Heliyon 10 (2024) e33710

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Do pilot zones for green finance reform and innovation avoid ESG greenwashing? Evidence from China

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ARTICLE INFO

Keywords:
Green finance reform and innovation pilot zone (GFRIPZ)
ESG greenwashing
Financial constraints
Corporate reputation
Monitoring

ABSTRACT

As ESG investments have grown, many companies are emphasizing them to impress capital markets and consumers with their responsibility and environmental consciousness. However, managers in unethical companies greenwashing ESG reports to keep clients. The present investigation employs quasi-natural experiment data obtained from a sample of 1200 Chinese A-share listed companies spanning the period from 2011 to 2021 to examine how the Green Finance Reform and Innovation Pilot Zone (GFRIPZ) affects ESG greenwashing. GFRIPZ can prevent publicly traded companies from ESG greenwashing. The statistical analysis of heterogeneity demonstrates that GFRIPZ in non-state-owned, mid-west, heavy-polluting, manufacturing industries reduces ESG greenwashing. GFRIPZ suppresses corporate ESG greenwashing better in companies with severe financial constraints and a poor corporate reputation. GFRIPZ's inhibition of corporate ESG greenwashing is enhanced by internal and external monitoring. This study shows how financial markets affect firms' ESG greenwashing. It helps implement GFRIPZ theoretically. It also recommends raising listed companies' awareness of ESG disclosure and reducing corporate ESG greenwashing.

1. Introduction

The Chinese government and enterprises are faced with the challenge of reconciling economic expansion and environmental preservation, while promoting sustainable and ecologically sound development, owing to the swift pace of economic growth and resource depletion [1]. The capital market has paid more attention to corporations' non-financial performance since the UN introduced ESG. To promote corporate sustainability and investment soundness, several countries and regions have started or improved ESG disclosure systems. Stakeholders are pushing companies to adopt sustainable practices that align with sustainable development principles and disclose ESG information [2,3].

As the lack of policy support mechanisms, regulatory and service agencies, standardized ESG disclosure protocols, and specialized ESG disclosure organizations [4–6], ESG disclosure often serves as a proactive corporate communication tactic. However, ESG performance is poor [7,8]. Unethical executives, organizations, and associates "greenwash" ESG reports to retain clients. Corporate ESG greenwashing makes corporate ESG practices formal [9], difficult for regulators to monitor [10], difficult for investors to identify good investment projects [11], consumers lose trust in companies [12,13], and a bad culture of pursuing good ESG disclosure data but not good actual ESG performance develops in the market [14]. Consequently, it is imperative to examine strategies that impede corporate

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https://doi.org/10.1016/j.heliyon.2024.e33710
Received 29 June 2023; Received in revised form 14 June 2024; Accepted 26 June 2024
Available online 26 June 2024

ESG greenwashing.

From a market guidance perspective, green finance is essential for green development and carbon peaking and neutrality. Current development focuses on real economy financial services. Green finance and corporate ESG greenwashing need immediate resolution. In August 2016, the People's Bank of China (PBOC), the Ministry of Finance (MOF), and the Ministry of Environmental Protection (MEP) jointly established the Green Finance Reform and Innovation Pilot Zone (GFRIPZ). This noteworthy reform initiative in Chinese green finance integrates a "top-down" approach of policy promotion with a "bottom-up" strategy of reform and innovation. The Chinese government has undertaken a significant endeavor to advance the development of green finance through the GFRIPZ in China. The pilot zone's primary goal is to encourage local efforts to develop environmentally friendly financial institutions, product innovation, infrastructure development, external collaboration, and risk mitigation mechanisms. This aims to enhance financial backing for economic and social green development while also facilitating the exchange of valuable knowledge on crucial matters such as aligning green financial standards and enhancing the sustainability of green finance enterprises. In June 2017, the State Council approved the first batch of Green Finance Reform and Innovation Pilot Zones (GFRIPZ) in five provinces and eight places, namely Quzhou City, Zhejiang Province; Huzhou City, Zhejiang Province; Guangzhou City, Guangdong Province; Gui'an New District, Guizhou Province; Ganjiang New District, Jiangxi Province; Hami City, Xinjiang; Changji Hui Autonomous Prefecture, Xinjiang; and Karamay City, Xinjiang. The GFRIPZ was extended for the first time in November 2019, and Lanzhou New District, Gansu Province was permitted to develop the Green Finance Reform and Innovation Pilot Zone. In August 2022, the People's Bank of China and six other departments issued the General Plan for the Construction of Green Finance Reform and Innovation Pilot Zone in Chongqing", marking the official launch of the Green Finance Reform and Innovation Pilot Zone in Chongqing. China's GFRIPZ aspires to create a green financial system. It aims a sustainable green financing strategy to encourage regional green and low-carbon development.

GFRIPZ has been studied on corporate energy efficiency [15,16], haze pollution [17], financing costs [18], green innovation [19,20], and investment efficiency [21]. The policy has increased the financing scale of green enterprises and reduced that of polluting enterprises [22]. Researchers also find that GFRIPZ reduces the total factor productivity (TFP) of heavily polluting enterprises in pilot zones [23]. Media coverage, environmental policies, digital finance, corporate governance, and stakeholder influence are all factors in corporate ESG greenwashing [24–28].

Unfortunately, few studies have examined how GFRIPZ affects corporate ESG greenwashing. China's Green Finance Reform Implementation Plan (GFRIPZ) is important. Nevertheless, several conventional or non-environmental initiatives are rebranded as green ventures in order to reduce funding expenses or enhance market visibility. GFRIPZ's effect on corporate ESG greenwashing should be examined. GFRIPZ's effect on corporate ESG greenwashing may depend on internal and external monitoring. However, current research is insufficient to mitigate corporate ESG greenwashing. Green financing and social image requirements drive corporate greenwashing [29]. When offered large financial gains, organizations may "greenwash" their ESG disclosures. Green finance policies can increase green industry financing and financial capital guidance [30,31]. According to reputation theory, green finance policies can boost businesses' positive social image [32]. These factors may improve business ESG disclosure practices. In this research, the GFRIPZ initiative may help reduce ESG greenwashing. Hence, the primary aim of this research is to examine the green financial reform policy as a means to mitigate the impact and influence of ESG greenwashing. The implementation of the "six provinces nine locations" GFRIPZ will achieve this goal by disseminating a collection of replicable experiences. The study also seeks to broaden the scope of green finance reform and innovation pilot zones, thereby offering robust support. Additionally, this study will provide functional recommendations regarding the role of green finance in curbing corporate ESG greenwashing.

