DOES FISCAL AND FINANCIAL GREEN POLICY COORDINATION CURB CORPORATE "GREENWASHING"? EVIDENCE FROM THE GREEN LOAN INTEREST SUBSIDIES POLICY IN CHINA

Xubing FANG[1], Maotao LIU[2][✉]

[1]*School of Economics and Management, Huaibei Normal University, Huaibei, China*
[2]*School of Public Economics & Administration, Shanghai University of Finance & Economics, Shanghai, China*

Abstract. Amidst the push for green development, finding ways to effectively coordinate fiscal and financial policies to curb corporate "greenwashing" has emerged as a crucial issue to investigate. Using data from non-financial listed firms in China from 2011 to 2022, this study employs a multi-period difference-in-differences model, treating the green loan interest subsidies (GLIS) policy as a quasi-natural experiment to examine its impact on "greenwashing". We find that the GLIS policy significantly suppresses corporate "greenwashing." GLIS policy not only stimulates bank credit supply and increases the scale of green credit, but also motivates banks to strengthen their risk identification mechanisms, thereby curbing "greenwashing." The inhibitory effect is more pronounced in firms with high financing constraints, low transparency in environmental management systems, and heavy pollution firms. Moreover, GLIS policy can synergize fiscal and financial policies, addressing the deficiencies of individual policies and enhancing their practical effectiveness in green governance. Overall, our results verify the inhibitory effect of the GLIS policy on "greenwashing," providing evidence and useful insights for China and other countries or regions to promote coordinated green policies between fiscal and financial sectors.

1. Introduction

With the growing global attention to ESG investment principles, companies are increasingly disclosing ESG information to enhance their competitiveness and image in the international market. However, some enterprises may engage in "greenwashing" to meet market and investor expectations, misleading stakeholders by exaggerating or embellishing their ESG information (Walker & Wan, 2012; Roulet & Touboul, 2015; Liu et al., 2024). Such behavior not only undermines market fairness and transparency, but also poses potential compliance risks and reputational damage to the companies (Kahraman & Kazançoğlu, 2019). Therefore, effectively preventing "greenwashing" is crucial for the sustainable development.

The global call for environmental protection and sustainable development has been growing louder than ever (Zhao & Lee, 2024). Governments at all levels in China place great emphasis on using economic policies to guide capital flows toward ecological and environmental

protection and other green sectors, gradually establishing a diversified green economic policy system (Lee et al., 2022, 2023), particularly by strengthening the coordination between fiscal and financial policies. Among them, the GLIS policy has been widely adopted by local governments in recent years as a concrete manifestation of the coordination between fiscal and financial policies in the green sector. However, quantitative research on the effectiveness of policy coordination is relatively scarce.

Compared to green credit policies, the GLIS policy involves both fiscal and financial sectors. Specifically, when qualified enterprises apply for green loans from financial institutions, part or all of the loan interest is subsidized by local finance. For one thing, compared to fiscal policies, the GLIS policy can leverage bank approval mechanisms, making full use of the information filtering function of the banking system to effectively prevent "greenwashing" companies from defrauding loans or subsidies. For another thing, unlike general green loan projects, the GLIS policy requires local finance to bear part or all of the green loan interest for enterprises, which can effectively stimulate financial institutions' willingness to lend and alleviate corporate financing constraints. Despite the importance of this topic, existing studies have not yet conducted a comprehensive and thorough exploration of the connection between the GLIS policy and "greenwashing."

The literature related to our study mainly falls into two categories. One category, which is relatively rich, focuses on identifying the factors influencing "greenwashing." First, in terms of macro-level government policy factors, prior studies have found that government regulation, institutional change, and environmental regulations have significant impacts on corporate "greenwashing" (Kim & Lyon, 2015; Marquis et al., 2016; Tashman et al., 2019; Zhang, 2023b; Wang et al., 2023; Zhao & Lee, 2024). Second, regarding economic environment factors, prior studies mainly examine the impacts of consumer green demand, social media supervision, and stakeholder pressure on "greenwashing" (Testa et al., 2018a, 2018b; Szabo & Webster, 2021; Long et al., 2025). Third, concerning firm heterogeneity, scholars have focused discussions on factors such as firm size, performance, and environmental performance (Delmas & Burbano, 2011; Roulet & Touboul, 2015).

Another strand of literature mainly concentrates on the influence of green finance on sustainable development (Lee et al., 2024a, 2024b). To avoid endogeneity issues, prior studies have concentrated on assessing the impacts of single policies such as green finance, green credit, and green bonds on land ecological security, corporate green innovation, green investment efficiency, and green transformation (Fang et al., 2024; Lee & He, 2024; Tian et al., 2024; Chen et al., 2024). Notably, prior studies have shown that green finance can inhibit "greenwashing" (Zhang, 2023a). Specifically, some scholars have investigated the impacts of green finance policies and green credit policies on corporate "greenwashing" (Zhang, 2022b; Hu et al., 2023).

The above two strands of literature are highly inspirational but still leave room for expansion. For one thing, few studies have identified the factors influencing "greenwashing" from the perspective of GLIS policy. We believe that the GLIS policy can enhance the coordination between fiscal and financial policies in the green sector, addressing the shortcomings of implementing them separately, which may have a significant impact on corporate

"greenwashing." Therefore, accurately identifying the causal effect of this policy on corporate "greenwashing" is crucial. For another thing, while some literature has confirmed the effects of single green policies on sustainable development, green credit policies suffer from insufficient incentives for financial institutions. The information advantages, areas of influence, and degrees of incentive differ among various policy-making entities promoting corporate environmental governance. Therefore, the coordination of different policies can leverage their respective strengths to optimize policy outcomes. However, few studies have conducted empirical analyses on the actual effects of green policy coordination. Thus, our study focuses on GLIS policy, aiming to systematically analyze how the GLIS policy affects "greenwashing."

The staggered implementation of GLIS policy not only allows us to study how the coordination of fiscal and financial green policies affects corporate "greenwashing", but also helps alleviate potential endogeneity issues in previous research indicators, overcoming challenges in causal relationship identification. We found that the GLIS policy significantly inhibits corporate "greenwashing," particularly in firms facing high financing constraints, low transparency in environmental management systems, and heavy pollution enterprises. Mechanism analysis indicates that the GLIS policy mainly suppresses corporate "greenwashing" through two channels: incentivizing bank credit supply and strengthening banks' risk screening mechanisms. Additionally, we discovered that the GLIS policy enhances the coordination between fiscal and financial policies, compensating for the deficiencies of single policy implementation and improving the actual effects of policies in green governance.

