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Patient Capital and Corporate Greenwashing

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Abstract. In the ESG investment wave, capital markets are highly concerned about corporate environmental performance. However, this creates a significant paradox with the increasingly covert and technological upgrading of corporate "greenwashing" behavior. This paper takes non-financial listed companies on the Shanghai and Shenzhen A-share markets in China from 2014 to 2023 as samples, constructs indicators of greenwashing and patient capital, and combines empirical methods such as the two-way fixed effects model to deeply explore the impact of patient capital on corporate greenwashing and its mechanism of action. The study found that patient capital can effectively curb corporate greenwashing behavior. The action pathways mainly include correcting the short-termism tendencies of management, enhancing the degree of green innovation of enterprises, and improving the transparency of information. Heterogeneity analysis shows that the effect varies under different financial conditions, governance structures, and institutional environments. This study reveals new mechanisms to curb corporate greenwashing from the perspective of the capital supply side, providing important theoretical and empirical evidence for investment institutions to optimize ESG strategies, enterprises to introduce long-term capital to drive real transformation, and regulators to build long-term governance mechanisms.

Keywords: Patient capital, Corporate greenwashing, ESG investment, Capital supply-side

1. Introduction

Amid the globalization of ESG investment, capital markets now scrutinize corporate environmental performance with unprecedented intensity, yet this has generated a paradox: Regulatory pressure and green valuation incentives should enhance disclosure authenticity, but corporate "greenwashing" through selective disclosure, ambiguous commitments, and symbolic emission reductions has become technologically sophisticated [1]. This paradox reflects a structural dilemma—capital markets' short-term performance pressures induce covert environmental strategy disguises rather than curbing opportunism, eroding market trust, and impeding substantive transformation. Introducing governance forces balancing short-term and long-term values is imperative, with patient capital—characterized by long-term vision, risk tolerance, and value co-creation—emerging as a key solution [2]. While existing research confirms its positive ESG impact, its intervention mechanism for strategic environmental behavior remains underexplored, particularly amid capital's growing short-termism in the digital age. This theoretical gap constrains greenwashing governance.

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Greenwashing constitutes a complex strategic choice driven by institutional incentives, extending beyond reputational damage to distort capital allocation toward "pseudo-green" projects, intensify ESG trust crises, and delay low-carbon transitions. Current research inadequately explains heterogeneous greenwashing tendencies under uniform regulation, overlooking capital attributes in shaping environmental decisions. Although patient capital's positive ESG effects are validated, whether and how it curbs greenwashing remains unresolved. This study bridges the theoretical gap via an integrated framework combining resource dependence and signaling theories, innovatively proposing three action pathways that decode patient capital's greenwashing suppression mechanism. Empirically, it analyzes 2014–2023 Chinese A-share non-financial firms using bidirectional fixed-effects models to measure patient capital and greenwashing while controlling for firm-specific and temporal factors. The theoretical innovations achieve three breakthroughs: empirically demonstrating non-financial governance paths beyond traditional incentives; deconstructing the micro-foundations of "patience" with a long-term perspective as core; and establishing a technology synergy framework revealing digital tools' multiplicative effects on governance pathways.

This study's marginal contributions hold dual significance. Theoretically, it advances greenwashing research by revealing capital supply-side drivers, counterbalancing prior overemphasis on internal motives and external regulation. Simultaneously, it extends patient capital theory to environmental strategy, proving its governance and norm-setting functions, thereby promoting theoretical microscopization and contextualization. Practically, it guides investors toward authentic ESG allocation, empowers firms to leverage patient capital for substantive innovation, and assists regulators in building greenwashing containment mechanisms aligned with dual-carbon goals and high-quality development.

2. Literature review

Greenwashing, as a pivotal challenge in environmental governance, fundamentally constitutes deceptive practices in environmental performance embellishment. Existing literature has examined this phenomenon through multifaceted determinants. Regarding driving mechanisms, Huang Rongbing et al. identified external financing needs as a primary catalyst, demonstrating how heavily polluting enterprises systematically exaggerate environmental disclosures to secure green credit and ESG investments [3]. Concerning restraining mechanisms, current research proposes two principal pathways: Externally, Shen Yi et al. established that administrative environmental supervision significantly curbs corporate greenwashing tendencies by elevating penalty risks and political costs, while Huang Rongbing et al. highlighted how green certification systems compel substantive environmental improvements via entry barriers and certification premiums. Zhao Mengjie points out that ESG information exchange between investors and listed companies effectively curbs corporate greenwashing by enhancing information transparency and increasing external reputational pressure [4]. Gu Wei provide evidence that green technology innovation fosters an internal green culture and improves corporate governance, thereby reducing greenwashing decisions [5]. However, the extant literature remains deficient in exploring capital market influences on corporate greenwashing mechanisms. This study addresses this gap by examining the inhibitory effect of patient capital—as a proxy for capital markets—from an investor perspective.