This study makes three main contributions. GFRIPZ may affect ESG greenwashing among publicly traded Chinese firms. GFRIPZ promotes environmentally friendly finance and explores new domains and frameworks for sustainable development, ecological preservation, and environmental protection. It deters ESG greenwashing. The policy proposal proposes creating GFRIPZ in China to encourage companies to disclose ESG information truthfully, reduce corporate ESG greenwashing, and help investors find promising investment opportunities. The study found that GFRIPZ affect corporate ESG greenwashing through financing constraints and corporate reputation. This inhibitory effect is stronger in companies with high financing constraints and low reputation. The study also shows that GFRIPZ mitigates ESG greenwashing across firm heterogeneity. Considering firm heterogeneity, this study helps select GFRIPZ policy pilots. The study shows that GFRIPZ inhibits corporate ESG greenwashing through internal and external monitoring. This study integrates green finance policy with the company's ESG disclosure, enhancing the existing body of research on addressing and mitigating challenges related to enterprise ESG greenwashing. The GFRIPZ facilitates the effective implementation of suppressing enterprise ESG greenwashing behavior, allowing enterprises in the pilot area to more effectively adhere to the ESG concept and provide accurate ESG information. This ensures that the outcomes of the green financial reform contribute to the development of ecological civilization and the achievement of the "double carbon" goal. Additionally, it enhances support for the emergence of a green low-carbon real economy.

2. Literature review and hypotheses development

2.1. GFRIPZ and ESG greenwashing

The financial system boosts productivity and economic development, boosting economic growth. Scholarly research suggests that an improved financial system can boost innovation and economic growth [33]. GFRIPZ in six provinces and nine regions have aligned green financial reform with ecological civilization and the "double carbon" goal. These zones have supported green and low-carbon real economy development by implementing and learning from early and pilot initiatives. Business environmental governance requires green financial policies [34]. Huang et al. performed a Difference-in-Differences (DID) analysis on the first five provinces of the

experimental green financial policy zones and found that GFRIPZ could reduce pollution and improve the environment [35]. GFRIPZ policies can boost urban green space productivity by encouraging innovative practices and reducing energy intensity [36]. The green finance pilot program increased Tobin's Q of environmentally conscious businesses in the pilot area [37]. The GFRIPZ policy helps companies improve their ESG scores by using environmental, social, and governance mechanisms [38].

Sustainable development requires ESG disclosure [39]. Sustainability awareness has expanded global ESG investment. Thus, more companies are prioritizing environmental and social responsibility. They innovate and develop sustainable products and services to promote their ESG practices [40]. In response to the ESG trend, some companies have used irrational tactics to promote their fake management and business sustainability advantages. These firms use "pseudo-ESG" practices to attract customers and investors. "Pseudo-ESG" practices include ESG greenwashing. This study defines ESG greenwashing as a company disclosing a lot of ESG data to attracted the stakeholders at the organizational level, but this disclosure conceals the company's poor ESG performance [27,41].

Given information asymmetry, green finance must identify environmentally sustainable companies and projects [42]. Green companies and projects struggle to find financial resources, while financial institutions lack knowledge of how to identify them [43]. According to financial sustainability theory, promoting local green financial development among enterprises can help allocate resources to environmentally conscious businesses. The financial sector has tightened lending for environmentally friendly investments in incomplete markets [44]. Green financial regulation requires banks to offer "green lanes" to eco-friendly businesses before extending credit. Policymakers and financial institutions are trying to persuade corporations to adopt sustainable practices [45]. Lee examines sustainable finance and green finance's environmental, social, and governance aspects. Green finance's role in sustainable development and relevant events in China are examined [46]. GFRIPZ has established a self-regulatory framework in the green finance sector to improve environmental information disclosure, standardize the system, and set high standards for green projects in the project pool. This initiative promotes high-quality green finance development. GFRIPZ promotes environmentally sustainable finance through monetary, fiscal, and market-stimulating policies. The GFRIPZ policy could improve ESG information disclosure standards for pilot enterprises through financial institution regulation and policy incentives, aligning them more closely with sustainable development goals and curbing ESG greenwashing. This observation suggests hypothesis 1.

Hypothesis 1. GFRIPZ can reduce enterprise ESG greenwashing.

2.2. GFRIPZ, financing constraints and ESG greenwashing

The technological innovation and financial risk of firms are impacted by financing constraints [47,48], which in turn have an effect on both economic growth and social welfare. The decision of firms to engage in greenwashing is influenced by financing constraints, indicating that the financial landscape plays a crucial role in shaping greenwashing behavior [49].

Companies that face significant limitations in obtaining financing are inclined towards engaging in greenwashing practices. Organizations opt to engage in greenwashing practices with the primary objective of meeting their future investment and financing requirements. Empirical evidence suggests that companies with higher debt ratios are more likely to participate in greenwashing practices [29]. Companies may be motivated to engage in greenwashing as a means of attaining the objective of maximizing corporate profits and evading financial difficulties [50]. Entities may transmit particular indicators of sustainable performance with the aim of misleading policymakers and financial institutions, in order to conform to policy mandates and alleviate financial constraints.

The establishment of GFRIPZ is intended to addressing the financial constraints encountered by environmentally-friendly industries and initiatives in China. These limitations arise from factors such as information asymmetry, risk preference, and inadequate regulation, which impede the progress of ecological civilization development and low-carbon transformation in the country. The mitigation of corporate financing constraints through the implementation of green financial policies holds significance in augmenting ESG performance of corporations [51]. The provision of green financial capital support by GFRIPZ can effectively alleviate financing constraints and curb ESG greenwashing behavior in enterprises with higher financing constraints, as compared to those with lower financing constraints. Therefore, the hypothesis 2 proposes that.

Hypothesis 2. The inhibitory impact of GFRIPZ on corporate ESG greenwashing is more pronounced in situations where financing constraints are elevated.

2.3. GFRIPZ, corporate reputation and ESG greenwashing

According to the reputation effect, a favorable reputation of a company can confer upon it a sustained competitive edge. It is imperative for managers to uphold a favorable corporate reputation in terms of ESG factors [52]. Corporate reputation is considered a valuable intangible asset by investors. The disclosure of adverse ESG information through media channels has been found to have a substantial and adverse impact on a company's valuation, according to research [53]. According to scholarly sources, the potential consequences of reputational damage on financial performance can be severe [54].