The marginal contributions are as follows: First, our study evaluates the effectiveness of GLIS policy from the perspective of "greenwashing." Prior studies have primarily discussed the impact of single policies on sustainable development from the perspectives of green credit policies. However, there is a scarcity of study evaluating the effects of GLIS policies. Our study identifies the causal effect of GLIS policy on corporate "greenwashing." This not only offers a novel viewpoint for implementing green and low-carbon development concepts, but also deepens the academic comprehension of the impact of GLIS policies on micro-entities. Second, our study expands the research boundaries of factors influencing corporate "greenwashing." Existing studies on factors affecting corporate "greenwashing" have conducted detailed discussions from aspects of government policies, economic environments, and heterogeneous firm characteristics. However, our study extends the government policy factor to the top-level institutional design arrangement of GLIS policy, precisely identifying the causal relationship between GLIS policy and corporate "greenwashing." This enriches the body of literature on factors influencing corporate "greenwashing" and also provides new empirical evidence for in-depth exploration of the effect of government policies on "greenwashing." Third, our study reveals the dual mechanisms through which the GLIS policy influences corporate "greenwashing": increasing banks' green credit supply and incentivizing stronger risk screening by banks. Our study also reveals that GLIS policy can effectively compensate for the deficiencies of implementing single policies, enhancing the actual effectiveness of policy green governance. Our results not only provide deeper theoretical backing for the implementation of GLIS policy and the effective suppression of corporate "greenwashing", but also offer beneficial insights for regulatory authorities to strengthen information disclosure norms.

2. Institutional background and hypothesis

2.1. Institutional background

In the face of global warming and environmental degradation, nations are prioritizing sustainable development strategies. Among these efforts, promoting financial sector support for green economic growth has become a significant measure. Since 2016, China has implemented a dual-track strategy to foster the development of green finance. This strategy combines central government policy guidance and strategic planning with local and market entity-level practical exploration and innovative momentum. In this process, the Chinese government has focused on optimizing the internal incentive framework of green finance, aiming to properly address the common issues of information asymmetry and maturity mismatch in financing green projects, thereby boosting green economic growth. The importance and core position of policy coordination and the integrated use of political resources were both emphasized in the "Overall Plan for Ecological Civilization System Reform" issued in 2015 and the subsequent "Guidance on Building a Green Financial System" released in 2016. The GLIS policy has been introduced with the aim of encouraging banks and other financial institutions to issue loans for environmental protection and energy conservation through fiscal measures. Such policies typically include subsidies for some or all of the interest on loans for green projects, thereby reducing the financing costs for enterprises and encouraging investment in green technologies and projects. Starting from 2017, local governments have successfully implemented GLIS policy, and by the end of 2022, over 16 provinces and 50 cities had released relevant policy documents. The government enforces a strict approval mechanism and a third-party certification system for green credits, adopting an operational model where fiscal subsidies are disbursed after an initial interest advance and subsequent compensation. Typically, only financing enterprises whose projects are certified as green in nature by local financial institutions at the time of loan application are eligible for the subsidies.

The GLIS policy serves as an integral part of the green financial system, utilizing economic incentives to encourage firms and social capital to invest in environmentally beneficial green projects. Under this policy, eligible enterprises can apply for green loans from financial institutions, with part or all of the interest subsidized by local government finance. This policy is introduced based on several considerations. Due to externalities, environmental investments often cannot secure adequate funding through market mechanisms alone, necessitating government intervention. Traditional credit markets may favor short-term, low-risk projects without proper incentives, potentially overlooking long-term environmental benefits and social welfare. By integrating fiscal subsidies with green loan policies, the GLIS policy bridges fiscal and financial sectors, fostering business green transitions and supporting initiatives aligned with green benchmarks through financial backing.

2.2. Hypothesis

First, based on the resource dependence theory, the survival and development of enterprises depend on the acquisition of key external resources, especially financial resources. Green finance through funds provided by banks and other investors helps to break through the financing bottlenecks of enterprises and effectively curbs potential "greenwashing" tenden-

cies (Jin et al., 2022). The GLIS policy is essentially a positive incentive for corporate green investment behavior, reducing costs of financing green projects for enterprises through fiscal subsidies, enhancing internal motivation for enterprises to shift towards greener, low-carbon development, thereby weakening motive for enterprises to engage in "greenwashing" for short-term gains (Jin et al., 2022). Under the guidance for the GLIS policy, the financial market's preference for green industries increases, raising market value and social reputation of green enterprises. In contrast, the non-authenticity of "greenwashing" enterprises faces stricter market supervision and public opinion pressure, thereby inhibiting "greenwashing".

Second, drawing on the theory of the guiding role of fiscal funds, the GLIS policy reflects the government's use of fiscal funds as a lever to effectively guide financial institutions and corporate capital towards green industries. This policy encourages banks to increase green credit, making 'genuinely green' projects more competitive and attractive to investors than 'greenwashing' projects, thereby suppressing corporate 'greenwashing'. If preferential interest of green credit lacks fiscal fund support, lower interest rate risk of green credit would mainly be borne by banks, which could weaken their enthusiasm to lower interest rates to support green projects. After implementation of the GLIS policy, government can provide partial or full interest for enterprises or green projects applying for green credit, enhancing willingness of banks to offer green credit. As banks become more willing to lend to green enterprises, a large amount of credit resources is invested in the environmental protection field, not only alleviating financing constraints of enterprises and easing financing difficulties, but also thus forming a strong constraint on corporate 'greenwashing'.

Third, according to financial intermediation theory, the GLIS policy utilizes channels of financial institutions to materialize policy orientation into market actions. When issuing loans with preferential interest rates, financial institutions must strictly implement green credit standards and rigorously review the environmental performance and social responsibility of the applying enterprises. Guided by the GLIS policy, execution of green credit business by banks becomes a core element of their performance assessment. This means when allocating credit resources, banks must prioritize green projects to ensure maximization of positive social effects of resources (Li et al., 2023). This stringent filtering mechanism acts as a barrier, effectively preventing enterprises attempting to engage in "greenwashing" to obtain discounted interest benefits, while also incentivizing other enterprises to strive to improve their green development standards to qualify for policy dividends, thereby suppressing the motivation for "greenwashing" from the source.

