their social responsibilities.

Hypothesis 3 (H3): The greater the media scrutiny, the more significant the contribution of green financial development to the social responsibility of high polluting enterprises.

3. Research design

3.1. Sample selection and data sources

In June 2017, the State Council of China decided to select five provinces (regions) – Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang – as the first batch of pilot projects. First, this provided a good opportunity to explore the economic effects of the development of green finance. Second, as highly polluting enterprises are the key targets of the green financial policy, investigating the status of their social responsibility

activities enables assessing the effect of this policy can be assessed more. Therefore, this study employs the 2013–2020 Chinese A-share listed companies with heavy pollution as the research sample and screens them as follows. First, financial and insurance companies are removed; second, ST/PT companies (Samples with two consecutive years of negative net profit) were excluded; third, companies whose asset–liability ratio is greater than 1 are removed; and fourth, companies with missing variables are removed. Finally, we obtain 548 companies with 5699 observations. The selection of highly polluting enterprises is based on the Guidelines on Industry Classification of Listed Companies revised by the China Securities Regulatory Commission in 2012; the List of Industry Classification and Management of Environmental Verification of Listed Companies established by the Ministry of Environmental Protection of China in 2008 and the Guidelines on Environmental Information Disclosure of Listed Companies, which includes thermal power, iron and steel, cement, electrolytic aluminium, coal, metallurgy, chemical, petrochemical, building materials, paper, brewing pharmaceutical, fermentation, textile, tannery and mining industries. The CSR data used in this study are from Hexun.com, a third-party rating agency that publishes annual reports on the social responsibility of listed companies, covering all A-share listed companies in Shanghai and Shenzhen. Moreover, the data provide a comprehensive evaluation of social responsibility in five aspects – shareholder responsibility; employee responsibility; supplier, customer and consumer responsibility; environmental responsibility and social responsibility. Media coverage data are from the China Important Newspaper Full Text Database (CNKI), and news reports are collected manually from China Securities Journal, Shanghai Securities Journal, Securities Times, Securities Daily, Economic Observer, 21st Century Business Herald, First Financial Daily and China Times. Data pertaining to corporate finance and governance are from the China Stock Market and Accounting Research CSMAR database.

3.2. Model construction and variable definition

To determine whether green finance promotes the social responsibility of highly polluting enterprises, the following double difference model (Model (1)) is constructed. Moreover, to test whether financing constraints play a mediating role, we construct Models (2) and (3) by referring to the mediation effect test proposed by Baron and Kenny (1986). Hypothesis 3 was tested using Model (4). The specific models are:

$$CSR_{i,t} = \alpha_0 + \alpha_1 Treat_{i,t} * Post_t + \alpha_i Controls_{i,t} + \sum Id + \sum Year + \varepsilon_{i,t} \quad (1)$$

$$SA_{i,t} = \delta_0 + \delta_1 Treat_{i,t} * Post_t + \delta_i Controls_{i,t} + \sum Id + \sum Year + \varepsilon_{i,t} \quad (2)$$

$$CSR_{i,t} = \alpha'_0 + \alpha'_1 Treat_{i,t} * Post_t + \gamma_1 SA_{i,t} + \alpha_i Controls_{i,t} + \sum Id + \sum Year + \varepsilon_{i,t} \quad (3)$$

$$CSR_{i,t} = \alpha_0 + \alpha_1 Treat_{i,t} * Post_t * Media + \alpha_2 Treat_{i,t} * Post_t + \alpha_3 Media + \alpha_i Controls_{i,t} + \sum Id + \sum Year + \varepsilon_{i,t} \quad (4)$$

The explained variable is the level of CSR performance, measured by a natural logarithm of the total CSR score published by Hexun.com; *treat* denotes the spatial dummy variable, which takes the value of 1 when a company is in a highly polluting industry and 0 otherwise; *post* is a temporal dummy variable, which takes the value of 0 before 2017, 0.5 in 2017 (the current year) and 1 thereafter. Additionally, *i* represents the firm; *t* represents the year; *Controls* represents the control variable; *Year* represents the year effect; *Id* represents the individual firm effect, and ε represents the random disturbance term. The key explanatory variable *Treat*Post* represents the interaction term between the spatial and temporal dummy variables, and its coefficient α_1 is the focus of this study. When α_1 is significantly positive, it means that green finance can significantly promote social responsibility fulfilment of highly polluting enterprises. Besides, the given random disturbance term (ε) is assumed to be normally distributed at zero mean value and constant variance. Besides, the given error term (ε) is assumed to be normality distributed with zero mean value and constant variance (Ehsan et al., 2019).