The academic consensus, as articulated by Jiang Zhongyu et al., defines patient capital as equity or debt characterized by long-term orientation and active governance, with core attributes encompassing strategic tolerance for short-term volatility in pursuit of sustained value and relational engagement fostering mutual trust. Jiang Zhongyu et al. further classified it into two forms: strategic equity and relational debt. Li Jipeng found that patient capital significantly enhances corporate high-

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quality development by alleviating information asymmetry and Type I agency costs [6]. Wu Minjia et al. corroborated its positive impact on firm performance [7]. Li Sifei et al. focused on ESG outcomes, revealing that patient capital boosts manufacturing innovation efficiency and overall ESG performance by reducing informational gaps [8]. Qiu Rong further substantiated its role in elevating innovation efficiency, lowering perceived uncertainty, and improving total factor productivity [9].

In summary, while existing studies predominantly explore patient capital's influence on corporate "bright-side" behaviors, they largely overlook its potential effects on "dark-side" practices—particularly opportunistic or unethical conduct. Specifically, the relationship between patient capital and strategic, deceptive environmental disclosures like greenwashing warrants rigorous investigation to address this critical research gap.

3. Mechanism analysis and hypothesis presentation

Grounded in the theoretical frameworks of the resource dependence theory and signaling theory, this paper posits that patient capital exerts a suppressive effect on corporate greenwashing through the strategic reconfiguration of resource allocation and governance structures. The core inhibitory mechanism operates along three distinct pathways: mitigating managerial short-termism pressures, fostering green technological innovation, and augmenting corporate information transparency.

Primarily, patient capital functions to curb greenwashing by correcting management's hyperbolic discounting tendencies. Persistent trading pressure exerted by short-term investors often compels corporate management to overvalue immediate gains—such as transient stock price increases derived from greenwashing—while simultaneously undervaluing substantial long-term risks, including regulatory penalties and reputational damage. Patient capital fundamentally reconstructs the temporal discount rate underpinning corporate decision-making by its inherent long-term holding characteristic: it mitigates stock price volatility through the provision of stable equity support. Concurrently, by integrating environmental performance metrics into executive long-term evaluation systems, it compels management to de-emphasize short-term performance metrics, thereby eroding the foundational incentive structure that motivates greenwashing at its core.

Secondly, viewed through the lens of strategic resource allocation as prescribed by the resource dependence theory, patient capital enables enterprises to undertake resource reallocation by absorbing the substantial sunk costs associated with green technological innovation. Under the influence of short-term capital dominance, firms frequently opt for superficial, low-cost reporting embellishments over committing to capital-intensive technological investments. The enduring financial security furnished by patient capital renders the net present value of genuine environmental technology investments superior to pursuing greenwashing strategies. As empirically demonstrated by Wu Minjia et al., relational debt facilitates a transformative "resource-innovation-performance" pathway via sustained support for internal R&D. Building upon this foundation, this paper extends the finding to the realm of environmental governance, proposing that the operative mechanism manifests as a strategic redirection of funds away from symbolic environmental public relations towards robust green patent research and development, effectively displacing greenwashing practices through the cultivation of substantive technical capabilities and competencies.

Finally, within the information governance mechanism rooted in signaling theory, patient capital enhances information transparency through dual, reinforcing channels: Firstly, it compels enterprises to proactively disclose detailed environmental technology roadmaps and implementation milestones, thereby significantly increasing the imitation costs inherent in greenwashing. Secondly, it incentivizes core supply chain enterprises to establish sophisticated digital supervision platforms and embed stringent environmental compliance clauses within procurement contracts—exemplified by

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real-time carbon emissions tracking requirements. Drawing on resource dependence theory, this "contractual accountability" design capitalizes on the bargaining power wielded by core enterprises to transform environmental investment from a discretionary option into an operational imperative for supplier survival. Consequently, enhanced transparency empowers the market to efficiently distinguish between greenwashing enterprises and authentic environmental stewards, ultimately channeling rewards towards firms demonstrating genuine environmental commitment through this very pathway.