Overall, the GLIS policy primarily works through reshaping resource dependency patterns of enterprises, stimulating the guiding role of fiscal funds within the market, and leveraging risk screening and regulatory functions of financial institutions. These mechanisms collectively influence the decision-making processes of enterprises, compelling them to recognize the significance and economic value of advancing green transformations. Consequently, this effectively curbs behavior of enterprises engaging in "greenwashing" strategies for short-term gains. Accordingly, we propose:

H2: *GLIS policy inhibits corporate "greenwashing."*

The GLIS policy can stimulate banks to expand the supply of green credit. Without financial support to cover part of the preferential interest on green credit, its potential risks

will mainly be borne by banks alone. To promote the effective implementation of the GLIS policy, government departments not only guide the direction of capital investment, but also play a leveraging effect by bearing certain interest subsidies, attracting more bank credit funds to invest in green projects. With the introduction of the GLIS policy, the government provides partial or even full loan interest subsidies for eligible enterprises or projects, significantly enhancing the willingness of banks to issue green loans. The increase in the scale of green credit has promoted market attention and supervision towards green development and behaviors, creating a positive atmosphere. Corporate "greenwashing" is easily identified by the market and faces questioning and rejection from financial institutions, partners, and consumers, effectively curbing greenwashing practices. Accordingly, we propose:

> **H3:** *GLIS policy can leverage fiscal funds to guide and stimulate bank credit supply, increasing the scale of green credit.*

For one thing, the GLIS policy can encourage banks to strengthen their supervisory functions and ensure precise allocation of credit resources. According to the application conditions for green credit discounts, enterprises or projects receiving green loans must undergo strict green assessment certification by third-party institutions commissioned by the government, effectively preventing "greenwashing." This indicates that the government has implemented rigorous evaluation and supervision mechanisms for the issuance of green credit. Any situation where funds are used for environmental damage due to a bank's subjective will or operational errors will be subject to corresponding punitive measures. Therefore, this will force banks to elevate their green credit review standards and enhance their ability to identify genuinely green projects, effectively preventing "greenwashing" companies from defrauding credit funds. For another thing, in the course of approving green credit discounts, the government can utilize financial institutions' risk identification capabilities to assess enterprises' "greenwashing" risks. By adopting loan interest subsidies instead of direct subsidies, the government can fully leverage banks' informational advantages during loan approvals, reduce information asymmetry, and ensure that fiscal support precisely reaches those enterprises that truly meet green standards. Accordingly, we propose:

> **H4:** *GLIS policy can incentivize banks to strengthen their risk screening mechanisms, effectively preventing "greenwashing."*

3. Data, variables and model

3.1. Data and sample

Based on the GLIS policy enacted in the place of enterprise registration, we examine the impact of GLIS policy on "greenwashing" using firms from 2011 to 2022. Following prior studies (Zhang, 2023a, 2023b), We have omitted samples from firms categorized as ST or *ST, those in financial sectors, and firms with significant missing data on crucial variables. Additionally, we have implemented winsorization on all continuous variables at the 1st and 99th percentiles. Our data sources are as follows: first, the raw data of GLIS policy comes from documents on substantive incentives for green finance published on the websites of provincial and municipal people's governments. Second, the raw data of for the measurement

of "greenwashing" indicators and firm-level variables come from the China Stock Market and Accounting Research [CSMAR] database (n.d.) and the Wind database (n.d.). We have also manually collected and supplemented some of the missing data from the annual reports of listed firms. Third, the raw data for city-level variables are derived from the China City Statistical Yearbook (National Bureau of Statistics, n.d.) over the years.

3.2. Variables

3.2.1. Corporate "greenwashing" measures

Following prior studies, we quantify the degree of corporate "greenwash" in ESG practices by comparing the relative "greenwash" scores of peers. Specifically, we use the Bloomberg ESG disclosure score to measure ESG disclosure. We also use Sino-Securities ESG ratings to measure firms' true ESG performance, and define "greenwash" as the difference between the standardized ESG disclosure score and the standardized ESG performance score (Zhang, 2022a; Zhang, 2023a). In particular, the Bloomberg ESG disclosure score is based on a comprehensive assessment of each firm's disclosure in three core areas: environmental performance, social responsibility fulfilment, and corporate governance. This disclosure score interval is set at [0, 100], reflecting the amount of ESG information publicly disclosed by companies and the degree of ESG information disclosure. The Sino-Securities ESG rating system is designed for the characteristics of China's capital market, with a wide coverage and fast update frequency. The system measures the true ESG performance of companies by constructing 26 key indicators and adopting an industry-weighted average. The Sino-Securities ESG rating system classifies companies into nine grades: C, CC, CCC, B, BB, BBB, A, AA, AAA, based on their ESG performance from the lowest to the highest (Lin et al., 2021). The specific calculation Equation is as follows.

$$GW_{it} = \left[\frac{\left(Disclosure_{it} - \overline{Disclosure_{it}} \right)}{\sigma_{Disclosure}} \right] - \left[\frac{\left(Performance_{it} - \overline{Performance_{it}} \right)}{\sigma_{Performance}} \right], \quad (1)$$

where, $\overline{Disclosure_{it}}$ and $\overline{Performance_{it}}$ are the mean of the ESG disclosure score and the ESG performance score, respectively. $\sigma_{Disclosure}$ and $\sigma_{Performance}$ are the standard deviations of the ESG disclosure score and the ESG performance score, respectively.

3.2.2. Measure of GLIS policy

We take the pilot of the GLIS policy implemented in China at the city level as an exogenous policy shock. Specifically, first, we search for information documents related to the green credit policy from the websites of provincial and municipal people's governments. By the end of 2022 more than 16 provinces and 50 cities have enacted documents related to the GLIS policy. For this purpose, we construct a dummy variable (*Treat*), and consider the enterprises whose registered places have issued documents on GLIS policy as the treatment group (*Treat* is assigned a value of 1), and the rest as the control group (*Treat* is assigned a value of 0). Second, we construct a dummy variable (*Post*) based on the starting year of policy implemen-

tation. We assign a value of 1 to the year of policy implementation and the following years; and 0 to the year before policy implementation. We define the GLIS policy (*GLIS*) as *Treat* multiplied by *Post* to assess the specific impact effect on corporate "greenwashing" before and after the implementation of the policy.

3.2.3. Control variables

Consistent with previous studies (Zhang, 2023a, 2023b), we include the main characteristics: state ownership (*SOE*), firm size (*SIZE*), financial leverage (*LEV*), return on assets (*ROA*), total asset turnover (*ATO*), cash ratio (*CASH*), sales growth (*GROWTH*), level of regional economic development (ln*PGDP*), and size of urban credits (*TC*). Table 1 presents the description and definition of the main variables.