The motivation behind corporate ESG greenwashing is driven by the desire to cultivate a sustainable corporate image and reputation [55]. Studies have indicated that corporations exhibiting subpar ESG performance are prone to engaging in the practice of greenwashing [28]. Corporations are increasingly prioritizing the upkeep of their environmentally-friendly reputation as a means of garnering the interest of financial establishments, bolstering investor assurance, and cultivating consumer reliance. According to research, there is a higher probability for individuals or organizations to participate in the misrepresentation of environmentally friendly practices and the dissemination of inaccurate ESG information, leading to the manifestation of ESG greenwashing behavior [56]. Companies that engage in greenwashing also leverage media channels to enhance their reputation and gain support for their

environmental, social, and governance (ESG) initiatives [57]. According to research, corporations that effectively handle and reveal data regarding environmental, social, and governance (ESG) concerns tend to enjoy a more favorable public image [58].

This study examines the impact of GFRIPZ on reputation. The implementation of GFRIPZ has the potential to enhance the appeal of businesses operating within the locality. Organizations may exhibit a greater propensity to establish their principal offices or subsidiaries within the experimental green finance region to avail themselves of additional policy backing and convenience, while also leveraging the reputation of the experimental green finance region to augment their image and competitive edge. The GFRIPZ, consisting of six provinces and nine regions, has been observed to exert a beneficial influence impact on the reputation of local enterprises. Following their designation as a pilot enterprise of the GFRIPZ policy, companies may experience a boost in their reputation, which could potentially reduce the motivation for engaging in ESG greenwashing practices. Hence, it can be inferred that the efficacy of GFRIPZ in curbing ESG greenwashing is relatively higher when compared to other factors. This is particularly evident in firms with lower reputations. Hypothesis 3 is proposed based on this observation.

Hypothesis 3. The inhibitory impact of GFRIPZ on corporate ESG greenwashing is more pronounced in situations where the corporate reputation is relatively low.

3. Research design

3.1. Econometric model

GFRIPZ's impact on ESG greenwashing was examined using a multiple-period DID model. Beck et al.'s framework inspired this model [59]. Empirical regression analysis preceded this study. After the Hausman test, Prob > chi2 = 0.0000. The employed methodology in this research involved utilizing a two-way fixed-effects model for panel data regression to effectively manage and account for the potential influence of both firm and time effects. This paper's model (1) evaluates hypothesis 1.

$$GW_{it} = a_0 + \alpha_1\ GFRIPZ_{it} + \sum \alpha_i\ Controls_{it} + \lambda_i + \delta_t + \xi_{it} \quad (1)$$

"GW_{it}" represents corporate ESG greenwashing, The letters "i" and "t" are used to denote the respective variables of firm and year. The variable $GFRIPZ_{it}$ represents Green Finance Reform and Innovation Pilot Zones. $GFRIPZ_{it}$ is the product of Treat * Time. If the State Department of China designates the city or district where the firm is registered as a GFRIPZ in year t, then GFRIPZ will be assigned a value of 1 (Treat = 1, Time = 1) for that year and the following years. Before that, GFRIPZ was 0, treatment was 1, and time was 0. Organizations without GFRIPZ initiatives fall into two categories: those with GFRIPZ = 0 (Treat = 0, Time = 0) and those with GFRIPZ = 0 (Treat = 0, Time = 1). Control variables in a statistical model are called "$Controls_{it}$". λ_i and δ_t represent the fixed effects of the firm and year, respectively. The aforementioned model also has a random error term, ξ_{it}. we still use model (1) to test hypotheses 2 and 3 by examining the grouping mechanism associated with financing constraints and corporate reputation.

3.2. Variable definition and description

3.2.1. Dependent variable

ESG greenwashing (GW) is the dependent variable. ESG greenwashing occurs when companies disclose extensive ESG data to hide poor ESG performance [27,60]. There exists a disparity between the disclosure of ESG factors and the actual performance of companies in relation to these factors. The Bloomberg ESG Disclosure Index (BESG) can evaluate ESG disclose data. Bloomberg globalizes ESG data. According to sources [61], Chinese corporations' ESG performance is quantified using the ESG rating index or score. The HuaZheng ESG Composite Score (HESG) can evaluate ESG performance. BESG is more incomplete than HESG. The industry-year standardized ESG disclosure index (BESG) - industry-year standardized ESG score (HESG) is used to obtain the value of corporate ESG greenwashing (GW) A higher GW indicates more corporate ESG greenwashing. The BESG Sub-Index and HESG sub-score standardized by industry-year, specifically the GW-E, GW-S, and GW-G components, may be suitable proxy variables for robustness tests.

3.2.2. Independent variable

GFRIPZ is the independent variable. In 2017, the State Council's 176th executive meeting approved a total of eight locations across five provinces (Quzhou City, Zhejiang Province; Huzhou City, Zhejiang Province; Guangzhou City, Guangdong Province; Gui'an New District, Guizhou Province; Ganjiang New District, Jiangxi Province; Hami City, Xinjiang; Changji Hui Autonomous Prefecture, Xinjiang; and Karamay City, Xinjiang) as the GFRIPZ, plus the 2019 expansion of Lanzhou New District in Gansu, a total of nine locations in six provinces. The 2022 Chongqing pilot location was shorter so it is not included in GFRIPZ. Drawing on Ge et al. [62] and Su [63], We use a quasi-natural experiment to identify GFRIPZ firms in their district or city and 36 firms with 98 observations implemented the GFRIPZ.

3.2.3. Mediating variables

The mediating variables are firm reputation (Rep) and financing constraints (WW). Firms cannot obtain cost-effective external funds due to the financing constraint. This study uses the financing constraint index (WW) by Whited and Wu [64]. The WW Index considers companies' capital market financing options and assesses the degree of financing restrictions based on the debt-to-equity ratio. The formula for calculating the WW index is as follows:

$$WW = -0.091*CF - 0.062*DIV + 0.021*LDEBT - 0.044*LNTA + 0.102*ISG - 0.035*SG$$

In which CF, DIV, LDEBT, LNTA, ISG, and SG respectively represent cash flow to total asset ratio, share-payment mud variables, long-term liability to asset ratios, total assets natural counterparts, industry sales growth rate, and sales revenue growth rate, the vector of which is given by White and Wu (2006), the larger the value indicates a higher degree of corporate financing constraints.