The intermediate variable, *SA*, indicates the level of corporate financing constraints, and this study selects the exogenous *SA* index to measure corporate financing constraints. The *SA* index was proposed by Hadlock and Pierce (2010) and is calculated as follows: $SA = -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age$, where *Size* is the natural logarithm of the total assets of the firm, *Age* indicates the age of the firm and *media* indicates media attention. The higher the *SA* value, the higher the degree of financing constraint the firm is subject to. This study uses the natural logarithm of the total number of media reports on the firm +1; the higher the value, the greater the media scrutiny the firm is subject to.

Referring to Hong et al. (2016) and Ali et al. (2017), this study controls for the following factors that may affect CSR performance at the company financial and corporate governance levels: company size (*Size*, the natural logarithm of total assets), gearing (*Lev*, total liabilities/total assets), profitability (*ROA*, return on net assets), growth (*Growth*, growth rate of revenue), board size (*Board*, natural logarithm of the number of board members), independent directors (*Indep*, ratio of the number of independent directors to the number of board members), the same person occupying the position of a board chairman and CEO (if the same person is the chairman and CEO, it takes a value of 1 and 0 otherwise), number of shares held by the top shareholder (*Top1*, number of shares held by the top shareholder/total number of shares), executive shareholding (*Mshare*, number of executive shareholdings/total shareholdings) and firm age (*Age*, the natural logarithm of the number of years the firm has been in existence). Additionally, this study controls for year (*Year*) and individual firm (*Id*) fixed effects.

According to the mediation effect test method, the coefficient α_1 must be significant; if not, stop the test. If α_1 is significant, proceed to the next step. If both δ_1 and γ_1 are significant but α'_1 is not significant, it implies that a full mediation effect is present. If either δ_1 and γ_1 is insignificant, a Sobel test is performed. If $\delta_1 \cdot \gamma_1$ and α'_1 are all significant and $\delta_1 \cdot \gamma_1$ has the same sign as α'_1 , it indicates that a partial mediation effect is present. Otherwise, the mediating effect is not valid.

4. Empirical results

4.1. Descriptive statistical results

Table 1 reports the summary statistics for the variables. The mean value of the level of social responsibility fulfilment of the sampled companies is 3.097, and the standard deviation is 5.105 (the standard deviation is greater than the mean value). The minimum and maximum values are 0.066 and 4.285, respectively, indicating that the level of social responsibility fulfilment varies greatly between the sampled companies. The mean value of SA is 3.549, indicating that high-polluting enterprises generally face high financing constraints, while the minimum value of SA is 1.163 and the maximum value of SA is 8.937, indicating that the degree of financing constraints varies widely between enterprises. The mean value and standard deviation of *Media* are 1.821 and 1.980, respectively, (the standard deviation is greater than the mean), indicating that the sampled companies have greater variation in terms of media attention. Additionally, the descriptive statistics of the control variables are not significantly different from those in the existing literature and have good statistical distribution properties.

4.2. Green finance and social responsibility fulfilment of heavily polluting enterprises

Table 2 reports the regression results of Model (1). Column (1) presents the univariate regression results without the control variables but controls for industry and individual fixed effects, whereas Column (2) presents the multivariate regression results with the control variables. Additionally, this study examines the differential impact of green finance on the fulfilment of different dimensions of social responsibility of highly polluting enterprises by dividing the sample into other social responsibilities group (*CSR_Other*) and environmental social responsibility group (*CSR_Envir*) according to Hexun's classification of the dimensions of social responsibility. The coefficient *Treat*Post* is significantly positive with or without the control variables. In Columns (3) and (4), the coefficient *Treat*Post* is significantly positive; however, the coefficient is larger and has a higher level of significance in the environmental social

Table 1. Summary statistics.