Table 1. Definition of the main variables

Variables	Definition
GW	Difference between disclosure and performance after standardized treatment
GLIS	Dummy variable for GLIS policy
SOE	A dummy variable that equals 1 if the firm is controlled by the state, and 0 otherwise
SIZE	The natural logarithm of the total assets
LEV	Total liabilities over total assets
ROA	Net profit over total assets
ATO	Sales revenue over total assets
CASH	Net cash flows from operating activities over total assets
GROWTH	Current year's operating income/previous year's operating income - 1
lnPGDP	The Natural logarithm of GDP per capita
TC	Total urban credit over GDP

3.3. Model

The GLIS policy, which began in 2017, is an external policy impact on "greenwashing", which provides a reasonable basis. Since the policy was implemented in phases and expanded the pilot scope progressively, we establish the multi-period DID model to test H1.

$$GW_{i,t} = \alpha + \beta GLIS_{c,t} + \gamma X_{i,c,t} + \lambda_i + v_t + \varepsilon_{i,t}, \tag{2}$$

where $GW_{i,t}$ denotes the degree of "greenwash" of firm i in year t. $GLIS_{c,t}$ is a dummy variable before and after the implementation of the city's GLIS policy, which takes the value of 0 before the implementation of the GLIS policy in the city where the enterprise is registered and the value of 1 after the implementation of the policy. We include a series of firm-level and city-level control variables and different fixed effects. Particularly, λ and v are dummy variables that account for firm, and year fixed effects. $\varepsilon_{i,t}$ is the random disturbance term.

4. Results

4.1. Summary statistics

Table 2 shows the summary statistics. The standard deviation of the *GW* is 1.1460, indicating significant variation in firms' ESG disclosure "greenwashing" behavior. The mean of *GLIS* is 0.1000, indicating that approximately 10% of the sample firms are located in cities that have enacted GLIS policy. The control variable firm size (*SIZE*) averages 23.1353, with a range of 19.3049 to 25.9357, showing diverse firm sizes in the sample. The average financial leverage (*LEV*) is 47.59%, showing most firms have a balanced debt-to-equity ratio.

Table 2. Descriptive statistics of the main variables

Variables	Observations	Mean	Std	Min	Max
GW	12,588	–0.0520	1.1460	–4.0437	6.3771
GLIS	12,588	0.1000	0.3000	0	1
SOE	12,588	0.5026	0.5000	0	1
SIZE	12,588	23.1353	1.2539	19.3049	25.9357
LEV	12,588	0.4759	0.1971	0.0569	0.8919
ROA	12,588	0.0507	0.0611	–0.2466	0.2286
ATO	12,588	0.6774	0.4643	0.0656	2.6489
CASH	12,588	0.1169	0.1770	–0.7392	0.7149
GROWTH	12,588	0.1664	0.3579	–0.5796	2.4122
ln*PGDP*	12,588	11.4255	1.1248	9.0913	21.0353
TC	12,588	1.6259	0.6227	0.4834	3.5203

4.2. Testing parallel trends assumption

We first verified whether the DID model satisfies the parallel trends assumption by conducting a dynamic effects analysis (Li & Ponticelli, 2022). The specific econometric model is as follows.

$$GW_{i,t} = \sum_{k=-4, k\neq-1}^{4} \theta_k GLIS_{c,t}(k) + \gamma X_{i,c,t} + \lambda_i + v_t + \varepsilon_{i,t}, \tag{3}$$

where, $GLIS_{c,t}$ indicates whether city *c*, where the enterprise is registered, has enacted the GLIS policy. j_c denotes the year when the GLIS policy was first enacted in city *c*. Define *GLIS* (–4) = 1 when $t - j \leq -4$, otherwise equal to 0. For $t - j \leq k$, where *k* = –3, –2, –1, 0, 1, 2, 3, 4 we set *GLIS* (*k*) = 1, otherwise *GLIS* (*k*) = 0. And when $t - j \geq 4$, we set *GLIS* (4) = 1, otherwise *GLIS* (4) = 0. To avoid potential perfect multicollinearity, we use the year before the policy implementation as the base year. The definitions of the other variables remain consistent with Model (2). Figure 1 shows no significant difference in "greenwashing" between the treatment and control groups before the GLIS policy. After its implementation, the treatment group's "greenwashing" significantly decreased compared to the control group, indicating that the DID model satisfies the parallel trends assumption.
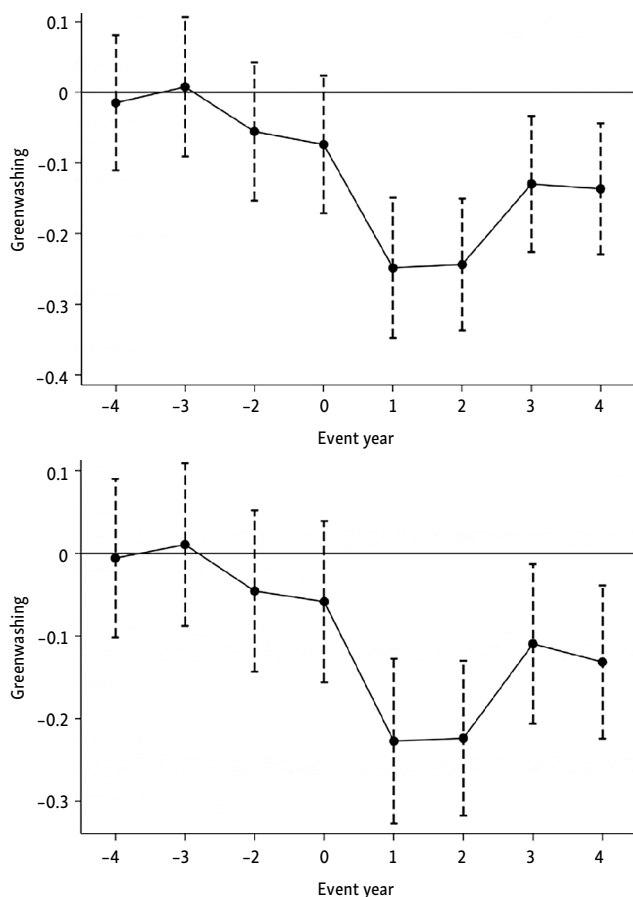
Figure 1. Parallel trend test (top panel without controls; bottom panel with controls)

4.3. Baseline results

Table 3 reports the results of the impact of GLIS policy on "greenwashing". The results show that the coefficients of *GLIS* are all significantly negative, indicating that the GLIS policy significantly inhibits "greenwashing". To more intuitively describe the effect of the GLIS policy on "greenwashing", we calculated based on the coefficients in Column (3) and found that implementing this policy reduced "greenwashing" by approximately 0.0765 standard deviations. To sum up, the impact of GLIS policy on corporate "greenwashing" has high statistical and economic significance. For one thing, to promote the implementation of the GLIS policy, government departments need to bear a certain amount of interest subsidies, guide the direction of capital investment, leverage their influence to attract more bank credit funds, thereby easing corporate financing constraints and effectively preventing companies from "greenwashing". For another thing, the GLIS policy can incentivize banks to increase the scrutiny of green credit disbursements and enhance their ability to identify green projects, thereby effectively curbing "greenwashing" enterprises from defrauding credit funds. And our results are generally consistent with those of domestic and international studies (Zhang, 2022b).