Fombrun and Cravens [65,66]used a list system to evaluate corporate reputation. Chang et al. [67] used Rep to evaluate corporate reputation in China. This study evaluated corporate reputation using Guan's [68] method. Factor analysis determined corporate reputation. The factor analysis method was used to calculate corporate reputation scores for 12 indicators, such as the ranking of the company's assets, revenues, net profits, and value in the industry from the perspective of consumers and society; gearing ratio, current ratio, long-term debt ratio from the perspective of creditors; earnings per share, dividends per share, and whether or not they are audited by the Big Four accounting firms from the standpoint of shareholders; and sustainable growth rate and the percentage of independent directors from the perspective of the company, and so on. Corporate reputation scores were sorted into ten ascending groups and assigned a Rep from 1 to 10.

3.2.4. Control variables

According to existing literature, several variables at the firm level have been identified as having an impact on the occurrence of ESG greenwashing demonstrated by companies. The present investigation examines a set of variables, namely firm size (Size), gearing (Lev), net profit margin on total assets (ROA), cashflow ratio (Cashflow), years on the market (ListAge), top shareholder shareholding ratio (Top1), and executive compensation (TMTPay1) [49,69–72] Table 1 contains the definitions of the aforementioned variables.

3.3. Data source

Given the availability of sample data and the impact of ignoring Chongqing experimental areas in 2022 and beyond the data, the present investigation employed a sample of 1200 Chinese A-share listed firms from 2011 to 2021. BESG data comes from Bloomberg. Wind database provides HESG data. The GFRIPZ dataset is derived from the executive session of the State Council. Guotaian (CSMAR) provided the remaining data. The sample excludes financial companies, abnormal companies like "ST" and "PT," and insolvent companies. To reduce outlier effects, companies with missing values in continuous variables are removed, and the tails of continuous variables are winsorized at the 1st and 99th percentiles. This study has 7643 observations. This study collected and analyzed data using Excel and Stata.

4. Results

4.1. Variable measurement and description

Table 2 displays that the mean value of GW is −0.285, with a minimum and maximum value of −2.901 and 3.273, respectively. The

Table 1
Variable definitions.

Variable	Name	Calculation/Value
GW	ESG greenwashing	(Industry and annual standardised Bloomberg ESG disclosure score) - (Industry and annual standardised Huazheng ESG rating score)
GW_E	E greenwashing	(Industry and annual standardised Bloomberg E disclosure score) - (Industry and annual standardised Huazheng E rating score)
GW_S	S greenwashing	(Industry and annual standardised Bloomberg S disclosure score) - (Industry and annual standardised Huazheng S rating score)
GW_G	G greenwashing	(Industry and annual standardised Bloomberg G disclosure score) - (Industry and annual standardised Huazheng G rating score)
GFRIPZ	Green Finance Reform and Innovation Pilot Zone	GFRIPZ = 1 if the firm has been listed as Green finance reform and innovation pilot zone during the years, otherwise GFRIPZ = 0
WW	Financing constraints	Drawing on the financing constraint index proposed by Whited and Wu
Rep	Corporate reputation	The corporate reputation scores were calculated using factor analysis and divided into ten groups, each of which was assigned a value of Rep 1 to 10 in turn.
Size	Company Size	ln (total assets) for the given year
Lev	Gearing ratio	Total liabilities/total assets at the end of a given year.
ROA	Net profit margin on total assets	Net Income/Average Balance of Total Assets
Cashflow	Cash Flow Ratio	Net cash flow from operating activities/total assets
ListAge	Years on the market	ln(current year - list year + 1)
Top1	Percentage of shareholding of the largest shareholder	Number of shares held by the largest shareholder/total number of shares
TMTPay1	Executive Compensation	Natural logarithm of the total compensation of the top three executives
Indep	Percentage of independent directors	Number of independent directors/directors
INST	Institutional investors' shareholding ratio	The ratio of shares held by institutional investors to the total number of shares in equity
ER	Environmental Regulation	Investment in industrial pollution control in the province where the enterprise is registered/industrial added value
ANALYST	Analyst Focus	ln(the number of analyst teams tracking the firm in the current year + 1)

standard deviation of GW is 1.152, which suggests that the degree of ESG greenwashing among the sample companies exhibits significant variation. The primary independent variable, GFRIPZ, is a binary variable with a value of 0.013, indicating that the majority of Chinese listed companies are not registered in the nine experimental zones. Furthermore, it has been observed that non-state enterprises exhibit a higher degree of ESG greenwashing compared to state-owned enterprises, thereby highlighting the need for greater scrutiny of ESG information disclosure by non-state enterprises.

4.2. Baseline regression results

Table 3 presents two models, where model (1) is devoid of any control variables, whereas model (2) incorporates certain corporate control variables. The results indicate that the regression coefficients of GFRIPZ in both model (1) and model (2) are at 1 % statistically significant and negative. This suggests that the implementation of GFRIPZ by listed companies can effectively mitigate the occurrence of corporate ESG greenwashing. Thus, the first hypothesis is being evaluated.

The study found that firm size (Size) is a control variable that exhibits a statistically significant negative impact on ESG greenwashing. Conversely, firm gearing (Lev), cashflow ratio (Cashflow), top shareholder ownership (Top1), and executive compensation (TMTPay1) are control variables that demonstrate a statistically significant positive impact on ESG greenwashing. There exist multiple potential explanations for the obtained outcomes. According to research [73], larger corporations typically possess greater resources to formulate intricate sustainability policies. This enables them to provide more transparent data on corporate ESG disclosure, thereby reducing the likelihood and magnitude of corporate ESG greenwashing. On the contrary, companies with high leverage may amplify financial pressure, thereby augmenting their tendency towards greenwashing, as suggested by previous research [49]. According to research [74], cash flow is a crucial indicator of investment. High cash flows indicate good investment opportunities ， companies that have greater cash flow tend to allocate fewer resources towards disclosing ESG information. Such companies are also more likely to resort to deceptive practices such as greenwashing ESG information. Similarly, we found a significant correlation between cash flow as a control variable and ESG greenwashing [75]. According to research, a firm's corporate governance structure lacks diversity and independence when the shareholding of its first largest shareholder is higher, resulting in a more concentrated shareholding. This is supported by previous studies [76]. Research findings indicate a direct association between executive remuneration and the degree of self-interest demonstrated by executives, leading to escalated agency expenditures for the organization [77]. The implementation of such corporate governance practices has been found to have adverse effects on corporate transparency and decision-making efficiency, as well as to foster corporate corruption and illegal behavior. Furthermore, it has the potential to manipulate ESG disclosure and promote ESG greenwashing behavior.

4.3. Robustness test

4.3.1. Parallel trend test

The assumption of parallel trends is a necessary condition for the application of the difference-in-differences (DID) methodology. The difference-in-differences (DID) method can be employed for the target variables in both the treatment and control groups, pro-

Table 2
Descriptive statistics analysis.