Variables	N	mean	sd	Min	P50	Max
CSR	5699	3.097	5.105	0.066	1.160	4.285
SA	5699	3.549	1.452	1.163	2.482	8.937
Media	5699	1.821	1.980	0.000	1.873	5.316
Size	5699	23.270	1.393	19.550	23.185	26.403
Lev	5699	0.487	0.198	0.046	0.496	0.990
Roa	5699	0.039	0.061	-0.415	0.034	0.244
Growth	5699	0.121	0.346	-0.732	0.078	4.712
Board	5699	2.178	0.208	1.609	2.197	2.708
Indep	5699	0.377	0.056	0.308	0.364	0.600
Dual	5699	0.187	0.390	0.000	0.000	1.000
Top1	5699	0.367	0.157	0.084	0.356	0.755
Mshare	5699	0.063	0.139	0.000	0.000	0.702
Age	5699	2.964	0.295	1.792	2.996	3.555

Notes: This table presents summary statistics for the variables. We tabulate the number of observations (*N*), the sample average (mean), the standard deviation (*sd*), the median (*p50*), the minimum (*min*), and the maximum (*max*). All continuous variables are winsorised at the 1% and 99% levels.

Source: Author's Source.

Table 2. Green finance and the fulfilment of social responsibility of highly polluting enterprises.

Variables	(1) CSR	(2) CSR	(3) CSR_Other	(4) CSR_Envir
Treat*Post	1.625** (2.497)	1.696*** (2.602)	0.937** (1.981)	3.346*** (3.738)
Size		3.946*** (26.235)	3.924*** (20.239)	3.964*** (15.901)
Lev		-3.646*** (-3.822)	-3.365*** (-2.679)	-3.633** (-2.402)
Roa		9.148*** (3.322)	10.476** (2.340)	8.809** (2.439)
Growth		-0.239 (-0.578)	-0.567 (-1.068)	0.032 (0.050)
Board		5.029*** (5.705)	4.075*** (3.549)	6.296*** (4.371)
Indep		2.091 (0.682)	5.455 (1.403)	-2.364 (-0.469)
Dual		-0.932** (-2.516)	-1.587** (-2.453)	-0.479 (-1.022)
Top1		2.734*** (2.629)	6.001*** (3.993)	-1.131 (-0.671)
Mshare		4.714*** (4.345)	3.812 (0.609)	3.393*** (2.710)
Age		-1.140** (-2.009)	0.642 (0.800)	-3.181*** (-4.007)
Constant	30.668*** (121.889)	-39.493** (-2.273)	-26.918 (-1.057)	-69.550*** (-2.915)
Year&ld	YES	YES	YES	YES
N	5699	5699	5699	5699
Adj-R ²	0.430	0.437	0.452	0.424
P-test	-	-	0.032**	

Notes: Columns (1)–(4) present the results on the relation between green finance and CSR of highly polluting enterprises. Column (1) reports the univariate regression results. Columns (2)–(4) reports the multiple regression results. Column (3) presents the results on the relation between green finance and CSR_Other. Column (4) presents the results on the relation between green finance and CSR_Envir. All continuous variables are winsorised at the 1% and 99% levels. The t-statistics are calculated based on robust standard errors clustered by firm and are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Author's Source.

responsibility group than the other social responsibilities group. Moreover, the difference between the groups has a p value of 0.032, indicating that there is a significant difference between the two groups in terms of the enhancement effect of green finance on highly polluting enterprises.

The aforementioned regression results indicate that, in general, green finance can promote the fulfilment of social responsibility of highly polluting enterprises, which initially supports H1. After distinguishing the types of social responsibilities, we find that the promotion effect of green finance on the fulfilment of the social responsibility of highly pollution enterprises is the main focus of environmental social responsibility. This indicates that under the influence of green finance policy, highly polluting enterprises pay more attention to environmental protection and actively undertake social responsibility related to environmental management.

4.3. Testing the intermediary effect

In the theoretical analysis, this study argues that capital rationing rules of green finance can severely restrict the external financing ability of highly polluting

enterprises, whereas a higher level of social responsibility fulfilment can send a positive signal to stakeholders that enterprises seek to transform and value long-term development to alleviate the credit discrimination caused by green finance. Furthermore, because environmental protection is becoming increasingly important, government officials and financial institutions are motivated to obtain information on the operation status and social responsibility fulfilment of highly polluting firms (one of the main players causing environmental degradation). Consequently, highly polluting firms face increased media scrutiny, which amplifies the facilitation effect of green finance on highly polluting firms' social responsibility fulfilment. Table 4 presents the test results for the moderating effect of media monitoring.

Table 3 presents the results of testing the mediating effect of financing constraints. In Column (2), the coefficient *Treat*Post* is significantly positive, indicating that the development of green finance significantly strengthens the financing constraints of highly polluting enterprises. In Column (3), the coefficient of SA is significantly positive, indicating that the higher the financing constraint faced by enterprises, the more they will fulfil their social responsibility. Moreover, the regression results indicate that strengthening financing constraints can force enterprises to fulfil their social responsibility, which is consistent with the findings of Chen and Zheng (2020). After adding SA, the coefficient *Treat*Post* is still

Table 3. The mediating effect of financing constraints.