Table 3. Baseline results

	GW	GW	GW
	(1)	(2)	(3)
GLIS	−0.0917***	−0.0874***	−0.0877***
	(0.0320)	(0.0321)	(0.0321)
SOE		−0.0847	−0.0847
		(0.0559)	(0.0559)
SIZE		−0.0532*	−0.0545*
		(0.0285)	(0.0286)
LEV		0.2493**	0.2484**
		(0.1193)	(0.1194)
ROA		0.6088**	0.6114**
		(0.2399)	(0.2399)
ATO		0.0485	0.0490
		(0.0554)	(0.0554)
CASH		0.1618***	0.1619***
		(0.0603)	(0.0602)
GROWTH		0.0380	0.0382
		(0.0267)	(0.0268)
ln*PGDP*			0.0056
			(0.0089)
TC			0.0336
			(0.0438)
Constant	−0.0428***	1.0224	0.9336
	(0.0074)	(0.6491)	(0.6545)
Firm/Year FE	Yes	Yes	Yes
Observations	12,588	12,588	12,588
Adj R^2	0.5713	0.5725	0.5725

Note: Standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively (same as below).

4.4. Endogeneity tests

4.4.1. Instrumental variables approach

Due to the potential bidirectional causality between the GLIS policy and "greenwashing", we have used regional insurance premium income as an instrumental variable for testing. In economically prosperous and financially active regions, insurance premium income tends to be higher. These areas often have more mature financial systems, enabling banks and other financial institutions to implement the GLIS policy more efficiently and with greater enthusiasm, thus meeting the relevance requirement. Changes in regional insurance premium income primarily follow the inherent laws of the insurance market and socioeconomic factors, and are not directly affected by corporate greenwashing behavior or the GLIS policy, thereby satisfying the exogeneity requirement. In Column (1) of Table 4, the coefficient of *IV* is significantly positive, indicating relevance. The coefficient of *GLIS* in Column (2) is significantly negative, and the conclusion is robust.

4.4.2. Heckman two-stage model

We use the Heckman selection model to address potential sample selection bias due to non-random firm behavior. First, we estimate the probability of observing firms using the Probit model and calculate the Inverse Mill's Ratio (*IMR*). We then incorporate the IMR into the model to adjust for sample selection bias. The results are presented in Column (3). The significantly negative coefficient of GLIS indicates that the results are robust.

4.4.3. Sample matching regression

Considering that the model may have a sample selection problem, we utilize the PSM method to more accurately identify the causal relationship between GLIS policy and corporate "greenwashing". Specifically, we perform PSM with mixed years for the full sample, using each control variable as a benchmark variable for firm characteristics, and perform 1:1 nearest-neighbor matching with replacement. In the DID estimation results after matching using both PSM and EBM (Column (4) and (5)), the coefficients of *GLIS* are significantly negative, indicating that the results are robust.

Table 4. Endogeneity tests

	GLIS	*GW*	*GW*	*GW*	*GW*
	(1)	(2)	(3)	(4)	(5)
GLIS		−0.5111** (0.2244)	−0.0870*** (0.0321)	−0.0870*** (0.0322)	−0.0853** (0.0347)
IV	0.3064*** (0.0458)				
IMR			7.8263*** (2.1490)		
Constant	−0.4262 (0.2759)	0.6692 (0.9488)	−20.4893*** (5.9143)	1.0823* (0.6563)	−0.0187 (0.7681)
Controls	Yes	Yes	Yes	Yes	Yes
Firm/Year FE	Yes	Yes	Yes	Yes	Yes
Observations	12,588	12,588	12,588	12,539	12,588
Adj R²	0.5342	0.5722	0.5731	0.5724	0.6756

Note: The F-statistic is 44.73; the Kleibergen-Paap rk LM statistic is 65.12; and the Cragg-Donald Wald F-statistic is 38.68. The above results confirm the rationality of the selection of instrumental variables.
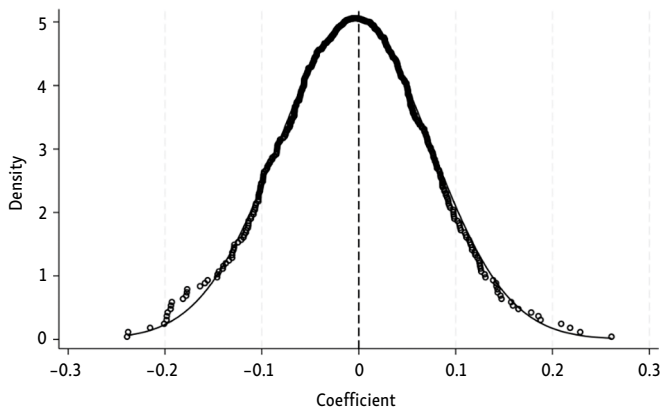
4.5. Robustness tests

4.5.1. Placebo test

We have constructed hypothetical implementation timelines for GLIS policy, setting the policy's occurrence three years before and three years after its actual implementation across various regions. Given that these policy timings are fictitious, it is anticipated that such the policy would not influence "greenwashing". Table 5 shows that the made-up GLIS policy has no significant effect on "greenwashing". Our results suggests that the policy indeed affects "greenwashing", rather than being influenced by other policies around the same time period.

Table 5. Fabricated policy implementation years

	GW	GW
	(1)	(2)
False(−3)GLIS	−0.0732 (0.0450)	
False(+3)GLIS		0.0062 (0.0614)
Constant	1.0134 (0.8123)	0.9891 (0.6541)
Controls	Yes	Yes
Firm/Year FE	Yes	Yes
Observations	12,588	12,588
Adj R^2	0.5665	0.5722

Figure 2. Randomized placebo test

Our study also conducted 500 random samplings for the placebo test (Figure 2). The results showed that the coefficient values were closely distributed around zero and exhibited normal distribution characteristics, indicating that the results are not influenced by underlying factors.