PanelA						
Variable	Obs	Mean	SD	Min	Median	Max
GW	7643	−0.285	1.152	−2.901	−0.393	3.273
GW_E	7643	−0.337	1.212	−3.327	−0.375	3.802
GW_S	7643	−0.214	1.202	−2.628	−0.382	4.343
GW_G	7643	−0.132	1.247	−3.535	−0.220	3.771
GFRIPZ	7643	0.013	0.113	0.000	0.000	1.000
WW	7643	−1.071	0.068	−1.303	−1.068	−0.859
Rep	7643	7.685	2.292	1.000	8.000	10.000
Size	7643	23.250	1.357	20.209	23.133	27.933
Lev	7643	0.484	0.191	0.050	0.495	0.867
ROA	7643	0.058	0.049	0.001	0.044	0.295
Cashflow	7643	0.059	0.067	−0.173	0.057	0.293
ListAge	7643	2.407	0.704	0.000	2.639	3.367
Top1	7643	0.381	0.162	0.073	0.367	0.815
TMTPay1	7643	14.758	0.730	12.910	14.691	17.526
Indep	7643	0.376	0.057	0.286	0.364	0.615
INST	7643	0.509	0.221	0.007	0.530	0.932
ER	7643	0.003	0.002	0.000	0.002	0.019
ANALYST	7643	2.109	1.118	0.000	2.303	4.127

Panel B						
Variable	Obs	Mean	SD	Min	Median	Max
GW:non-state-owned firms	3691	−0.279	1.142	−2.901	−0.386	3.273
GW:state-owned firms	3952	−0.290	1.162	−2.901	−0.405	3.273

Table 3
Baseline regression results.

	(1)	(2)
	GW	GW
GFRIPZ	−0.305***	−0.300***
	(0.118)	(0.116)
Size		−0.151***
		(0.038)
Lev		0.427***
		(0.156)
ROA		−0.428
		(0.439)
Cashflow		0.572**
		(0.227)
ListAge		0.068
		(0.069)
Top1		0.513**
		(0.212)
TMTPay1		0.109***
		(0.039)
_cons	−0.281***	1.043
	(0.010)	(0.865)
Firm Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
N	7643	7643
Adj. R2	0.470	0.473
F	6.690	5.568

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

vided that they meet the prerequisite of the parallel trend assumption prior to the implementation of the policy (ex ante). This implies that there should not be any notable dissimilarity in the extent of ESG greenwashing between the treatment and control groups prior to the occurrence of the event. Therefore, the subsequent equation was formulated for the purpose of testing.

$$GW_{it} = a + D0 \sum_{j=-4}^{4} \alpha_{j\ i}\ ,\ _{t+j} + \sum \beta_i\ Controls_{it} + \lambda_i + \delta_t + \xi_{it} \tag{2}$$

The distinction between equations (1) and (2) lies in the creation of the dummy variable D. Specifically, D is assigned a value of 1 if the firm has been incorporated into the Green Finance Reform and Innovation Pilot Zone (GFRIPZ) during the present year, while D is assigned a value of 0 if otherwise. The outcomes of the parallel trend analysis for the four years preceding and following the firm's inclusion in the GFRIPZ are presented in Fig. 1. Utilizing the year prior to the implementation of the policy as the reference period, the regression coefficients α-4 to α-2 exhibit insignificance, thereby suggesting the absence of a noteworthy variance in ESG greenwashing between the treatment and control groups prior to the execution of GFRIPZ. Upon the implementation of GFRIPZ, it was observed that the regression coefficients α1 and α2 exhibited a significant negative trend. This suggests that GFRIPZ has the ability to effectively mitigate the occurrence of ESG greenwashing among firms. Fig. 1 illustrates that the parallel trend hypothesis holds true for both the treatment and control groups.

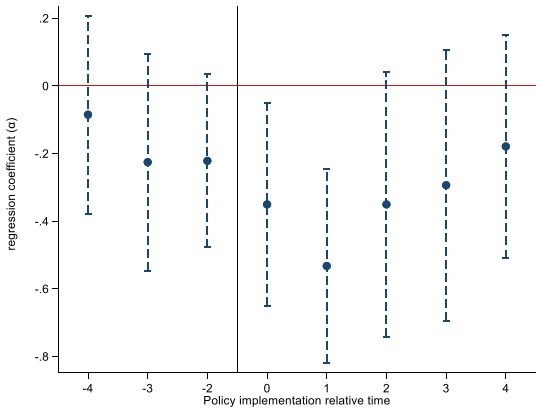

Fig. 1. Impact of GFRIPZ on GW parallel trend test.

4.3.2. PSM-DID test

The presence of self-selection bias must be acknowledged when examining the non-random or endogenous nature of the incorporation of Chinese listed companies into the GFRIPZ. Consequently, a propensity score matching (PSM) methodology is employed to attain a control group that is comparable. The study employed a nearest-neighbor matching technique with a ratio of 1:4 to obtain control groups that were comparable. The matching criteria used were corporate control variables. The enhancement of comparability between the treatment and control groups was achieved.

Table 4 displays the outcomes indicating that the %Bias of all covariates was below 10 % following matching. Furthermore, the absolute values of %Bias exhibited a significant decrease from 24.2 % to 97.3 % in comparison to the pre-matching values, thereby signifying that the samples successfully passed the balance test subsequent to PSM. The t-tests conducted on the matched variables did not yield significant results, indicating that the hypothesis of "absence of any systematic bias in the covariate values between the two groups" could not be rejected.

Table 5 displays the latest regression findings for models (1) and (2), utilizing the recently matched sample of 6820. The regression analysis reveals that the GFRIPZ coefficient remains significantly negative and statistically significant at a 5 % level. Moreover, the magnitude of the coefficient remains stable compared with Table 3, implying that the regression outcomes are credible.

4.3.3. Replace the evaluation index of ESG greenwashing

The BESG Sub-Index, which has been standardized within industry years, and the HESG score, also standardized within industry years and comprising GW_E, GW_S, and GW_G, may serve as a suitable proxy variable for GW. The outcomes of the regression analysis are displayed in models (1)–(3) as shown in Table 6. The statistical analysis indicates that the regression coefficients of GFRIPZ on ESG's environmental aspect greenwashing (GW_E) and social aspect greenwashing (GW_S) are statistically significant at the 5 % and 10 % levels, respectively, and exhibit a negative relationship. On the other hand, the significance of GW_G in relation to ESG's corporate governance aspect is not noteworthy in the case of GFRIPZ. The findings suggest that the effective implementation of GFRIPZ results in a reduction of greenwashing in the environmental and social dimensions of ESG. Notably, the suppression of greenwashing in the environmental dimension is more pronounced.