Synthesizing the foregoing mechanism analysis, this paper advances the following conceptual hypotheses:

Hypothesis H1: Patient capital can curb greenwashing by enterprises.

Hypothesis H2: The higher the proportion of patient capital, the less short-termism pressure on the management, thereby reducing the degree of greenwashing.

Hypothesis H3: Patient capital replaces greenwashing with real environmental protection capabilities by enhancing the green innovation capabilities of enterprises.

Hypothesis H4: Patient capital curbs greenwashing by enhancing corporate information transparency.

4. Empirical findings and analysis

4.1. Data sources and sample selection

This paper selects non-financial A-share listed companies in China's Shanghai and Shenzhen stock markets from 2014 to 2023 as the research sample and screens them based on the following criteria: First, financial and insurance companies are excluded due to the particularity of their operating and financial characteristics; Second, exclude listed companies marked as ST or PT; Finally, remove samples with missing data on key variables and tail the continuous variables at the 1th percentile. After the above screening, a valid sample containing 7,618 enterprise observations from 2014 to 2023 was finally obtained. Corporate greenwashing data, by integrating Bloomberg ESG and Huazheng ESG, focused on comparing corporate environmental advocacy commitments with actual capital expenditures. Patient capital data is sourced from the China Stock Market & Accounting Research Database (abbreviated as CSMAR), Wind Institutional Investor Holdings Details Database, and the screening criteria are pension funds, sovereign wealth funds, and industrial capital with an average holding period of no less than five years. Data on other control variables are sourced from the CSMAR. To eliminate the influence of extreme values, this paper performs Winsorizing tailing at the 1% level on all continuous variables of the model. Data processing and empirical tests were performed using the statistical software STATA 18.0.

4.2. Variable definitions and measures

4.2.1. Dependent variable

Corporate greenwashing (GW). This paper draws on Zhang's robustness test method to construct enterprise greenwashing metrics [10]. ER_{dis} Specifically, the Bloomberg ESG rating environmental dimension Score (E-score) is used as a proxy variable for corporate environmental information disclosure level (ER_{dis}), reflecting the strength of corporate environmental commitment claims; Use Huazheng ESG Rating's environmental dimension score (E-score) as a proxy variable for corporate environmental actual performance (ER_{per}) to measure corporate substantive

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environmental ER_{per} behavior. The greater the difference between the two after standardization, the stronger the tendency of enterprises to "talk more than do" greenwashing. Greenwashing scores are calculated using formula (1) :

$$GW = \frac{ER_{dis} - \overline{ER}_{dis}}{\sigma_{dis}} - \frac{ER_{per} - \overline{ER}_{per}}{\sigma_{per}} \quad (1)$$

4.2.2. Independent variable

Patient capital (PC). This paper combines the composite measurement idea of Jiang et al. And the definition method of relational claims by Wu Minjia et al. To construct the patient capital index from the perspective of long-term claims. Specifically drawing on Wu Minjia et al. 's operational definition of "relational financing", the total amount of long-term liabilities in the balance sheet of listed companies, including long-term borrowings, bonds payable and long-term payables, is calculated by adding up the total amount of long-term liabilities, the level of patient capital is measured by the proportion of these to the total liabilities of the enterprise, namely formula (2) :

$$PC = \frac{\text{Long-term borrowings+bonds payable+long-term payables}}{\text{total liabilities}} \quad (2)$$

4.2.3. Control variables

Concerning the existing literature on enterprise greenwashing, the following table of control variables was introduced into the model. In addition, industry effects and annual effects were also controlled.

Table 1. Variable definitions1

Variable type	Variable Name	Variable symbols	Variable definitions
Dependent variable	Corporate greenwashing	GW	Equation (1)
Independent variable	Patient capital	PC	Equation (2)
Control variables	Enterprise size	Size	Natural logarithm of total assets
	Actual controller Separation rate	Seperate	The ratio of cash flow rights to control rights
	Gross margin on sales	GrossProfit	The ratio of operating revenue operating cost to operating revenue
	Inventory share	Inv	The ratio of net inventory to total assets at the end of the period
	Growth rate of total assets	AssetGrowth	The ratio of Ending total assets - Beginning total assets to Beginning total assets
	Net profit margin on total assets	ROA	The ratio of net profit to total assets
	Board size	Board	Total number of board members
	Largest shareholder's ratio	Top1	The ratio of the number of shares held by the largest shareholder to the total share capital of the company