4.5.2. Replacing measures of critical variables

For one thing, to replace the "greenwashing" indicator, we first score corporate environmental reports and corporate social responsibility reports based on the CSMAR database and text analysis. We determine whether each part of the report involves the content examined by the "greenwashing" indicator system, assigning a value of 1 for "yes" and 0 for "no", thereby obtaining two indicators: the completeness of the items that should be disclosed and the substantive disclosure of the items that have been disclosed. Next, we further define corporate "greenwashing" behavior into two methods: selective disclosure (selectively reporting environmental matters, *Gwls*) and representational manipulation (strategically wording to beautify the company's image, *Gwle*). Finally, we calculate the corporate "greenwashing" (*Gwl*)

using the geometric mean. In Column (1) of Table 6, the coefficient of *GLIS* is significantly negative, indicating that the results are robust.

For another thing, replacement of core explanatory variables. Given that the GLIS policy has a more pronounced effect on green and low-pollution enterprises, it may result in more subsidy funds flowing towards businesses with excellent green performance. Therefore, we redefine the treatment group of the policy as "green and low-pollution enterprises," with the remaining enterprises forming the control group for re-estimation. We construct a dummy variable for green enterprises (*Green*). If an enterprise involves 257 keywords related to green projects during the sample period, indicating its main business has significant environmental protection characteristics, then Green is assigned a value of 1; otherwise, it is 0. We also create a dummy variable for low-pollution enterprises (*LightPolluted*). There are three methods for construction: first, in accordance with the classification management directory for environmental protection inspection industries applicable to listed companies, we identify heavy pollution industries. When an enterprise is in a heavy pollution industry, *LightPolluted* is assigned a value of 0; when it is in another industry, *LightPolluted* is assigned a value of 1. Second, we construct the dummy variable of two high-growth industries[1]: when an enterprise is in the non-two high-growth industries, *NoTwoHigh* is assigned a value of 1; when it is in the two high-growth industries, *NoTwoHigh* is assigned a value of 0. Third, we linearly standardize and aggregate various types of pollutant emission data for each industry to calculate the pollution emission intensity of each industry. For industries with a pollution emission intensity greater than 0.1669, *LessPolluted* is assigned a value of 0; for those with less than 0.1669, *LessPolluted* is assigned a value of 1. In Column (2) to (5), the coefficients of *GLIS* are significantly negative, indicating that the results are still robust.

Table 6. Replacing measures of critical variables

	Gwl	GW	GW	GW	GW
	(1)	(2)	(3)	(4)	(5)
GLIS	−0.1399*** (0.0323)				
Green_GLIS		−0.0840* (0.0464)			
LightPolluted_GLIS			−0.2333*** (0.0612)		
NoTwoHigh_GLIS				−0.2396*** (0.0559)	
LessPolluted_GLIS					−0.1243** (0.0570)
Constant	3.1167*** (0.6141)	0.9764 (0.6532)	1.0015 (0.6531)	1.0165 (0.6530)	0.9867 (0.6536)
Controls	Yes	Yes	Yes	Yes	Yes
Firm/Year FE	Yes	Yes	Yes	Yes	Yes
Observations	12,588	12,588	12,588	12,588	12,588
Adj R^2	0.2172	0.5724	0.5726	0.5728	0.5724

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[1] We categorize thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, building materials, mining, chemical, petrochemical, pharmaceutical, light industry (brewing, papermaking, fermentation), textile, and leather as two high-growth industries; other industries are considered non-two high-growth industries.

4.5.3. Excluding other contemporaneous policy interference

In the same period when the GLIS policy was implemented, China also implemented some major policies that may have a potential impact on "greenwashing", thus forming the competing hypotheses. The first is the policy of the *Environmental Protection Law of the People's Republic of China*, which came into effect on 1 January 2015 and aims to use efficient green processes and equipment to reduce pollution emissions. Since the policy has heterogeneous impacts at the regional and industry levels, we re-estimate it by replacing the year fixed effects with industry-by-year and province-by-year interaction fixed effects. The results are shown in Column (1) of Table 7. Secondly, the State Council set up the first batch of green financial reform and innovation pilot zones in eight places in five provinces in June 2017, expanding them for the first time in December 2019 and again in August 2022.The first batch of green financial reform and innovation pilot zones is defined as the number of provinces in the country that have a green financial reform and innovation pilot zone. Among them, the group dummy variable is defined as taking the value of 1 if it is located in the green financial reform and innovation pilot zone, and 0 otherwise; the time dummy variable is defined as taking the value of 1 in 2017 and later, and 0 before 2017. Thirdly, in August 2016, seven Chinese ministries issued the *Guiding Opinions on Building a Green Finance System*. It emphasized that the primary goal of establishing a green finance system is to mobilize and incentivize more social capital to invest in green industries. After introducing a dummy variable for the green financial reform and innovation pilot zone policy (*Reform2*) and the Guiding Opinions on Building a Green Finance System (*Reform3*), we re-estimate Model (2). The results are as shown in Column (2) and (3). Column (4) presents the results of the all-variables test. The coefficients of *GLIS* are all significantly negative, indicating that the results are still robust.

Table 7. Excluding other contemporaneous policy interference

	GW	GW	GW	GW
	(1)	(2)	(3)	(4)
GLIS	−0.1088** (0.0453)	−0.0773** (0.0322)	−0.0817** (0.0321)	−0.0721** (0.0322)
Reform2		−0.1361*** (0.0355)		−0.1282*** (0.0356)
Reform3			0.2444*** (0.0358)	0.2410*** (0.0357)
Constant	1.1452 (0.7486)	0.9509 (0.6562)	0.5896 (0.6537)	0.6108 (0.6554)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Industry*Year FE	Yes	No	No	No
Province*Year FE	Yes	No	No	No
Observations	12,588	12,588	12,588	12,588
Adj R^2	0.5915	0.5730	0.5747	0.5751

5. Additional analysis

5.1. Mechanism analysis

We have confirmed that GLIS policy is effective in curbing corporate "greenwashing." So, how does the implementation of related policies suppress "greenwashing" through the coordinated efforts of fiscal and financial measures? Our analysis primarily identifies this mechanism from the perspective of the incentive effects of GLIS policy on banks.

5.1.1. Mechanisms to incentivize banks to supply green credit

The GLIS policy, led by the government, aims to provide interest subsidies for bank loans that meet green standards. This effectively reduces the cost and risk associated with banks engaging in green credit activities. Consequently, under the same profit expectations, banks can achieve greater profit margins, allowing them to expand the scale of green credit and invest more resources in reviewing and issuing related loans. The discount policy not only manifests the government's steadfast support and guidance for the advancement of the green industry, but also showcases the potential for growth and favorable policy environment in this sector. This motivates banks to adjust their credit structures, increase funding allocation for green credit, and thereby significantly enhance the supply of green credit.