Variables	(1) CSR	(2) SA	(3) CSR
<i>Treat*Post</i>	1.696*** (2.602)	0.408** (2.372)	1.202** (1.974)
SA			1.008*** (3.156)
Size	3.946*** (26.235)	-0.106*** (29.340)	4.274*** (24.391)
Lev	-3.646*** (-3.822)	0.092*** (-4.096)	-7.625*** (-7.260)
Roa	9.148*** (3.322)	-0.326*** (-5.557)	5.152* (1.748)
Growth	-0.239 (-0.578)	-0.001 (-0.072)	0.792 (1.627)
Board	5.029*** (5.705)	-0.051*** (3.169)	3.306*** (3.406)
Indep	2.091 (0.682)	-0.383*** (6.068)	-0.973 (-0.282)
Dual	-0.932** (-2.516)	-0.005 (-0.686)	-0.610 (-1.520)
Top1	2.734*** (2.629)	0.181*** (8.090)	1.511 (1.293)
Mshare	4.714*** (4.345)	-0.121*** (4.819)	5.869*** (4.965)
Age	-1.140** (-2.009)	-0.556*** (-35.910)	-1.351*** (4.595)
Constant	-39.493*** (-2.273)	0.182*** (4.545)	-40.338*** (4.113)
Year&ld	YES	YES	YES
N	5699	5699	5699
Adj-R ²	0.437	0.371	0.451

Notes: Columns (1)–(4) present the mediating effect of financing constraints. All continuous variables are winsorised at the 1% and 99% levels. The t-statistics are calculated based on robust standard errors clustered by firm and are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Source: Author's Source.

significantly positive, with an absolute value that is smaller than that in Column (1). The coefficient $\delta_1^* \gamma_1$ has the same sign as α'_1 , indicating that financing constraint has a mediating effect on green finance promoting the social responsibility of highly polluting enterprises, and the mediating effect is 24.25% ($0.408^* 1.008 / 1.696$). Thus, H2 is supported.

4.4. Testing the moderating effects

The regression results of the moderating effect of media monitoring are shown in Table 4. In Column (1), the coefficient of Treat*Post is significantly positive at the 1% level, indicating that since the establishment of the green finance reform and innovation pilot zones, the highly polluting firms in the pilot zones have received more media attention, thus increasing the pressure from external public opinion on those firms. Column (2) shows that Media is significantly positive at the 5% level, indicating that with more extensive media coverage, the relevant firms will fulfil their social responsibilities more actively, which is consistent with the findings of Lei and Zhang (2020). The Treat*Post*Media coefficient is significantly positive, indicating

Table 4. Testing the moderating effect of media monitoring.

Variables	(1) Media	(2) CSR
Treat*Post	0.263*** (7.044)	1.256*** (4.844)
Media		1.719** (2.097)
Treat*Post*Media		1.115*** (3.227)
Size	0.157*** (32.467)	3.931*** (25.906)
Lev	-5.460 (-1.420)	-3.424*** (-3.591)
Roa	-0.526*** (-7.932)	10.708** (2.093)
Growth	-0.009 (-0.834)	-0.243 (-0.586)
Board	0.047** (2.137)	5.003*** (5.677)
Indep	0.558*** (5.464)	2.122 (0.695)
Dual	-0.006 (-0.605)	-0.926** (-2.496)
Top1	0.177*** (6.507)	2.670*** (2.567)
Mshare	0.124*** (4.311)	4.443*** (4.101)
Age	-0.614*** (-26.126)	-1.158** (-2.037)
Constant	-2.046*** (-16.917)	-67.911*** (-16.366)
Year&ld	YES	YES
N	5699	5699
Adj-R ²	0.149	0.489

Notes: Columns (1) and (2) present the moderating effect of media monitoring. All continuous variables are winsorised at the 1% and 99% levels. The t-statistics are calculated based on robust standard errors clustered by firm and are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Author's Source.

that media coverage can effectively exert the external governance effect and amplify the facilitation effect of green finance policies on highly polluting firms' environmental responsibility fulfilment. In this study, Hypothesis 3 is confirmed based on the regression results.