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4.3. Model building

To test the impact of patient capital on corporate greenwashing behavior, this paper constructs the following OLS regression (3)

$$GW_{it} = \alpha_0 + \alpha_1 PC + \sum \alpha_k Controls_{it} + \varepsilon_{it} + \lambda_i + \mu_t \quad (3)$$

Here, the dependent variable GW represents corporate greenwashing. The independent variable PC represents patient capital. $Controls$ is the relevant control variable. ε_{it} is the random perturbation term. λ_i refers to the individual fixed effect, and μ_t refers to the time fixed effect. OLS regression is suitable here due to the continuous nature of both the dependent and independent variables. It provides an intuitive way to estimate the linear relationship between patient capital and greenwashing. Including individual and time fixed effects accounts for unobserved heterogeneity, ensuring the results are not biased by omitted firm- or time-specific variables.

5. Empirical results and analysis

5.1. Descriptive statistics

According to Table 2, notably, the median and quartile distribution indicate that the majority of enterprises exhibit a low or negative degree of greenwashing, reflecting relatively conservative environmental information disclosure, while the dispersion is significant, confirming that a minority of enterprises engage in significant greenwashing behavior. The mean of the patient capital variable and the median indicate that the patient capital allocation of the sample firms was generally at a moderate level, but there were significant differences among firms.

Table 2. Descriptive statistics2

VarName	Obs	Mean	SD	Median	P25	P75	Min	Max
GW	7618	-0.008	1.161	-0.039	-0.766	0.658	-4.906	6.327
PC	7618	0.179	0.183	0.128	0.021	0.278	0	0.911
Size	7618	23.446	1.234	23.377	22.564	24.228	19.552	26.452
Seperate	7618	0.055	0.078	0.001	0.000	0.098	0.000	0.286
GrossProfit	7618	0.276	0.183	0.236	0.144	0.370	-0.062	0.871
Inv	7618	0.122	0.105	0.101	0.046	0.165	0.000	0.666
AssetGrowth	7618	0.141	0.303	0.084	0.011	0.187	-0.408	5.270

5.2. Benchmark regression analysis

As demonstrated across columns (1) through (4), the regression coefficients for the core explanatory variable PC range from -0.2000 to -0.2559 and are significantly negative at either the 5% or 1% statistical level. This robust finding indicates that enterprises obtaining higher levels of patient capital demonstrate a lower likelihood of engaging in greenwashing, thereby providing strong support for this paper's research hypothesis H1 that patient capital effectively curbs greenwashing. Concerning the control variables, the significantly positive coefficients for enterprise size and asset growth rate imply that larger and faster-growing enterprises may exhibit greater tendencies toward greenwashing; the significantly negative coefficient for the separation of ownership and control

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suggests this structural separation may help constrain greenwashing practices; and the significantly positive coefficient for gross margin in certain models indicates that profitability may heighten motivations for greenwashing.

Table 3. Basic results: the effect of patient capital on corporate greenwashing3

	(1) GW	(2) GW	(3) GW	(4) GW
PC	-0.2000**	-0.2096***	-0.2459**	-0.2559***
	(0.08)	(0.08)	(0.10)	(0.10)
Size	0.0869***	0.0895***	0.0977***	0.1008***
	(0.01)	(0.01)	(0.01)	(0.01)
Seperate	-0.5938***	-0.5938***	-0.6078***	-0.6055***
	(0.17)	(0.17)	(0.18)	(0.18)
GrossProfit	0.1582**	0.1657**	0.1735*	0.1808*
	(0.08)	(0.08)	(0.10)	(0.10)
Inv	-0.1710	-0.1797	-0.2491	-0.2588
	(0.13)	(0.13)	(0.16)	(0.16)
AssetGrowth	0.2356***	0.2346***	0.2349***	0.2334***
	(0.04)	(0.04)	(0.05)	(0.05)
_cons	-2.0343***	-2.0410***	-2.2084***	-2.2202***
	(0.28)	(0.28)	(0.38)	(0.39)
N	7618	7618	7618	7618
R2	0.013	0.014	0.015	0.015
adj. R2	0.013	0.012	0.006	0.005
year	No	Yes	Yes	Yes