We measure the effectiveness of commercial banks' implementation of green credit by assessing both the availability and scale of green credit. Specifically, we analyze loan announcements and annual reports of listed companies using a text analysis method, based on the definition of green projects provided in the *Instructions for Filling Out the Green Credit Statistics Form* issued by the former China Banking Regulatory Commission in 2013 (Uotila et al., 2009). Firstly, we construct a dummy variable *GLoan*: whether or not the enterprise obtains green credit in the current year, taking 1 for obtaining and 0 otherwise. Secondly, we use the natural logarithm of the total amount of green credit received by the company to measure the scale of green credit (*GLoanAmount*). Finally, we calculate the ratio of the total amount of green credit received to total assets to measure the proportion of green credit (*Loan_Asset*). Columns (1) to (3) of Table 8 reports the results of GLIS policy on green credit. The coefficients of *GLIS* are all significantly positive, indicating that GLIS policy is conducive to increasing the scale of green credit and supports the mechanism by which GLIS policy incentivizes bank credit supply.

5.1.2. Mechanisms to incentivize banks to screen for risk

The GLIS policy, through government-provided interest subsidies for loans that meet strict green standards, not only reduces the cost for banks, but also incentivizes them to strengthen their risk screening mechanisms. To ensure eligibility for the subsidy, banks will assess more rigorously the environmental compliance of enterprises and the actual green benefits of projects, thereby effectively identifying and preventing "greenwashing" behaviors. Specifically, we construct a dummy variable (*HighGW*) based on the extent of "greenwashing" before the introduction of the GLIS policy (2016): if an enterprise's "greenwashing" level in 2016 is in the top 50% among all enterprises, it is defined as 1; otherwise, it is defined as 0.

The results in Columns (4) to (6) of Table 8 show that the coefficients of *GLIS*HighGW* are significantly negative, indicating that after the implementation of the GLIS policy, enterprises with lower levels of "greenwashing" can obtain more green credit amounts. After the introduction of the GLIS policy, banks have been able to fully leverage their information screening advantages and strengthen post-loan supervision. This makes it difficult for enterprises with higher levels of "greenwashing" to apply for green credit, while effectively reducing the likelihood and amount of green credit funds obtained by such enterprises. This result effectively supports the role of the GLIS policy in incentivizing banks to actively supervise, thereby curbing corporate "greenwashing."

Table 8. Mechanism analysis

	GLoan	GLoanAmount	Loan_Asset	GLoan	GLoanAmount	Loan_Asset
	(1)	(2)	(3)	(4)	(5)	(6)
GLIS	0.0314***	0.4278***	0.0172**	0.0684***	0.7014***	0.0522***
	(0.0107)	(0.1128)	(0.0075)	(0.0197)	(0.2077)	(0.0157)
GLIS*HighGW				−0.1144***	−1.1233***	−0.0628***
				(0.0250)	(0.2626)	(0.0168)
Constant	−0.0136	−1.8962***	−0.2438**	−0.5042**	−8.7647***	−0.3116**
	(0.0624)	(0.7005)	(0.0968)	(0.2154)	(2.5017)	(0.1273)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm/Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,588	12,588	12,588	9,547	9,547	9,547
Adj R^2	0.1012	0.1152	0.4713	0.3962	0.4252	0.4894

5.2. Heterogeneity analysis

5.2.1. Financing constraints

The GLIS policy rewards companies that genuinely practice environmental protection by reducing their financing costs. For businesses with higher financing constraints, this economic incentive is more critical and can more effectively curb "greenwashing". Firms with lower financing constraints, which find it easier to obtain funds, may be less sensitive to the discount policy. We believe that the suppressive effect of the GLIS policy on "greenwashing" is more pronounced among firms with high financing constraints. To verify this hypothesis, we used the WW index to represent the extent of financing constraints and divided the sample into two groups according to the annual median of the WW index: high and low financing constraints. The results in Columns (1) and (2) of Table 9 show that the coefficient of *GLIS* is significantly negative in firms with high financing constraints, but not significant in those with low financing constraints, which implies that the suppressive effect of GLIS policy on "greenwashing" is more pronounced in companies with high financing constraints.

5.2.2. Information transparency

In enterprises with low transparency of environmental management system information, the GLIS policy, by providing economic incentives, encourages companies to improve the authenticity of their environmental practices in order to obtain financial support, thereby

more effectively curbing "greenwashing". Since the environmental management activities of these enterprises are not easily accurately assessed by outsiders, the supervision and verification mechanisms attached to the policy can play a greater role, enhancing support for genuine green investments and reducing the motivation for false environmental claims. We believe that the suppressive effect of the GLIS policy on "greenwashing" is more pronounced among companies with low transparency of environmental management systems. To verify this hypothesis, we judge whether a company discloses any one of the following pieces of information: its environmental management system, environmental education and training programs, specialized environmental actions, emergency response plans for environmental incidents, environmental honors or awards, and the "three simultaneous" system. If any one of these is disclosed, it is assigned a value of 1; otherwise, it is assigned a value of 0. The results in Columns (3) and (4) show that the coefficient of *GLIS* is significantly negative in enterprises with low information transparency, but not significant in those with high information transparency, which implies that the inhibitory effect of GLIS policy on "greenwashing" is more pronounced in firms with low transparency of environmental management system information.

5.2.3. Heavily polluting and non-heavily polluting enterprises

The GLIS policy imposes stricter environmental reviews and performance requirements on heavily polluting firms. Under high regulatory pressure, these firms rely more on policy support to achieve transformation, thus the suppressive effect on "greenwashing" is more significant. In contrast, non-heavily polluting firms face less environmental compliance pressure, and their access to credit is relatively less affected by environmental performance. We believe that the suppressive effect of the GLIS policy on "greenwashing" is more pronounced among heavily polluting enterprises. To verify this hypothesis, we divided the sample into heavily polluting enterprises and non-heavily polluting enterprises. The results in Columns (5) and (6) show that the coefficient of *GLIS* is significantly negative in heavily polluting firms, indicating the disincentive effect of GLIS policy on "greenwashing" is more pronounced in such firms.