4.3.4. Placebo Test

A randomized placebo-controlled experiment was conducted to investigate whether random factors contributed to the effectiveness of inhibitors of corporate ESG greenwashing, with the aim of achieving a more credible causal identification effect. The study generated core density plots to represent the t-values of the GFRIPZ regression coefficients. This was achieved by randomly selecting treatment groups and repeating the process 500 times to extract the t-values of the placebo outcome regression coefficients. As illustrated in Fig. 2, the t-values of almost all regression coefficients exhibited a deviation from the dashed position which is the t-value (−2.59) in the model (2) of Table 3. It indicated that the influence of other random factors on the outcomes could be eliminated. This suggests that the impact of GFRIPZ on ESG greenwashing was relatively stable and contributed to the mitigation of corporate ESG greenwashing.

5. Heterogeneity test

5.1. Corporate ownership and regional heterogeneity

According to research, SOEs in China tend to prioritize social benefits and political objectives, whereas non-SOEs prioritize economic benefits and maximizing profits [78]. SOEs are subject to regulatory scrutiny and intervention by the government, whereas non-SOEs are subject to relatively lower levels of government intervention, as per a study [79]. The disparities between non-SOE and SOEs result in a higher mean occurrence of greenwashing in ESG practices of non-SOEs entities.

Table 4
Balance test.

Variable	Unmatched	Mean		%Bias	%Reduct |Bias|	*t*-Test		V(T)/V(C)
	Matched	Treated	Control			t	p>|t|	
Size	U	23.705	23.244	35.2		3.34	0.001	0.86
	M	23.705	23.693	1.0	97.3	0.06	0.949	0.70
Lev	U	0.47614	0.48401	−4.5		−0.40	0.686	0.63*
	M	0.47614	0.46909	4.1	10.4	0.28	0.777	0.62*
ROA	U	0.05853	0.05764	1.8		0.18	0.857	1.06
	M	0.05853	0.05786	1.4	24.2	0.10	0.918	1.45
Cashflow	U	0.0675	0.05925	12.3		1.20	0.229	0.98
	M	0.0675	0.06157	8.8	28.1	0.63	0.527	1.07
ListAge	U	2.3389	2.4075	−9.4		−0.96	0.338	1.17
	M	2.3389	2.3182	2.8	69.7	0.19	0.851	0.93
Top1	U	0.3901	0.38068	5.4		0.57	0.567	1.30
	M	0.3901	0.39384	−2.2	60.3	−0.15	0.884	1.11
TMTPay1	U	15.209	14.752	65.4		6.17	0.000	0.84
	M	15.209	15.192	2.5	96.1	0.18	0.859	0.83

Table 5
Regression results on adopting PSM-DID.

Variable	(1)	(2)
	GW	GW
GFRIPZ	−0.310**	−0.306**
	(0.121)	(0.119)
Size		−0.104**
		(0.043)
Lev		0.249
		(0.176)
ROA		−1.043**
		(0.486)
Cashflow		0.765***
		(0.248)
ListAge		0.034
		(0.067)
Top1		0.520**
		(0.236)
TMTPay1		0.157***
		(0.045)
_cons	−0.306***	−0.589
	(0.010)	(1.006)
Firm Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
N	6820	6820
Adj. R2	0.479	0.481
F	6.521***	4.836***

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

Table 6
Replace the evaluation index of GW.

Variable	(1)	(2)	(3)
	GW_E	GW_S	GW_G
GFRIPZ	−0.305**	−0.233*	−0.163
	(0.121)	(0.128)	(0.121)
Controls	Yes	Yes	Yes
_CONS	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
N	7643	7643	7643
Adj. R2	0.536	0.490	0.434
F	3.075	1.132	5.586

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

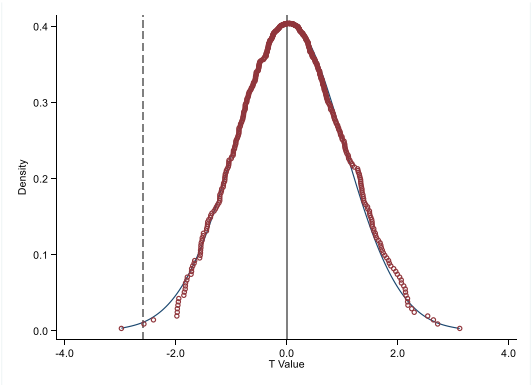

Fig. 2. t-value of regression of GFRIPZ on GW Placebo Test.

Consequently, the regression tests have been categorized based on the type of corporate ownership, and the outcomes are presented in Panel A of Table 7. According to the data presented in Table 7 Panel A, it can be inferred that GFRIPZ is insignificantly impact on the occurrence of ESG greenwashing among SOEs. Simultaneously, it has the potential to considerably impede the practice of ESG greenwashing among privately owned companies. The findings suggest that non-state-owned enterprises exhibit greater effectiveness in implementing GFRIPZ in their place of registration, as compared to their state-owned counterparts. This study posits that prioritizing the promotion of GFRIPZ in non-SOEs domiciles may prove to be a more efficacious approach in mitigating the pervasive issue of ESG greenwashing among Chinese listed companies.

China presently possesses 34 provincial-level administrative regions that exhibit significant variations in terms of their geographical location, degree of economic advancement, and regional disparities. Organizations situated in the eastern region exhibit a tendency to adhere to legal statutes and guidelines, and demonstrate a greater degree of openness and divulgence. Moreover, enterprises situated in the eastern region benefit from convenient exposure to global best practices and standards, and are subject to the scrutiny and oversight of worldwide capital markets. Conversely, the regions situated in the regions situated in the central and western areas of the nation exhibit inadequate familiarity with ESG principles and global harmonization.

Table 7 Panel A reveals that the study suggests that GFRIPZ has a significant impact on reducing the ESG greenwashing practices of companies that are in operation in the central and western regions at a significance level of 1 %. In contrast, the efficacy of GFRIPZ is limited to a 10 % significance level in the inhibit effect of ESG greenwashing among companies operating in the eastern region. Thus, the findings of this research indicate that there is a need to prioritize the promotion of GFRIPZ in the central and western regions, as well as to enhance sustainable development goals and awareness in these areas. These measures are crucial to effectively combat the issue of ESG greenwashing among Chinese listed companies.