5.3. Heterogeneity analysis

First, the Financial Stress Path. Paths (1) in Table 4 reveal significant heterogeneity in the regression results between loss-making enterprises and profitable enterprises from the previous year. For profitable companies, the inhibitory effect of patient capital on greenwashing is highly significant, indicating that long-term capital can effectively restrain the distortion of corporate environmental information disclosure. This finding suggests that the effectiveness of patient capital governance is strictly constrained by the financial health of the enterprise. Regarding governance structure, paths (2) reveal that patient capital has a significant inhibitory effect on greenwashing under concentrated ownership and control. However, the coefficient is not significant for enterprises with separated ownership and control. From this, it can be seen that the separation of ownership and control leads to a stronger short-term performance orientation among management, which may utilize patient capital for "greenwashing endorsements" rather than substantial environmental improvements. Concerning the institutional environment, paths (3) show that patient capital significantly curbs greenwashing in Eastern region enterprises, while this effect is absent in Midwest enterprises. This indicates that superior law enforcement and public scrutiny in the Eastern region reinforce the environmental governance imperatives of patient capital.

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Table 4. Heterogeneity analysis4

	GW		(2) GW		(3) GW	
PC	-0.2905***	0.0369	-0.2328**	-0.1330	-0.1262	-0.2373**
	(0.10)	(0.37)	(0.11)	(0.23)	(0.17)	(0.12)
Size	0.1084***	0.0365	0.0947***	0.1194***	0.0137	0.1237***
	(0.01)	(0.04)	(0.02)	(0.03)	(0.02)	(0.02)
Seperate	-0.6152***	-0.8633	-0.5568***	-1.4265***	-0.6856**	-0.4678**
	(0.18)	(0.59)	(0.20)	(0.45)	(0.30)	(0.22)
GrossProfit	0.2034*	0.1080	-0.0122	0.5019**	0.4355***	0.1731
	(0.11)	(0.35)	(0.12)	(0.22)	(0.17)	(0.13)
Inv	-0.2257	-1.7903***	-0.3297*	-0.1966	-0.2422	-0.2769
	(0.17)	(0.61)	(0.18)	(0.39)	(0.31)	(0.19)
AssetGrowth	0.2463***	0.1339	0.2778***	0.0543	0.3188***	0.1907***
	(0.05)	(0.10)	(0.05)	(0.09)	(0.07)	(0.06)
_cons	-2.3353***	-1.8060	-2.0652***	-2.4495**	-0.0394	-2.6967***
	(0.41)	(1.41)	(0.43)	(0.97)	(0.58)	(0.44)
N	7015	603	5789	1523	2470	5148
R2	0.017	0.190	0.020	0.087	0.062	0.030
adj. R2	0.006	0.071	0.006	0.041	0.037	0.014
year	Yes	Yes	Yes	Yes	Yes	Yes

5.4. Robustness test

Strengthening the reliability of the conclusions through three testing strategies:

(1) Controlling for additional variables: After incorporating corporate governance variables (Board, Top1) and return on assets (ROA) into the baseline model, the coefficient for patient capital remains statistically significant at −0.2286 (5% level). This confirms that omitted variables do not drive the core relationship.

(2) Lagged dependent variable test: When replacing the dependent variable with next-period greenwashing intensity (F.GW), the absolute value of the coefficient increases to −0.2830, suggesting a persistent governance effect of patient capital.

(3) Adjusted standard errors: Using cluster-robust standard errors yields a coefficient of −0.2559, which is more significant than in the baseline model and rules out heteroskedasticity concerns.

The key coefficients across all models consistently show negative signs and statistically significant results, providing robust support for Hypothesis H1.

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Table 5. Robustness tests5

	(1) GW	(2) F.GW	(3) GW
PC	-0.2286**	-0.2830***	-0.2559***
	(0.10)	(0.10)	(0.10)
Size	0.1027***	0.1001***	0.1008***
	(0.01)	(0.01)	(0.01)
Seperate	-0.6102***	-0.4534**	-0.6055***
	(0.18)	(0.18)	(0.18)
GrossProfit	0.0703	0.1251	0.1808*
	(0.11)	(0.10)	(0.10)
Inv	-0.2737*	-0.2453	-0.2588*
	(0.16)	(0.17)	(0.16)
AssetGrowth	0.2149***	0.1552***	0.2334***
	(0.05)	(0.04)	(0.05)
ROA	0.4758*		
	(0.27)		
Board	-0.1594**		
	(0.07)		
Top1	-0.0305		
	(0.10)		
_cons	-1.8935***	-2.1419***	-2.2202***
	(0.41)	(0.41)	(0.38)
N	7618	6797	7618
R2	0.016	0.014	0.015
adj. R2	0.005	0.002	0.005
year	Yes	Yes	Yes