Table 9. Heterogeneity analysis

	GW	*GW*	*GW*	*GW*	*GW*	*GW*
	High	Low	High	Low	Heavily	non-Heavily
	(1)	(2)	(3)	(4)	(5)	(6)
GLIS	−0.1921**	−0.0585	−0.0175	−0.1824***	−0.2276***	−0.0263
	(0.0786)	(0.0356)	(0.0412)	(0.0516)	(0.0632)	(0.0374)
Constant	0.3871	1.3859*	1.8789**	−0.7992	1.0764	0.9937
	(1.4492)	(0.7749)	(0.8870)	(1.0448)	(1.3070)	(0.7859)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm/Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,442	9,514	7,390	4,566	4,086	8,502
Adj R^2	0.5172	0.5841	0.5859	0.5388	0.5609	0.5769
P value	0.132***		−0.166***		0.202***	

5.3. Expanded analysis: coordinating the effectiveness of policy implementation

The GLIS policy can promote the synergy between fiscal and financial policies, compensating for the deficiencies when a single policy is implemented, and enhancing the actual effect of policies in green governance. To verify whether the GLIS policy has advantages, we compare coordinated policies with single policies. We select green direct subsidies (*GSubsidy*), green credit subsidies (*GLISubsidy*), and the logarithmic values of their amounts (ln*GSubsidy*, ln*GLISubsidy*) as dependent variables. Green credit subsidies refer to financial tools where local governments bear part or all of the interest to encourage commercial banks to engage in green credit operations. Green direct subsidies are financial incentives provided by the government to encourage businesses to adopt environmental measures, develop green products, or construct green factories. We compile and collect the amount of green credit subsidy and green direct subsidy received by each listed company from their official websites, annual reports, and social responsibility reports. Table 10 reports the results of the differences in fiscal funds received by different "greenwashing" enterprises before and after the implementation of the GLIS policy. The results in Columns (1) and (2) of Table 10 show that the coefficient of *GW_GLIS* is not significant, indicating that after the implementation of the green credit policy, "greenwashing" is not related to whether the enterprise receives green direct subsidies. The results in Columns (3) and (4) show that the coefficient of *GW_GLIS* is significantly negative, suggesting that after the implementation of the green credit policy, there is a significant negative correlation between "greenwashing" and whether the enterprise receives green credit subsidies, indicating that compared to a single policy, coordinated policies can significantly reduce the probability of "greenwashing" enterprises obtaining green credit subsidies. However, a single policy may lead to strategic behaviors of "greenwashing" enterprises attempting to fraudulently obtain subsidies.

Table 10. Coordinating the effectiveness of policy implementation

	GSubsidy	ln*GSubsidy*	*GLISubsidy*	ln*GLISubsidy*
	(1)	(2)	(3)	(4)
GLIS	0.0082	0.0045	−0.0051***	−0.0489***
	(0.0170)	(0.2224)	(0.0014)	(0.0153)
GW	0.0104**	0.1039	0.0003	0.0064**
	(0.0047)	(0.0652)	(0.0002)	(0.0030)
GW_GLIS	0.0007	−0.0353	−0.0006**	−0.0092**
	(0.0139)	(0.1860)	(0.0003)	(0.0040)
Constant	0.5030***	1.0732	0.0069	0.1278
	(0.1220)	(1.7251)	(0.0101)	(0.1270)
Controls	Yes	Yes	Yes	Yes
Firm/Year FE	Yes	Yes	Yes	Yes
Observations	9,011	9,011	9,011	9,011
Adj R²	0.1199	0.1417	0.0169	0.0127

6. Conclusions and limitations

Corporate "greenwashing" has emerged as a matter of significant concern in both academic and practical realms, and the imperative for coordinated governance to rein in "greenwashing" becomes even more pressing within the context of green development. This study, based on a sample of non-financial listed companies in China from 2011 to 2022, empirically examines the impact of GLIS policy on corporate "greenwashing". We found that GLIS policy can significantly inhibit corporate "greenwashing". Mechanism tests show that GLIS policy not only stimulates bank credit supply and increases the scale of green credit, but also motivates banks to strengthen their risk identification mechanisms, thereby curbing "greenwashing." The inhibitory effect is more pronounced in firms with high financing constraints, low transparency in environmental management systems, and heavy pollution firms. We also found that GLIS policy can promote synergy between fiscal and financial policies, address deficiencies when a single policy is implemented, and enhance the effectiveness of green governance policies.

   The policy recommendations and implications of this study are mainly reflected in the following three aspects. First, in terms of policy formulation, it is essential to strengthen the implementation of GLIS policy. Our findings indicate that GLIS policies significantly inhibit corporate "greenwashing." Therefore, future policy-making should promote coordinated fiscal and financial green policies, optimize credit resource allocation for green projects, and encourage financial institutions to enhance credit investment in green industries by raising the proportion of interest subsidies for green credits or expanding subsidy scopes. It is also necessary to improve the green credit regulatory system by establishing and refining assessment, audit, and information disclosure systems to ensure green credit funds reach environmentally compliant enterprises and projects, preventing misuse for "greenwashing." Additionally, guiding the market interest rate pricing mechanism to favor green initiatives is crucial. Financial institutions should implement lower interest rate pricing for green credit operations based on market-oriented rates, substantially reducing financing costs for green enterprises. Second, enterprises should actively respond to the national green credit policy by adjusting their business strategies and increasing investment in green technology R&D, environmental equipment, and clean energy to transition from traditional to sustainable models. They should also strengthen internal environmental risk management, establish sound environmental information disclosure mechanisms, and improve their green qualifications and credit ratings to obtain more green credit resources and preferential policies. Additionally, enterprises should seek cooperation with financial institutions, utilize the GLIS policy to reduce financing costs, promote green projects, and enhance their corporate image. Third, systematic planning and targeted measures are essential for precise policy positioning. This study finds that the impact of GLIS policy on "greenwashing" varies with marketization levels, industry, and corporate characteristics. Therefore, in policy formulation, it's important to design differentiated regional credit policies. For special regions, the government should implement stronger policies with higher interest subsidies to curb "greenwashing." For competitive industries, the government should prioritize green credit subsidies; for non-state-owned and high-pollution enterprises, customized credit policies can guide technological transformation.

Additionally, an interdepartmental cooperation mechanism involving finance, environmental protection, and financial regulation is needed to ensure GLIS policy considers environmental and sustainable economic development needs comprehensively.

Our study has certain limitations. First, our samples are derived from Chinese A-share listed companies; future study could further explore the impact of GLIS policy on the "green-washing" of small and medium-sized firms. Second, China's unique institutional environment provides an ideal sample for the study, but its specificity may constrain the generalizability of the findings. The follow-up study can be extended to other emerging economies or mature markets to verify the applicable boundaries of the model.

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