4.5. Robustness tests

To verify the reliability of the above main findings, this paper conducted parallel trend tests and placebo tests on model (1) in turn, and substituted the results of the main regression, the results of the mediating effect of financing constraints and the results of the moderating effect of media coverage for the key variable measures, and the results of all these tests indicate that the conclusions of this paper are robust.

5. Conclusion

This study uses the Chinese State Council's 2017 approval for establishing a pilot green financial reform and innovation zone as a quasi-natural experiment in order to empirically test the impact of establishing a green financial reform and innovation zone on fulfilment of CSR as well as its impact mechanism. It uses a double difference method and conducts a mediating effect test on a sample of highly polluting A-share listed companies in Shanghai and Shenzhen from 2013 to 2020. The following conclusions are obtained.

First, the results of the double difference test demonstrate that the establishment of the pilot zone for green financial reform and innovation rendered the social responsibility scores of the treatment group significantly higher than those of the control group, that is, green finance effectively pushes highly polluting enterprises to fulfil their social responsibility. Compared with the other aspects of social responsibility, the pilot zone of green financial reform and innovation mainly influenced enterprises to fulfil their environmental social responsibility. This indicates that green finance can induce highly polluting enterprises to focus more on social issues and change their development philosophy, thereby having a positive policy spillover effect.

Second, the establishment of the green financial reform and innovation pilot zones can force listed highly polluting enterprises to participate in green projects and fulfil their social responsibility by mitigating their financing constraints. The development of green finance can impose serious financing constraints on highly polluting enterprises. Moreover, when an enterprise actively fulfils its social responsibility, it can send positive signals to financial institutions that it seeks to transform its development methods, thus differentiating it from other highly polluting enterprises and improving its financing environment.

Third, media monitoring positively moderates the effect of green finance development on highly polluting firms' social responsibility fulfilment. Based on the need to meet political assessments and reduce investment risks, government officials and financial institutions should be incentivised to learn about the social responsibility fulfilment of highly polluting enterprises. Moreover, increased market demands have led the media to pay more attention to highly polluting enterprises. Media scrutiny

creates a strong public opinion for monitoring highly polluting enterprises, thus forcing them to take up social responsibility.

Based on the abovementioned findings, the policy implications of this study are as follows. First, financial institutions should respond positively to the national policy to guide the flow of funds to ecologically and environmentally friendly industries, reduce the supply of funds to highly polluting projects, increase their financing costs and realise the green allocation of capital factors. This will force highly polluting enterprises to fulfil their social responsibility and alleviate negative externalities of environmental costs. Second, this study discovers that media monitoring can amplify the facilitation effect of green finance on highly polluting firms' social responsibility fulfilment. Consequently, relevant media outlets should increase their coverage and supervision of highly polluting firms to create strong public opinion pressure, which will motivate highly polluting firms to consider social effects while seeking economic benefits and promote the green transformation of economic development. Third, in the general environment of pursuing green and sustainable development, highly polluting enterprises should actively change their development mode and adopt corresponding social responsibilities, thus making stakeholders form positive expectations for the development of enterprises and helping alleviate the financing constraints faced by enterprises.

Although, this study has clarified the impact of green finance development on the fulfilment of the social responsibility of highly polluting enterprises to a certain extent, there are still some limitations. First, this study uses data from Chinese listed companies with high pollution levels; however, the background of China's property rights and capital market systems is significantly different from that of developed Western countries. Therefore, the applicability of this study's findings to developed countries needs to be verified. Second, while this study explores the heterogeneous impact of green finance on the different social responsibilities of highly polluting enterprises, its classification of the types of CSR is crude and does not involve the heterogeneous impact of green finance on the fulfilment of the social responsibilities of highly polluting enterprises under different property rights' nature and marketisation levels, which can be a subject for future studies. Finally, this study does not discuss whether the active fulfilment of the social responsibility of highly polluting enterprises will alleviate their financing constraints or improve their financial performance. An affirmative answer would be helpful to further determine the economic effects of green finance development and motivate highly polluting enterprises to fulfil their social responsibility.

Although this paper finds the mediating effect of financing constraints in green finance to promote the social responsibility of highly polluting enterprises, it does not test other possible paths, such as agency problems, etc., which can be further explored in subsequent studies. In addition, this paper mainly focuses on heavy polluters, and in future studies, researchers can examine the impact of green finance policies on other industries to more comprehensively examine the economic effects of green finance policies.

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ORCID

Xiuling Li  <http://orcid.org/0000-0002-6017-0090>

Zhitao Wang  <http://orcid.org/0000-0001-5748-2985>

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