5.2. Corporate industry heterogeneity

This study performed grouping tests based on the industry attributes of the firms, specifically categorizing them according to their affiliation with either the heavy polluting industry or the manufacturing industry. According to the results presented in Panel B of Table 7, it can be observed that GFRIPZ has a significant impact in reducing the level of ESG greenwashing among companies operating in the heavy-polluting sector, at a significance level of 5 %. The significance of ESG greenwashing for companies operating in non-heavy polluting industries is deemed to be negligible. The findings validate the efficacy of the adoption of GFRIPZ in the heavily polluted sector, which exhibits a heightened propensity for greenwashing owing to the apprehension of facing sanctions for environmental degradation, among other factors. The implementation of the GFRIPZ program, aimed at enhancing supervision and attention to enterprises operating in the heavy pollution industry, has the potential to more efficiently curb instances of ESG greenwashing. This study posits that the promotion of GFRIPZ in the locations where heavy pollution industry companies are registered is crucial in effectively reducing the overall ESG greenwashing level of Chinese listed companies.

Table 7 Panel B reveals that GFRIPZ has a significant impact in reducing the level of ESG greenwashing among manufacturing firms,

Table 7
Heterogeneity test.

PanelA				
Variable	State-owned	Non-state-owned	Eastern region	Central & western region
	GW	GW	GW	GW
GFRIPZ	−0.008	−0.569***	−0.230*	−0.622***
	(0.154)	(0.172)	(0.132)	(0.189)
Controls	Yes	Yes	Yes	Yes
_CONS	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
N	3952	3691	5252	2391
Adj. R2	0.499	0.458	0.485	0.447
F	4.236	3.192	3.294	4.155
PanelB				
Variable	**Heavy pollution GW**	**Non-heavy pollution GW**	**Manufacturing GW**	**Non-manufacturing GW**
GFRIPZ	−0.670**	−0.163	−0.535***	0.022
	(0.278)	(0.119)	(0.154)	(0.183)
Controls	Yes	Yes	Yes	Yes
_CONS	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
N	2564	5079	4481	3162
Adj. R2	0.509	0.450	0.499	0.443
F	2.269	3.980	6.338	1.929

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

with a statistical significance of 1 %. Furthermore, the practice of ESG greenwashing among companies operating in non-manufacturing sectors is not statistically significant. China is a major manufacturing nation that exerts a substantial influence on resource utilization as a result of its manufacturing sector. In contrast to the non-manufacturing sector, the manufacturing industry produces a significant amount of carbon emissions, waste, and pollutants, as evidenced by previous research [35]. Hence, the matter of ESG disclosure in the manufacturing sector warrants further consideration. The findings indicate that the implementation of GFRIPZ yields a statistically significant reduction in the extent of ESG greenwashing within the manufacturing sector. Hence, the present research contends that the emphasis ought to be on advocating for the adoption of GFRIPZ in the manufacturing firms' localities to efficiently mitigate the comprehensive ESG greenwashing extent of the listed companies in China.

6. Further analysis

6.1. The impact channels of financing constraints and corporate reputation

To investigate the influence of GFRIPZ on ESG greenwashing, the firms were categorized based on their level of financing constraints and corporate reputations, distinguishing between those with high and low levels in each category. Table 8 demonstrates that GFRIPZ has a greater inhibitory impact on corporate ESG greenwashing among firms facing high financing constraints, as evidenced by a regression coefficient of −0.543, and the observed result exhibits statistical significance at a significance level of 1 %. This discovery provides evidence in favor of hypothesis 2. The acquisition of financial assistance is identified as a primary incentive for engaging in corporate greenwashing [29]. According to the findings, the implementation of GFRIPZ has provided financial assistance to businesses, leading to a reduction in the ESG greenwashing inclination of companies facing significant financing constraints. Additionally, the degree of greenwashing among such enterprises has been considerably diminished. The manifestation of the suppressive impact is notably conspicuous in companies that experience significant limitations in their financing capabilities. Hence, financial constrains is a mechanism through GFRIPZ influences ESG greenwashing practices of corporations.

Subsequent research has revealed that corporate reputation serves as a mechanism through which GFRIPZ influences corporate ESG greenwashing. Table 8 demonstrates that GFRIPZ has a greater inhibitory impact on corporate ESG greenwashing among companies with lower reputation scores. The regression coefficient for this relationship is −0.665, and it is statistically significant at the 1 % level, thus confirming hypothesis 3. The establishment of a sustainable image with the aim of gaining a favorable reputation is a primary driver behind the phenomenon of corporate ESG greenwashing [25]. According to the findings, the implementation of GFRIPZ exerts a beneficial influence on the reputation of local companies, leading to a reduction in their motivation to engage in ESG greenwashing practices. The manifestation of the inhibitory impact is notably conspicuous within companies that possess inferior reputations. Corporate reputation is a mechanism through which GFRIPZ impacts corporate ESG greenwashing.

6.2. Moderating effects

Firms can potentially enhance the quality of their corporate disclosure through an increased focus on internal and external monitoring, as suggested by previous research [80]. In order to investigate the potential for such monitoring to strengthen the inhibitory effect of GFRIPZ on ESG greenwashing, we have developed a regression model (3).

$$GW_{it} = a_0 + \alpha_1 GFRIPZ * M_{it} + \sum \alpha_i \, Controls_{it} + \lambda_i + \delta_t + \xi_i \tag{3}$$

In equation (3), the moderating variables, namely INST, Indep, ER, and ANALYST, are denoted by the symbol M. The metrics of INST and Indep are employed to assess the level of internal oversight within the organization, whereas the metrics of ER and ANALYST are utilized to evaluate the degree of external oversight of the organization. According to Table 9, the regression coefficients for GFRIPZ*INST, GFRIPZ*Indep, GFRIPZ*ER, and GFRIPZ*ANALYST are all statistically significant and exhibit a negative relationship. The findings indicate that augmenting the proportion of institutional investors' shareholding (INST), the ratio of independent directors (Indep), the stringency of environmental regulation (ER), and analyst attention (ANALYST) may enhance the restraining impact of

Table 8
Impact channels of GFRIPZ on GW.

Variable	High WW	Low WW	High Rep	Low Rep
	GW	GW	GW	GW
GFRIPZ	−0.543***	−0.176	−0.059	−0.665***
	(0.193)	(0.163)	(0.151)	(0.254)
Controls	Yes	Yes	Yes	Yes
_CONS	Yes	Yes	Yes	Yes
FirmFixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
N	3732	3620	4322	3076
Adj. R2	0.451	0.507	0.498	0.454
F	4.284	1.187	1.467	4.050

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

GFRIPZ on corporate ESG greenwashing. The present study posits that enhancing the internal and external regulatory mechanisms of companies can serve as a more efficacious approach to curbing the extent of ESG greenwashing among Chinese listed firms, particularly in the context of establishing GFRIPZ.