5.5. Mechanism testing

Following a comprehensive literature review, this paper employs the ratio of current short-term investment to total assets at the beginning of the enterprise (Shortinv) to directly measure the degree of short-sightedness in corporate management. For assessing corporate innovation capability, the study utilizes the proportion of green patent applications (GTI) among listed companies, defined as the ratio of an enterprise's green patent applications to its total patent applications in the current year. Corporate information transparency is measured by the sum of the absolute values of the company's discretionary accruals over the past three years (Opaque), where higher values indicate lower corporate information transparency. This study employs a three-step mediation test to examine how patient capital mitigates greenwashing through three mediating pathways. First, PC alleviates managerial short-termism, reducing short-term pressure and promoting long-term environmental focus. The findings of Zhao Mengjie further confirm that reducing managerial short-termism can inhibit corporate greenwashing, thereby supporting H2. Second, PC enhances green technology

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innovation, providing R&D stability and facilitating substantive innovation. According to research by Gu Wei, improving green technology innovation can reduce corporate greenwashing behavior, thereby replacing symbolic disclosure with actual performance. Finally, based on the empirical results, PC improves information transparency, which in turn suppresses greenwashing.

Table 6. Mechanism tests

	(1)	(2)	(3)	(4)
	Shortinv	GTI	Opaque	GW
PC	-0.0682***	0.0874***	-0.0813***	-0.3063**
	(0.01)	(0.02)	(0.01)	(0.15)
Size	0.0004	-0.0025*	0.0005	0.0056
	(0.00)	(0.00)	(0.00)	(0.01)
Seperate	-0.0140	-0.0073	0.0002	0.0265
	(0.02)	(0.02)	(0.02)	(0.18)
GrossProfit	0.0041	0.0007	0.0096	0.1380
	(0.01)	(0.01)	(0.01)	(0.10)
Inv	-0.0115	-0.0067	-0.0197	0.0681
	(0.01)	(0.02)	(0.01)	(0.16)
AssetGrowth	0.0012	0.0114**	0.0020	-0.0088
	(0.00)	(0.01)	(0.00)	(0.05)
Opaque				-0.2503*
				(0.13)
_cons	0.0335	0.0694	0.1714***	0.1275
	(0.03)	(0.04)	(0.04)	(0.39)
N	7539	7618	7279	7279
R^2	0.027	0.017	0.028	0.015
year	Yes	Yes	Yes	Yes

6. Conclusions and recommendations

This study systematically examines the influence mechanism and boundary conditions of patient capital on corporate greenwashing, revealing its key role in environmental governance. Patient capital effectively suppresses greenwashing by reconfiguring strategic resource allocation and alleviating managerial short-termism, covering sunk costs of green innovation. Enhanced environmental verification, supply-chain accountability, and market self-regulation increase greenwashing costs and detection probability. However, efficacy depends on corporate financial health, governance structure, and institutional environment: significant in profitable firms with concentrated ownership and eastern China's developed regions, but potentially distorting into "greenwashing endorsement" for financially distressed or governance-deficient enterprises.

Based on the above conclusions, this study proposes multi-level practical implications: For investment institutions, they should optimize ESG strategies using tools (e.g., equity lockups, ESG-linked covenants) to strengthen capital's long-term constraints, direct patient capital toward firms with high green-tech maturity, and establish full-cycle governance frameworks. For business

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entities, it must introduce strategic patient capital to optimize ownership structures, embed environmental technology roadmaps in long-term financing contracts, and leverage the capital's patience window for green patenting and supply-chain carbon data platforms—transforming greenwashing risks into low-carbon competitiveness. For regulatory authorities, there is an urgent need to build an incentive-compatible system. On the one hand, the proportion of patient capital should be included in the green finance evaluation index, and tax incentives should be given to long-term institutional investors; On the other hand, improve the third-party verification standards for greenwashing and the supply chain environmental responsibility traceability mechanism, strengthen the replication and promotion of the experience from the developed eastern regions to the central and western regions. Future research could further explore the multiplier mechanism of digital transformation on the governance effectiveness of patient capital.

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