7. Conclusions

The present research investigates the impact of GFRIPZ on ESG greenwashing. The study uses 1200 Chinese publicly traded companies' 2011–2021 data. The State Council designated nine regions in six provinces as GFRIPZ in 2017 and 2019. This tool finds pilot businesses. This quasi-natural experiment compares corporate ESG greenwashing mitigation in the GFRIPZ and outside the pilot zone. Firstly, This study found that implementing GFRIPZ is crucial to reducing corporate greenwashing in ESG disclosure. GFRIPZ may prevent corporate ESG greenwashing. Robustness tests confirmed this research's discovery. Heterogeneity tests show that GFRIPZ only reduces ESG greenwashing in privately-owned firms. State-owned ESG greenwashing is unaffected by GFRIPZ. GFRIPZ affects central and western China more than the east. According to statistical heterogeneity analysis, GFRIPZ affects ESG greenwashing more in heavy pollution and manufacturing sectors. Secondly, GFRIPZ inhibits ESG greenwashing through two channels: financing constraints and corporate reputation. This phenomenon dampens ESG greenwashing by firms with high financial constraints and a poor corporate image. Thirdly, This study provides corroboration that both internal and external monitoring mechanisms serve to enhance the inhibitory impact of GFRIPZ on corporate ESG greenwashing.

8. Implications and limitations

After several years of exploration and practice, GFRIPZ approved by the State Council one after another have initially completed the construction of the green financial system and have provided the experience of green financial development tailored to the needs of different regions, different economic conditions, and different basic situations. The establishment of GFRIPZ has been instrumental in mitigating the issue of ESG greenwashing. It has the potential to alleviate corporate financing constraints, enhance the reputation of firms operating within the pilot zone, and ultimately reduce the prevalence of ESG greenwashing. Notwithstanding, corporations continue to encounter the obstacle of enhancing the accuracy of their environmental, social, and governance (ESG) practices and promoting sustainable operations. Enhancing the internal and external oversight of firms is imperative to facilitate the transparency of green finance and ESG disclosure in China. The present study posits certain implications as follows:

Firstly, Governments and financial institutions should be mindful of differentiation strategies in the development and implementation of the GFRIPZ. It is recommended that special emphasis be placed on the execution of GFRIPZ initiatives within privately-owned businesses, as well as in the regions of China that are located in the central and western areas, heavy pollution industries, and manufacturing sectors. This approach has the potential to more efficiently mitigate the overall extent of ESG greenwashing among Chinese publicly traded corporations. Financial institutions should provide more green financial support to these enterprises, and they should track, monitor and evaluate the green behaviors of these enterprises, so as to avoid "greenwashing" the ESG information disclosed by enterprises in order to obtain financial support. Instead, they should encourage enterprises to make substantive ESG disclosures.

Secondly, it is imperative to enhance the constraint and incentive mechanism. The pilot zone must offer increased political and financial backing to alleviate the financing limitations faced by enterprises. Furthermore, it is imperative for the pilot zones to consistently foster innovation and reform to sustain their preeminent status in the realm of green finance, while also reinforcing and augmenting their reputation effect. Mitigate the motivation for corporations to engage in ESG greenwashing.

Thirdly, Establishment of strict information disclosure standards and regulatory mechanisms. Establish clear ESG disclosure standards and effective regulatory mechanisms to ensure that companies disclose true and accurate information in accordance with the standards. In addition, stakeholders should review and verify ESG disclosures. It is suggested that augmenting both the internal and external monitoring mechanisms can strengthen the inhibitory influence of GFRIPZ on corporate ESG greenwashing. The proportion of independent directors is crucial in overseeing the governance of publicly traded firms. Institutional investors have the ability to oversee management, mitigate opportunistic conduct, and enhance the caliber of corporate disclosure. Consequently, their monitoring measures are deemed efficacious. Environmental regulation pertains to the oversight and control of diverse activities that have the potential to contaminate the communal environment, to safeguard the environment. An external regulatory force has the potential to increase companies' awareness of sustainable development. Enhancing the environmental regulation of enterprises is deemed imperative. Moreover, augmenting the number of analyst teams dedicated to scrutinizing publicly traded firms and designating analyst teams as external regulatory bodies can enhance the veracity of disclosures. This can be achieved by imposing more stringent requirements on companies to show ESG information and forestalling any instances of ESG greenwashing.

The present investigation exhibits certain constraints. The study's sampling period concludes in 2021 and excludes Chongqing, which was recently incorporated into GFRIPZ in 2022. Hence, it is imperative to conduct further research on the implementation impact of GFRIPZ by enlarging the sample size in subsequent studies. Furthermore, the present study solely examines the control variables about micro-level control enterprises, while neglecting those at the macro level. Future research may incorporate additional variables such as industrial structure, regional GDP, and financial support level to enhance the scope of the investigation. The research mechanism solely addresses two factors, namely financing constraints and corporate reputation. Nevertheless, it is noteworthy that the influence of GFRIPZ on the phenomenon of corporate ESG greenwashing extends beyond a mere couple of channels. Further research could explore additional channels, including investor attention, public attention, green innovation, etc.

Table 9
The moderating impact of internal and external supervision.

	(1)	(2)	(3)	(4)
	GW	GW	GW	GW
GFRIPZ*INST	−0.395**			
	(0.190)			
GFRIPZ*Indep		−0.727**		
		(0.289)		
GFRIPZ*ER			−195.177***	
			(57.227)	
GFRIPZ*ANALYS				−0.110**
				(0.045)
Controls	Yes	Yes	Yes	Yes
_CONS	Yes	Yes	Yes	Yes
FirmFixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
N	7643	7643	7643	7643
Adj. R2	0.473	0.473	0.473	0.473
F	5.290	5.522	6.121	5.484

Note: Robust standard errors are indicated in parentheses; ***, **, and * represent significant levels at 1 %, 5 %, and 10 %, respectively.

Data availability statement

Data associated with my study has not been deposited into a publicly available repository.
Data will be made available on request.

CRediT authorship contribution statement

Youxia Tong: Writing – original draft, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization, Writing – review & editing, Methodology. **Yeng Wai Lau:** Software, Resources, Project administration, Methodology, Writing – review & editing. **Siti Manisah Binti Ngalim:** Visualization, Validation, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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